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**FINAL**

# PHASE II SWMU CONFIRMATORY SAMPLING REPORT

**MCB CAMP LEJEUNE, NORTH CAROLINA**

**CONTRACT TASK ORDER 0143**

**APRIL 2005**

TEXT-VOLUME I OF II

***Prepared for:***

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***Prepared by:***

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**Coraopolis, Pennsylvania**

QC Review Page

FINAL

Phase II SWMU
Confirmatory Sampling Report

MCB Camp Lejeune, North Carolina

Contract Task Order Number - 0143
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*Prepared by*

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*** All appendices can be found in PDF format on the following CD.**

## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOCs | area of concerns |
| AST | above ground storage tank |
| Baker | Baker Environmental, Inc. |
| bgs | below ground surface |
| °C | degrees Celsius |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLEAN | Comprehensive Long-Term Environmental Action Navy Program |
| CMI | Corrective Measures Implementation |
| CMS | Corrective Measures Study |
| CSF | cancer slope factor |
| CTO | Contract Task Order |
| CSI | Confirmatory Sampling Investigation |
| DEM | Division of Environmental Management |
| DoN | Department of the Navy |
| DOT | Department of Transportation |
| DRMO | Defense Reutilization Marketing Office |
| EQB | Environmental Quality Branch |
| ft/d | feet per day |
| $ft^2/d$ | square feet per day |
| FMFLANT | Fleet Marine Force Atlantic |
| FS | Feasibility Study |
| FSAP | Field Sampling and Analysis Plan |
| FSSG | Force Service Support Group |
| gpd | gallons per day |
| gpd/ft | gallons per day per foot |
| gpm | gallons per minute |
| GPR | Ground Penetrating Radar |
| GPS | Global Position System |
| GSRA | Greater Sandy Run Area |
| HSWA | Hazardous and Solid Waste Amendments of 1984 |
| HQW | high quality waters |
| IAS | Initial Assessment Study |
| ICR | incremental cancer risk |
| ID | Inside Diameter |
| IDW | Investigative Derived Waste |
| IR | Installation Restoration |
| LUST | leaking underground storage tank |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |

## LIST OF ACRONYMS AND ABBREVIATIONS
*(Continued)*

| | |
|---|---|
| MAGTF | Marine Air Ground Task Force |
| MCAS | Marine Corps Air Station |
| MCB | Marine Corps Base |
| MEK | methyl ethyl ketone |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate |
| msl | mean sea level |
| NC DENR | North Carolina Department of Environment, and Natural Resources |
| NCWQS | North Carolina Water Quality Standard |
| NFA | no further action |
| NREA | Natural Resources and Environmental Affairs |
| NSW | nutrient sensitive waters |
| NWI | National Wetland Inventory |
| PRGs | Preliminary Remediation Goals |
| PAHs | polynuclear aromatic hydrocarbons |
| PCBs | polychlorinated biphenyls |
| PID | photoionization detection |
| POL | petroleum, oil, and lubricant |
| PVC | Polyvinyl chloride |
| QA/QC | Quality Assurance/Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RFI | RCRA Facility Investigation |
| RI | Remedial Investigation |
| SA | State of North Carolina Surface Water Classification - estuarine water suited for commercial shell fishing and all other tidal saltwater uses |
| SC | State of North Carolina Surface Water Classification - salt waters protected for secondary recreation, fishing, aquatic life including propagation and survival |
| SI | Site Investigation |
| SOPs | Standard Operating Procedures |
| SVOA | semivolatile organic analysis |
| SVOCs | semivolatile organic compounds |
| SWMU | solid waste management unit |
| TAL | Target Analyte List |
| TCL | Target Compound List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TSD | treatment, storage, and disposal |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| U.S.C. | United States Code |
| 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)*

| | |
|---|---|
| VOA | volatile organic analysis |
| VOC | volatile organic compound |
| WQP | Water Quality Parameters |

## EXECUTIVE SUMMARY

This document presents the Phase II Solid Waste Management Unit (SWMU) Confirmatory Sampling Report prepared for 47 SWMUs at Marine Corps Base (MCB) Camp Lejeune, North Carolina (the Base). This document has been prepared by Baker Environmental, Inc. (Baker) under Contract Task Order (CTO) 0143 of the Department of the Navy's (DoN's) Comprehensive Long-Term Environmental Action Navy (CLEAN) Program. Baker is subcontracted to CH2M Hill for implementation of this project. The purpose of the Phase II Confirmatory Sampling Investigation (CSI) was to further evaluate potential impacts to soil at the SWMUs and determine if groundwater has been impacted as a result of a potential release(s) from the SWMUs.

The CSI was completed in two phases. Phase I consisted of a soil investigation in the vicinity of 62 SWMUs. Phase II consisted of additional soil sampling and a groundwater investigation at 41 SWMUs that warranted additional work at the conclusion of Phase I. Additionally, six new SWMUs were included in the Phase II CSI thus increasing the number of SWMUs to 47.

The analytical program for the Phase II Confirmatory Sampling Investigation focused on the suspected contaminants of potential concern (COPCs) identified for each of the SWMUs during the Phase I CSI (September 1997), past and present activities conducted at the SWMUs, and discussions with NC DENR, MCB, Camp Lejeune and the DoN. The Phase II CSI was conducted during March and April 2002. Samples collected during the Phase II investigation included: groundwater, surface soil, subsurface soil, sediment and surface water. The majority of samples collected from the SWMUs were analyzed for semivolatile organic compounds (SVOCs) and RCRA metals. Samples from some of the SWMUs were also analyzed for volatile organic compounds (VOCs) and pesticides.

The analytical results from each SWMU were compared to a specific set of media-specific screening criteria to determine if any additional investigations should be conducted at the SWMU. The screening criteria included:

<u>Soil</u>

- USEPA Region IX Residential or Industrial Preliminary Remediation Goals (PRGs)
- North Carolina Department of Environment and Natural Resources (NC DENR) Default and/or Site-Specific Soil to Groundwater Screening Levels
- Area of Concern (AOC) Background Concentrations
- Base Background Concentrations

<u>Groundwater</u>

- North Carolina 2L Standards
- Base Background Concentrations

<u>Surface Water</u>

- USEPA Region IV Surface Water Screening Criteria
- NCAC 2B Surface Water Quality Standards

Sediment

- USEPA Region IV Ecological Screening Values for Sediment (or default criteria for constituents that did not have screening criteria established)

Analytical results for the COPCs identified in the Phase I CSI were combined with the Phase II CSI and each SWMU was compared to two or more of the previously mentioned criteria. In some cases it was determined that a SWMU was located in an industrial setting, therefore soil analytical results from the Phase I and Phase II CSIs were compared to USEPA Region IX industrial PRGs in lieu of the residential PRGs. The screening criteria selected for each SWMU depended on the type(s) of media sampled.

Metals detected in surface and subsurface soil samples collected at the SWMUs were first compared to NC DENR and the USEPA Region IX Screening Criteria. If the detected concentration of any metal exceeded either of these comparison criteria, then it was compared to the AOC and/or Base background concentration range to determine if the concentration was within the range of soil conditions at the Base.

Of the 47 SWMUs, it is recommended that 29 SWMUs require no further action, 5 require additional confirmatory sampling, 3 require Interim Measures, 2 require additional confirmatory sampling/Interim Measures, and 8 require RFIs. The analytical results for each SWMU are discussed in detail in Section 4.0 of this report and the recommendations are summarized on Table 5-1.

## 1.0 INTRODUCTION

This document presents the Phase II Solid Waste Management Unit (SWMU) Confirmatory Sampling Report prepared for 47 SWMUs at Marine Corps Base (MCB) Camp Lejeune, North Carolina (the Base). This document has been prepared by Baker Environmental, Inc. (Baker) under Contract Task Order (CTO) 0143 of the Department of the Navy's (DoN's) Comprehensive Long-Term Environmental Action Navy (CLEAN) Program. Baker is subcontracted to CH2M Hill for implementation of this project. The purpose of the Phase II Confirmatory Sampling Investigation (CSI) was to further evaluate potential impacts to soil at the SWMUs and determine if groundwater has been impacted as a result of a potential release(s) from the SWMUs.

Section 1.1 provides a brief summary of the regulatory history of the Base as it pertains to the Resource Conservation and Recovery Act (RCRA). Section 1.2 describes the organization of this report and discussions included in each of the sections.

### 1.1 Regulatory History

A SWMU is defined by the NC DENR as: "Any discernible unit which has been used for the treatment, storage, or disposal of solid waste at any time, irrespective of whether the unit is or ever was intended for management of solid waste. RCRA regulated hazardous waste management units are also solid waste management units." (EnSafe, 1996). A SWMU may include any landfill, surface impoundment, waste pile, land treatment unit, incinerator, injection well, tank, container storage area, septic tank, drain field, waste water treatment unit, elementary neutralization unit, transfer station, or recycling unit (EnSafe, 1996).

A RCRA corrective action can have five stages. The stages are as follows (in chronologic order):

- RCRA Facility Assessment (RFA);
- Interim Measure;
- RCRA Facility Investigation;
- Corrective Measures Study; and
- Corrective Measures Implementation.

A RFA is conducted in response to a real or suspected release. The RFA may consist of three parts: preliminary review, a visual site inspection, and confirmatory sampling. The Phase I investigation conducted in September 1997 is part of the confirmatory sampling aspect of the RFA for MCB Camp Lejeune. Based on the Phase I results, the confirmatory sampling part of the RFA would be completed by instituting a Phase II investigation. Results of the RFA determine if a release has or is occurring. An interim measure can be conducted as a response to a release of hazardous constituents which is imminently endangering human health or the environment. The RFI involves the process of characterizing the nature and extent of a release (confirmed by the RFA). The Corrective Measure Study (CMS) is the process of evaluating and selecting technologies to address released hazardous constituents. A Corrective Measures Implementation (CMI) is the implementation of the selected remedy.

The Base was issued a RCRA Part B Permit to operate a hazardous waste container storage facility in September 1984. This permit was issued before the enactment of the Hazardous and Solid Waste Amendments of 1984 (HSWA), which under Section 3004(u) empowers the United States Environmental Protection Agency (USEPA) to order corrective action at treatment, storage, and disposal (TSD) facilities. This section of the HSWA requires corrective action to be taken for all releases of hazardous waste or hazardous constituents from any SWMU (EnSafe, 1996). A revised

Hazardous Waste Management Permit was issued on January 10, 1997 and included corrective actions for SWMUs.

An initial RFA was conducted at the Base by the USEPA Region IV and the North Carolina Department of Environment and Natural Resources (NC DENR) in January 1989. The RFA included 76 SWMUs. Seven of the SWMUs required confirmatory sampling; 23 of the SWMUs required an RFI; 46 of the SWMUs required no further action. The initial RFA was later expanded to include units such as landfills, surface impoundments, waste piles, tanks, container storage areas, septic tanks, drain fields, waste treatment units, and storm water conveyances. More than 3,500 SWMUs were identified during a preliminary review of Base records. Visual site inspections were conducted on nearly 500 of these SWMUs. The findings from the RFA are presented in the RCRA Facility Assessment Report for Marine Corps Base, Camp Lejeune, North Carolina (EnSafe, 1996).

The 1996 RFA Report categorized each of the potential SWMUs and areas of concern (AOCs) into four groups, as follows:

- Units having a release potential
- Units addressed under the Installation Restoration (IR) Program in accordance with CERCLA
- Units addressed under the IR Leaking Underground Storage Tank (LUST) Program in accordance with NC DENR requirements
- Units having a release potential under RCRA corrective action; therefore requiring confirmatory sampling

The 1996 RFA Report identified 41 IR sites, 112 underground storage tank (UST) sites, and 56 SWMUs that required confirmatory sampling or corrective measures. Based on further negotiations between NC DENR and the Base, 62 SWMUs required confirmatory sampling. These 62 SWMUs were investigated under the Phase I CSI conducted by Baker in 1997. Of the 62 SWMUs investigated, 20 SWMUs required no further action, and 42 SWMUs were recommended for a Phase II Confirmatory Sampling Investigation. The confirmatory sampling data are presented in the Phase I SWMU Confirmatory Sampling Report (Baker, 2001).

The 42 SWMUs requiring additional investigation are summarized on Table 1-1. Six additional SWMUs requiring investigation were added to the Phase II Investigation as requested by the Environmental Quality Branch (EQB) of the Environmental Management Division, at MCB, Camp Lejeune. These six additional SWMUs are summarized on Table 1-1.

It should be noted that additional investigation activities were recommended at SWMU 82. However, the additional investigation at this SWMU is currently being conducted under the Remedial Investigation (RI)/Feasibility Study (FS) at Building 45 and not the Phase II CSI.

Figure 1-1 provides a location map for the Base and an index for the locations of Figures 1-2 through 1-4. Figures 1-2 through 1-4 depict the locations of the 47 SWMUs investigated as part of the Phase II CSI.

## 1.2 Report Organization

In addition to Section 1.0, the following sections are presented in this Phase II Confirmatory Sampling Report:

- Section 2.0 - Background Information
- Section 3.0 - Investigation Procedures
- Section 4.0 - SWMU-Specific Information and Investigation Results
- Section 5.0 - Summary and Recommendations
- Section 6.0 - References

Section 2.0 summarizes relevant background information pertaining to the Base including location and setting, history and mission, hazardous wastes generated, topography and surface features, surface water hydrology, geology, hydrogeology, land use and demographics, climatology, water supply, and ecological characteristics. Information regarding the geology at each SWMU has been incorporated into Section 2.0. Section 3.0 describes the investigation procedures and analytical program. Section 4.0 provides information specific to the SWMUs and discusses the investigation results. Section 5.0 summarizes the results and recommendations for each of the SWMUs. Section 6.0 presents the references used in preparation of this report.

With the exception of Section 4.0, the tables and figures are provided following the text for each section. In Section 4.0, the tables and figures for each SWMU are provided following the text in the subsection that discusses SWMU-specific information.

# TABLES

**TABLE 1-1**

**SWMUs INCLUDED IN PHASE II CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**

| SWMU | Name |
|---|---|
| SWMU 43 | Pest Control Shop |
| SWMU 46 | Montford Point Dump Site |
| SWMU 53 | Coal Storage Area |
| SWMU 89 | SLCH785 Basin |
| SWMU 253 | 1205 AST |
| SWMU 254 | 1408 Dumpster |
| SWMU 255 | 1502 Oil/Water Separator-1 |
| SWMU 256 | 1700 Oil/Water Separator-1 |
| SWMU 257 | 1700 Oil/Water Separator-2 |
| SWMU 258 | S1745 Oil/Water Separator |
| SWMU 261 | 1780 UST-1 |
| SWMU 264 | 2611 Container |
| SWMU 265 | 2615 Oil/Water Separator |
| SWMU 269 | 816 Oil/Water Separator |
| SWMU 272 | AS137 Oil/Water Separator |
| SWMU 279 | FC200 Oil/Water Separator |
| SWMU 285 | S947 Oil/Water Separator |
| SWMU 291 | 034 Ditch |
| SWMU 293 | 1106/1107 Oil/Water Separator |
| SWMU 294 | 1203 Oil/Water Separator |
| SWMU 295 | 1601 AST |
| SWMU 296 | 1700 Basin B |
| SWMU 297 | 1780 Oil/Water Separator-2 |
| SWMU 299 | AS114 AST |
| SWMU 300 | AS118AST |
| SWMU 302 | AS504 AST |
| SWMU 303 | AS515 AST-E |
| SWMU 305 | BB224 Pile |
| SWMU 306 | FC230 Oil/Water Separator-1 |
| SWMU 307 | G649 Rack |
| SWMU 308 | GP-19 Oil/Water Separator |
| SWMU 311 | S1619 Oil/Water Separator |
| SWMU 312 | S1735 Oil/Water Separator |
| SWMU 313 | S1753 Oil/Water Separator and AST |
| SWMU 314 | SM187 Oil/Water Separator |
| SWMU 315 | SM269 Oil/Water Separator |
| SWMU 316 | TC773 Oil/Water Separator |
| SWMU 317 | TT2453 Release |
| SWMU 318 | AS515 Oil/Water Separator |
| SWMU 319 | Camp Geiger Wastewater Treatment Plant |
| SWMU 336 | AS4106 Paint Stripper |
| SWMU 339 | AS146 Sand Blaster |
| *SMWU 358 | Sneads Ferry Road Battery Dump |
| *SWMU 359 | Lot 201 Battery Dump |
| *SWMU 360 | Building 1817 UST |
| *SWMU 361 | 333-C Former UST |
| *SWMU 362 | Dog 11 Area |
| *SWMU 363 | M-21 Arresting Gear |

* = Denotes the six additional SWMUs requiring investigation that were added to the Phase II Investigation; as requested by the Installation and Restoration Department at MCB, Camp Lejeune.

# FIGURES

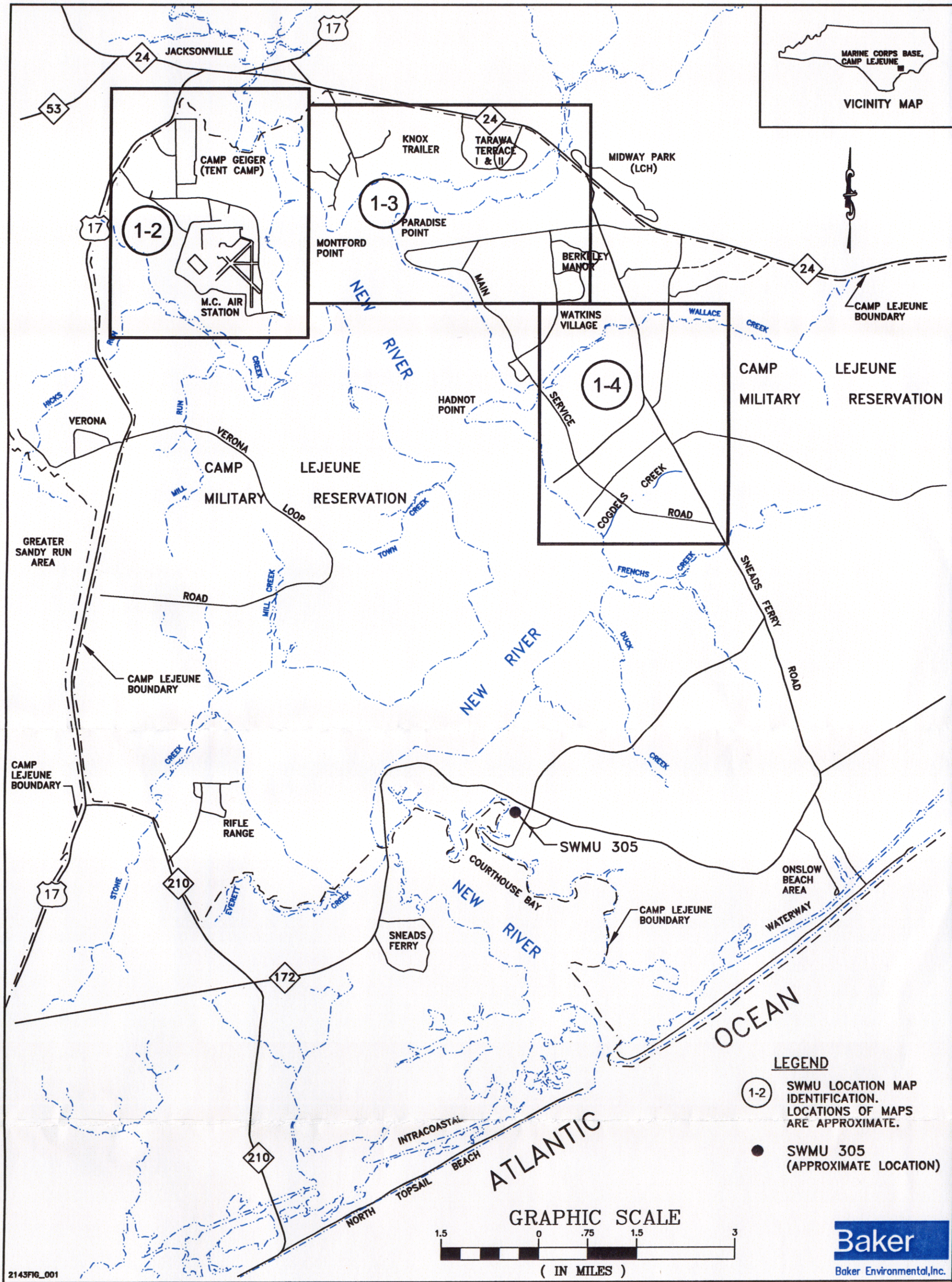
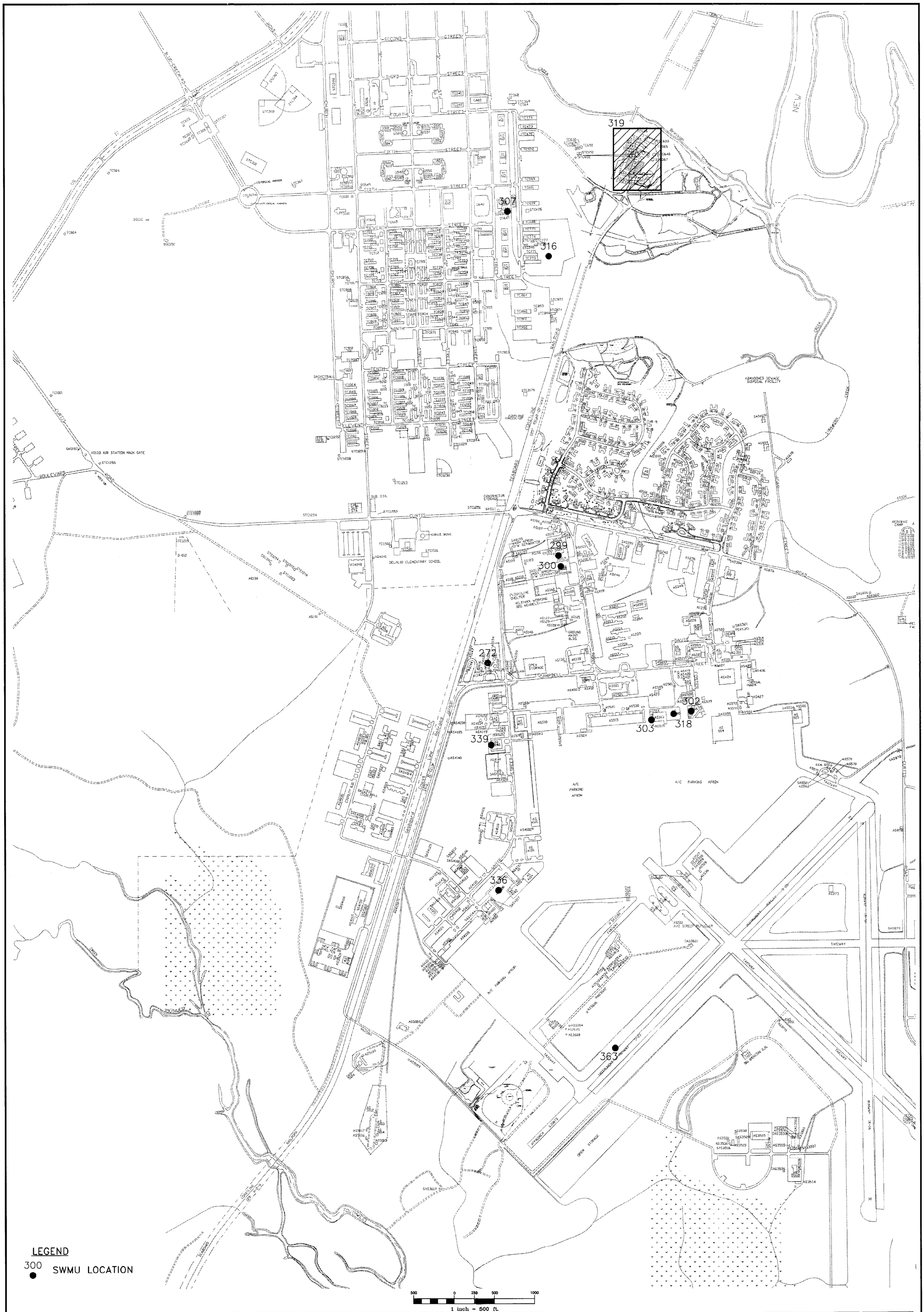



FIGURE 1-1
MCB CAMP LEJEUNE LOCATION/INDEX MAP
PHASE II CONFIRMATORY SAMPLING REPORT
CTO - 0143

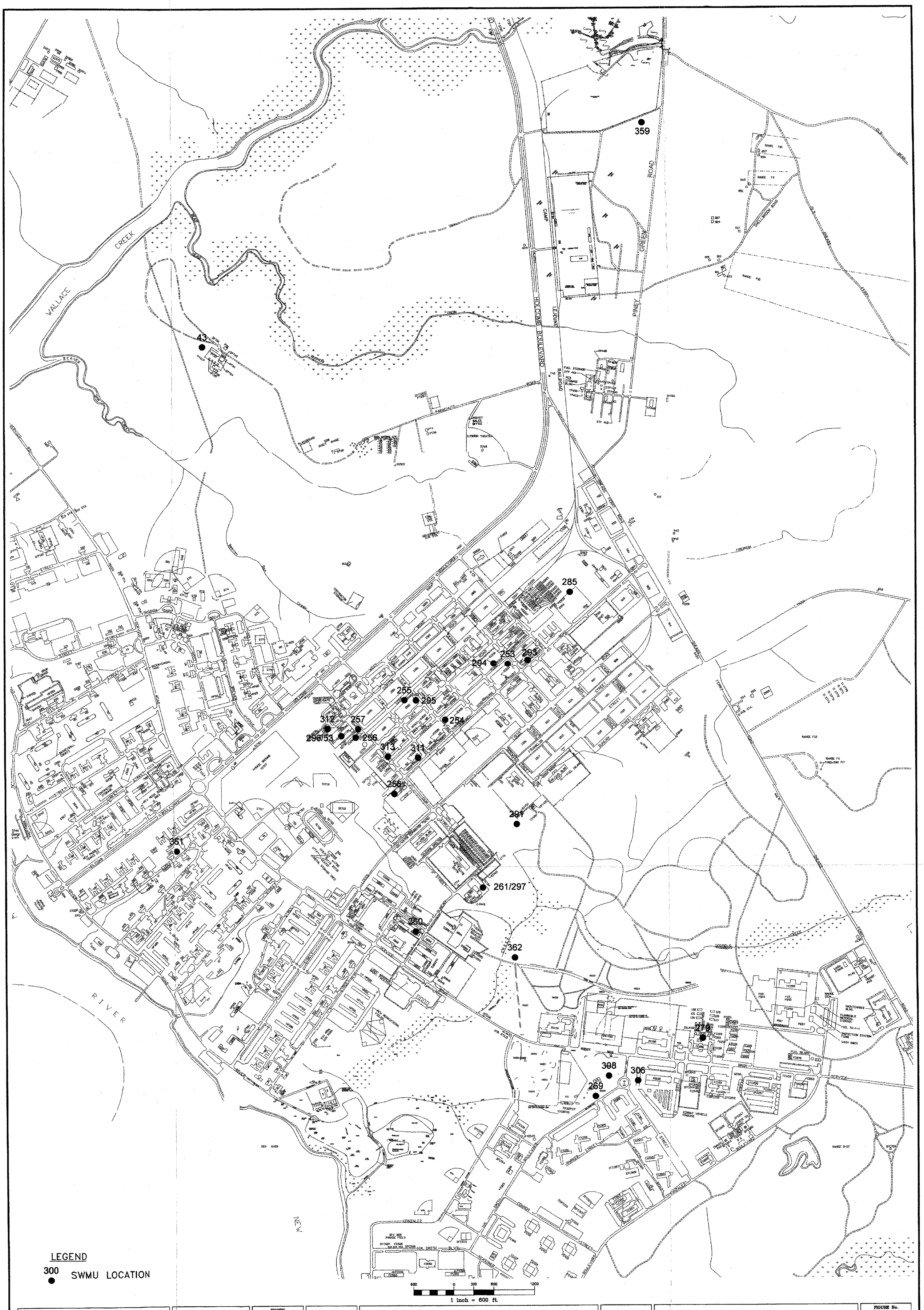
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| LEGEND | DRAWN REL<br>REVIEWED JSC<br>MODIFIED RMS<br>S.O.# 26007-143<br>CADD# 1-2<br>CAD\FIELD PREP | NORTH | | MARINE CORPS BASE, CAMP LEJEUNE<br>NORTH CAROLINA<br>BAKER ENVIRONMENTAL, Inc.<br>Moon Township, Pennsylvania | Baker<br>Baker Environmental, Inc. | CAMP GEIGER/MCAS AREA<br>PHASE II SWMU LOCATION MAP<br>SCALE 1"= 500'<br>DATE June 7, 2005 | FIGURE No.<br>1-2 |
|---|---|---|---|---|---|---|---|

03753EB2X

| REVISIONS | | NORTH | | MARINE CORPS BASE, CAMP LEJEUNE<br>NORTH CAROLINA | Baker<br>Baker Environmental, Inc. | TARRAWA TERRACE/MONTFORD POINT AREA<br>PHASE II SWMU LOCATION MAP | FIGURE No. |
|---|---|---|---|---|---|---|---|
| | DRAWN REL<br>REVIEWED JSC<br>MODIFIED RRR<br>S.O.# 26007-143<br>CADD# 2143FP1-3<br>K\26007\143\Graphics\Cad\Field Prep | | | BAKER ENVIRONMENTAL, Inc.<br>Coraopolis, Pennsylvania | | SCALE 1"= 600' / DATE SEPTEMBER 13, 2002 | 1-3 |




LEGEND

300 ● SWMU LOCATION

| LEGEND | | NORTH | | MARINE CORPS BASE, CAMP LEJEUNE<br>NORTH CAROLINA | | HADNOT POINT AREA<br>PHASE II SWMU LOCATION MAP | FIGURE No. |
|---|---|---|---|---|---|---|---|
| | DRAWN REL<br>REVIEWED JSC<br>MODIFIED RMS<br>S.O.# 26007-143<br>CADD# 2143FP1-4<br>K\26007\143\Graphics\Cad\Field Prep | | | BAKER ENVIRONMENTAL, Inc.<br>Coraopolis, Pennsylvania | Baker<br>Baker Environmental, Inc. | SCALE 1"= 600' / DATE SEPTEMBER 13, 2002 | 1-4 |

## 2.0 MCB, CAMP LEJEUNE BACKGROUND

This section summarizes relevant background information pertaining to the MCB, Camp Lejeune including location and setting, history and mission, hazardous wastes generated, topography and surface features, surface water hydrology, geology, hydrogeology, land use and demographics, climatology, water supply, and ecological characteristics.

### 2.1 Location and Setting

The Base is located within the Atlantic Coastal Plain Physiographic Province in Onslow County, North Carolina, approximately 45 miles south of New Bern and 47 miles north of Wilmington. It covers approximately 236 square miles and is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. MCB, Camp Lejeune is bordered by the City of Jacksonville, North Carolina and State Route 24 to the north; the Atlantic shoreline to the south and east; and U.S. Route 17 to the west (see Figure 1-1).

The following overview of MCB, Camp Lejeune was taken from the document "Master Plan, Camp Lejeune Complex, North Carolina." The Base consists of 12 identifiable developed areas. Of the developed areas, Hadnot Point comprises the most concentrated area of development. This area includes the organizational offices for the Host Activity and for the Headquarters, 26th Marine Amphibious Unit, as well as the Headquarters and regimental areas for the 2nd Marine Division, Marine Expeditionary Force, 6th Marine Expeditionary Brigade, 22nd Marine Expeditionary Unit, 24th Marine Amphibious Unit, the Central Exchange & Commissary, and the Naval Dental Clinic Headquarters. Family housing areas concentrated throughout the wooded areas in the central portion of the Base and along the shores of the New River directly north of Hadnot Point. In addition, major personnel support facilities, including the Naval Hospital, school sites, recreational areas, as well as additional family housing areas (quarters developments, Midway Park and Tarawa Terrace I and II) are located in the north central portion of the Base.

MCAS New River and Camp Geiger are considered as a single urban area possessing two separate missions and supported by two unrelated groups of personnel. MCAS New River encompasses 2,772 acres and is located in the northwestern section of the Base 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.

Camp Geiger is located directly north of MCAS New River and contains a combination of troop housing, personnel support facilities, and training facilities. Currently, the area is used by a number of groups that have no direct relationship to one another. The majority of the land surrounding this area is comprised of buffer zones and unbuildable marshland.

MCB, Camp Lejeune contains five other areas of concentrated development, all of which are much smaller in size and population than Hadnot Point, MCAS New River, and the Camp Geiger area. The oldest of these developments is the Montford Point area, which is bordered by the New River to the south and west and by State Route 24 to the north. New development in Montford Point has been limited. Most of the facilities for troop housing, maintenance, supply, and personnel support have been converted from their intended uses. The majority of Base training schools requiring classroom instruction are located here and use surrounding undeveloped areas for training operations when required.

The French Creek area is located directly south of Hadnot Point and is occupied by the 2nd Force Service Support Group (2nd FSSG). Activities of the 2nd FSSG are directed toward providing combat

service and technical support as required by Headquarters, II Marine Expeditionary Force. Expansion of the French Creek area is constrained by the Ordnance Storage Depot explosives safety arc on the south and by the regimental area of Hadnot Point.

Onslow Beach is located along Onslow Bay east of the New River Inlet and provides assets for amphibious training as well as recreational use.

Courthouse Bay is located on one of a series of small bays, which are formed by the New River. This area is used for maintenance, storage, and training associated with amphibious vehicles and heavy engineering equipment. The Engineering School also is located in the Courthouse Bay area. Training activities are conducted in the large open area located southeast of Courthouse Bay.

The Rifle Range area is located on the southwest side of the New River and includes only a small number of assigned personnel. The Rifle Range was constructed in the early stages of Base development and is used solely for rifle qualification training. A small group of barracks is located at the Rifle Range and is used for two-week periods by troops assigned to range training.

## 2.2 History and Mission of Camp Lejeune

Development of MCB, Camp Lejeune began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base." Five geographical locations under the jurisdiction of the Base Command were developed, including Camp Geiger, Montford Point, Courthouse Bay, Mainside, and the Rifle Range. Construction of the Base started at Hadnot Point, where the major functions of the base are centered.

MCB, Camp Lejeune functions as the host command for the two Fleet Marine Force Atlantic (FMFLANT) tenant activities -- Headquarters of the II Marine Expeditionary Division and the 2nd FSSG. MCB, Camp Lejeune's mission is to provide housing, training facilities, logistical support, and certain administrative support for tenant units and for other units assigned to the Base and to conduct specialized schools and other training maneuvers, as directed.

## 2.3 Summary of Hazardous Wastes Generated

The Base generates various hazardous wastes which can generally be classified as waste batteries, waste oil filters, waste solvents, waste paint, discarded commercial chemical products, and others (EnSafe, 1996). Waste batteries are comprised of lithium, magnesium, mercury, nickel-cadmium, and electrolyte. Spent lithium batteries, if not deactivated, can be reactive. Magnesium and mercury batteries may be hazardous due to chromium and mercury contents. Nickel-cadmium batteries may be hazardous due to cadmium levels. Waste electrolyte may be generated when lead-acid batteries are drained, wet cell nickel-cadmium batteries are discarded, or when waste electrolyte is discarded. Electrolyte may be hazardous based on corrosivity properties and/or lead or cadmium contents (EnSafe, 1996).

Waste oil filters are routinely generated from vehicle and aircraft maintenance operations. In the past when terne-plated filters were used, the filters were classified as hazardous waste due to the lead content (EnSafe, 1996).

Solvents such as methyl ethyl ketone (MEK), toluene, xylene, and methylene chloride are used in vehicle, military hardware, and aircraft maintenance. These types of solvents may exhibit RCRA hazardous characteristics or are listed as a RCRA hazardous waste (EnSafe, 1996).

Several types of waste paint are generated at the Base, including enamel, chemical-resistive coating, epoxy, and oil-based. These waste paints may exhibit a RCRA hazardous characteristics and/or contain a RCRA-listed hazardous waste (EnSafe, 1996).

The Naval Hospital is a generator of discarded commercial chemical products. Generally, these products are discarded due to expired shelf life. These discarded products may be classified as RCRA hazardous waste (EnSafe, 1996).

## 2.4 Topography and Surface Features

The topography of MCB, Camp Lejeune is generally flat and typical of the North Carolina Coastal Plain. Elevations range from sea level to approximately 72 feet above mean sea level (MSL).

Drainage generally is toward the New River, except in areas near the coast, which drain through the Intracoastal Waterway. In developed areas, the natural drainage has been altered by asphalt cover, storm sewers, and drainage ditches. Approximately 70 percent of the Base is situated 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 the 100-year floodplain at MCB, Camp Lejeune at 7 feet above MSL in the upper reaches of the New River increasing downstream to 11 feet above MSL near the coastal area (WAR, 1983).

## 2.5 Surface Water Hydrology

The following summary of surface water hydrology was originally presented in the Initial Assessment Study (IAS) report (WAR, 1983). The dominant surface water body is the New River, which receives drainage from most of the Base. The river flows approximately 50 miles over 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. Within the boundaries of MCB, Camp Lejeune, the New River flows in a southerly direction into the Atlantic Ocean through the New River Inlet. The New River, the Intracoastal Waterway, and the Atlantic Ocean converge at the New River Inlet.

Classifications of 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, and 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).

## 2.6 Geology

The Base is located 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. The sediments 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 which overlie igneous and metamorphic basement rocks of the pre-Cretaceous age. Seven of these aquifers and their associated confining units are present at the Base (Cardinell, et al., 1993). Table 2-1 presents a generalized stratigraphic column for Jones and Onslow Counties, North Carolina. A hydrogeologic section location plan and hydrogeologic cross-sections of the Base are presented in the Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina (Cardinell, et al, 1993). The lithologic conditions at MCB, Camp Lejeune are discussed in further detail and related to the hydrogeologic framework of the region in Section 2.7.

As part of this investigation, at least one soil boring was advanced continuously at each individual SWMU. The individual borings provided information regarding the lithologic conditions in the vicinity of the SWMU. The borings also provided an estimated depth to groundwater to aid in the monitoring well installation.

The lithology encountered during the investigation consisted primarily of fine sand with varying amounts of silt and clay. In areas, silty and/or clayey strata predominated. Fill materials were also encountered at specific SWMUs. Refer to the boring logs that are presented in Appendix A for information regarding the lithology encountered at the individual SWMUs.

## 2.7 Hydrogeology

The following information was derived from literature published by the United States Geological Survey (USGS) (Harned, et al., 1989 and Cardinell, et al., 1993) and the technical memorandum prepared by Baker summarizing groundwater data and aquifer characteristics for the Base (see Appendix B).

USGS studies at the Base 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). The thickness of the surficial aquifer at the Base ranges from approximately 0 to 73 feet, and typically averages 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 the Base.

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 (see Table 2-2 and 2-3). The remaining 70 percent of 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 the Base (based on 150 square miles of recharge area). Water levels in 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 estimated lateral hydraulic conductivity for the surficial aquifer is 50 feet per day (ft/d) and is based on a general composition of fine sand mixed with some silt and clay (Cardinal, et al., 1993).

A study of data from aquifer pumping tests at the Base was conducted by Baker in 1994 to evaluate aquifer characteristics and production capacities. The technical memorandum is provided as Appendix B. The information contained in this memorandum pertains primarily to the surficial aquifer. Average pumping rates were established between 0.5 to three gallons per minute (gpm); transmissivity ranged from 7.1 to 7,100 square feet per day ($ft^2$/day); storativity ranged from $1.5 \times 10^3$ to $7.5 \times 10^2$; and hydraulic conductivity was estimated to range from 0.5 to 1.4 ft/d.

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 the Base because of its low yielding production rates (typically less than three gpm).

The Castle Hayne confining unit is comprised of silt, clay, and sandy clay beds. These beds form a unit across the Base that may be represented by one or more geological units including the 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. Overall, the Castle Hayne confining unit may be characterized as a group of less permeable beds at the top of the Castle Hayne aquifer that have been eroded in places. The thickness of the confining unit ranges from approximately 0 to 26 feet, and typically averages 9 feet where present. No discernible trend in the thickness of the confining unit exists although it is more than 20 feet thick only in the southern and southwestern portions of the Base. 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 and 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).

The principal water supply aquifer for the Base is the Castle Hayne aquifer. This aquifer primarily resides within the River Bend Formation, which consists of sand, cemented shells, and limestone. The upper portion of the aquifer primarily consists of calcareous sands with some thin clay and silt beds. The sand becomes increasingly more limy with depth. The lower portion of the aquifer consists of partially unconsolidated limestone and sandy limestone interbedded with clay and sand. In addition, buried paleostream channels containing various deposits exist within the aquifer. The top of the aquifer ranges from approximately 10 feet above msl to 70 feet below msl and is irregular over most of the northern portion of the Base. The aquifer is more regular in areas southeast of the New River, where it slopes southeastward. The Castle Hayne aquifer thickens to the east, from approximately 160 feet in the Camp Geiger area to more than 400 feet at the eastern boundary of the Base.

Estimated transmissivity values for the Castle Hayne aquifer range from 6,100 to 183,300 gallons per day per foot (gpd/ft); estimated hydraulic conductivity values range from 14 to 91 ft/d; and estimated storage coefficient values range from $2 \times 10^{-4}$ to $1.9 \times 10^{-3}$. An aquifer pump test conducted by ESE (1988) in the Hadnot Point Industrial Area, using an existing water supply well (HP642), indicates an average transmissivity of 9,600 gpd/ft and storage coefficient of $8.8 \times 10^{-4}$ (ESE, 1988). Table 2-4 presents a summary of the hydraulic property estimates of the Castle Hayne aquifer and confining unit.

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

The Base 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.

## 2.8 Land Use and Demographics

MCB Camp Lejeune presently covers approximately 236 square miles. The Base's population of active and retired military, dependants, and civilian employees is more than 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 population of Onslow County has grown from 17,738 in 1940, before the formation of the Base, to its approximate present population of 121,350.

During World War II, the Base was used as a training area to prepare Marines for combat. This has been a continuing function of the Base during subsequent conflicts. Toward the end of World War II, the Base was designated as home for the Second Marine Division. Since then, Fleet Marine Forces units also have been stationed here as tenant commands.

The existing land patterns in the various geographic areas within the Base are summarized, per geographic area, on Table 2-5. In addition, the number of acres comprising each land use category has been estimated and provided on the table.

## 2.9 Climatology

Although coastal North Carolina lacks distinct wet and dry seasons, there is some seasonal variation in average precipitation (see Table 2-2 and 2-3). 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 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. The average yearly rainfall at the Base is approximately 52 inches. Tables 2-2 and 2-3 presents a summary of climatic data collected between January 1955 to March 2002 at MCAS New River. The data on Tables 2-2 and 2-3 were supplied by the Fleet Numerical Meteorology and Oceanography Detachment. All totals and averages for Table 2-2 were calculated by the Fleet Numerical Meteorology and Oceanography Detachment. All totals and averages for Table 2-3 was calculated by Baker.

The Base 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 34°F to 57°F in January and 71°F to 89°F in July. The average relative humidity (75 to 85 percent) does not vary greatly from season to season.

Observations of sky conditions indicate yearly averages of approximately 112 clear, 105 partly cloudy, and 148 cloudy days. Measurable amounts of rainfall occur 120 days per year, on the average. Prevailing winds are generally from the south-southwest 10 months of the year. During the months of

September and October, the winds blow from the north-northwest at an average speed of 6.9 miles per hour.

## 2.10 Water Supply

Potable water for the base is derived entirely by groundwater. The Base does not have established groundwater preservation areas. However, because the Base controls more than 236 square miles of land, and because much of this land has remained undeveloped, the undeveloped areas serve the function of groundwater preserves. Groundwater usage is roughly eight million gpd (Cardinell, et al., 1993). Groundwater is pumped from approximately 84 water supply wells located within the boundaries of the Base. 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 maximum total capacity of 15.8 million gpd. However, the base population only requires 6.5 million gpd.

The water supply wells at the base withdraw water from the Castle Hayne aquifer. The Castle Hayne aquifer is a highly permeable, semi-confined aquifer that can yield several hundred to 1,000 gpm. The wells (8-inch diameter) at the Base average 162 feet in depth and yield 174 gpm (Harned, et al., 1989). The water is typically a hard, calcium bicarbonate type. Information concerning the supply wells was derived 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.

## 2.11 Ecological Characteristics

The Natural Resources and Environmental Affairs (NREA) Division at the Base, 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 the Base. Habitats are maintained at the Base 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. Approximately nine percent of the Base (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 approximately 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 the Base 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 at the Base 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 here. 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 at the Base are as follows:

- Loblolly Pine Forest - A dominant forest type at the Base. 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 the Base. 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 including 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 Federal endangered red-cockaded woodpecker (Picoides Borealis) is essentially restricted to opened, burned longleaf pine forests. 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 Martitime 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.

## 2.12 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. Corps of Engineers. The U.S. Fish and Wildlife Service has prepared National Wetland Inventory (NWI) maps for the Base area by stereoscopic analysis of high altitude aerial photographs (USDI, 1982).

Wetland ecosystems at the Base 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 the Base 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 the Base. 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 the Base 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).

## 2.13 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 the base and several programs are underway to manage and protect them. Table 2-6 summarizes the protected species present at the Base and their protected classifications. Of these species, the red-cockaded woodpecker, American alligator, and sea turtles 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. Approximately 2,512 acres of habitat have been identified and marked for protection at the Base. Research on the red-cockaded woodpecker at the base 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 at the Base. 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 the Base and are both classified as threatened species. The green turtle was found nesting in 1980. The sighting was the first time that 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 the Base. 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 the Base.

In addition to the protected species that breed or forage at the Base, several protected whales migrate through the coastal waters off the base during the spring and fall. These include the Atlantic right whale, finback whale, sei 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 the Base (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. In addition, several state endangered/threatened and Federal and state candidate species were found on the Base.

# TABLES

TABLE 2-1

**GEOLOGIC AND HYDROGEOLOGIC UNITS IN THE COASTAL PLAIN OF NORTH CAROLINA MCB, CAMP LEJEUNE, NORTH CAROLINA PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**

| 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 2-2

**CLIMATIC DATA SUMMARY**
**JANUARY 1955 - DECEMBER 1995**
**MARINE CORPS AIR STATION, NEW RIVER**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**

| | Precipitation (Inches) | | | Relative Humidity (Percent) | | Temperature (Farhrenheit) | | | Mean Number of Days With | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Precipitation | | Temperature | | |
| | Maximum | Minimum | Average | AM | PM | Maximum | Minimum | Average | >=0.01" | >=0.5" | >=90F | >=70F | <=32F |
| January | 8.3 | 1.4 | 4.4 | 79 | 57 | 54 | 34 | 45 | 11 | 3 | 0 | 3 | 15 |
| February | 9.1 | 0.9 | 3.7 | 77 | 53 | 58 | 36 | 47 | 9 | 3 | 0 | 5 | 11 |
| March | 8 | 0.8 | 4 | 79 | 52 | 65 | 43 | 54 | 10 | 3 | * | 11 | 5 |
| April | 8.8 | 0.1 | 2.9 | 79 | 49 | 74 | 51 | 62 | 8 | 2 | 1 | 20 | * |
| May | 8.4 | 0.6 | 3.9 | 82 | 56 | 80 | 60 | 70 | 10 | 3 | 3 | 29 | 0 |
| June | 11.8 | 2.2 | 5.2 | 84 | 62 | 86 | 67 | 77 | 11 | 4 | 8 | 30 | 0 |
| July | 14.3 | 2.4 | 7.4 | 86 | 66 | 89 | 72 | 81 | 14 | 5 | 15 | 31 | 0 |
| August | 16.4 | 1.7 | 6.5 | 88 | 67 | 88 | 71 | 80 | 12 | 4 | 12 | 31 | 0 |
| September | 12.8 | 0.8 | 4.6 | 88 | 63 | 83 | 66 | 75 | 9 | 3 | 4 | 29 | 0 |
| October | 8.9 | 0.6 | 3.2 | 86 | 58 | 75 | 54 | 65 | 7 | 2 | * | 24 | * |
| November | 6.7 | 0.6 | 3.2 | 82 | 56 | 67 | 45 | 56 | 8 | 2 | 0 | 13 | 3 |
| December | 6.6 | 0.4 | 3.6 | 80 | 57 | 58 | 37 | 48 | 9 | 2 | 0 | 5 | 12 |
| Annual | 65.9 | 38.2 | 52.7 | 82 | 58 | 73 | 53 | 63 | 118 | 36 | 41 | 230 | 48 |

Notes:
* = Mean no. of days less than 0.5 days

Source: The Fleet Numerical Meteorology and Oceanography Detachment Asheville is a Department of Navy (DoN) office within the Department of Defense (DoD) handling Navy, Marine Corps and other DoD agency climatological requirements. Contact: Brian Wallace, Technical Advisor, Ph. 828-271-4232
Measurements obtained at New River, NC from January 1955 to December 1995.

All totals and averages for data from January 1996 through March 2002 was calculated separately by Baker and therefore cannot be combined with data in 1955 - 1995 table <SCSNEWRI.doc>

TABLE 2-3

**CLIMATIC DATA SUMMARY**
**JANUARY 1996 - MARCH 2002**
**MARINE CORPS AIR STATION, NEW RIVER**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**

| | Precipitation (Inches) | | | Temperature (Farhrenheit) | | | Mean Number of Days With | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Precipitation | | Temperature | | |
| | Maximum | Minimum | Average | Average Maximum | Average Minimum | Average | >=0.01" | >=0.5" | >=90F | >=70F | <=32F |
| January | 1.8 | 0.01 | 4.1 | 57 | 35 | 46 | 12 | 4 | * | 4 | 13 |
| February | 11.8 | 0.01 | 3.7 | 61 | 38 | 49 | 9 | 2 | * | 6 | 8 |
| March | 2.4 | 0.01 | 3.8 | 67 | 42 | 54 | 10 | 3 | 1 | 14 | 5 |
| April | 2.0 | 0.01 | 3.3 | 73 | 50 | 62 | 9 | 2 | * | 21 | 1 |
| May | 3.3 | 0.01 | 3.5 | 81 | 59 | 70 | 9 | 2 | 4 | 29 | * |
| June | 3.3 | 0.01 | 5.3 | 86 | 67 | 77 | 10 | 3 | 9 | 30 | * |
| July | 5.0 | 0.01 | 8.5 | 88 | 71 | 80 | 13 | 5 | 12 | 31 | * |
| August | 8.0 | 0.01 | 6.1 | 88 | 70 | 79 | 11 | 3 | 11 | 31 | * |
| September | 6.9 | 0.01 | 12.2 | 82 | 65 | 73 | 12 | 5 | 2 | 30 | * |
| October | 5.4 | 0.01 | 3.0 | 75 | 51 | 63 | 5 | 2 | * | 24 | * |
| November | 3.8 | 0.01 | 3.4 | 67 | 43 | 55 | 8 | 2 | * | 13 | 5 |
| December | 1.2 | 0.01 | 3.1 | 59 | 37 | 48 | 8 | 2 | * | 5 | 10 |
| Annual | 55.0 | 0.1 | 59.8 | 74 | 52 | 63 | 115 | 36 | 39 | 238 | 43 |

Notes:
* = Mean no. of days less than 0.5 days
The maximum and minimum precipitation is the highest maximum or minimum precipitation for that month, from 1996 to 2002.

Source: The Fleet Numerical Meteorology and Oceanography Detachment Asheville is a Department of Navy (DoN) office within the Department of Defense (DoD) handling Navy, Marine Corps and other DoD agency climatological requirements. Contact: Brian Wallace, Technical Advisor, Ph. 828-271-4232
Measurements obtained at New River, NC from January 1996 through March 2002.

All totals and averages for data from January 1996 through March 2002 were calculated separately by Baker and therefore cannot be combined with data in 1955 - 1995 table <SCSNEWRI.doc>

TABLE 2-4

HYDRAULIC PROPERTY ESTIMATES OF THE CASTLE HAYNE AQUIFER AND CONFINING UNIT
MCB, CAMP LEJEUNE, NORTH CAROLINA
PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143

| 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) | -- | $2.0 \times 10^{-4}$ to $2.2 \times 10^{-4}$ | $5.0 \times 10^{-4}$ to $1.0 \times 10^{-3}$ average $8.0 \times 10^{-4}$ | $1.9 \times 10^{-3}$ | -- |
| Confining-unit vertical hydraulic conductivity (foot per day) | -- | $3.0 \times 10^{-2}$ to $4.1 \times 10^{-1}$ | $1.4 \times 10^{-3}$ to $5.1 \times 10^{-2}$ average $3.5 \times 10^{-3}$ | -- | -- |

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 2-5

LAND UTILIZATION: DEVELOPED AREAS LAND USE[1]
MCB, CAMP LEJEUNE, NORTH CAROLINA
PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143

| 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)** |

Note:

(1) Upper number is acres, lower number is overall percent.

TABLE 2-6

PROTECTED SPECIES
MCB, CAMP LEJEUNE, NORTH CAROLINA
PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143

| 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 |
| 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 |

TABLE 2-6 *(Continued)*

**PROTECTED SPECIES**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**

| Species | Protected Classification |
|---|---|
| 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

## 3.0 INVESTIGATION PROCEDURES

The field program for the Phase II CSI was initiated to further evaluate the potential impact SWMU-related operations have had on soil and groundwater at 47 SWMUs throughout MCB, Camp Lejeune. The CSI was completed in two phases. Phase I consisted of a soil investigation in the vicinity of 62 SWMUs. Phase II consisted of additional soil sampling and a groundwater investigation at 42 SWMUs that warranted additional work at the conclusion of Phase I. Additionally, six new SWMUs were included in the Phase II CSI thus increasing the number of SWMUs to 47. The locations of these SWMUs are illustrated on Figures 1-2 through 1-4. Table 3-1 provides a summary of the sampling and analytical program. The following sections describe the methods used to collect and analyze the samples.

### 3.1 Project Objectives

The objectives of the Phase II CSI were as follows:

- Further evaluate potential impacts to soil at the SWMUs that required additional investigation at the completion of Phase I CSI;
- Determine if groundwater has been impacted as a result of a spill(s)/release(s) from the SWMUs and/or SWMU-related activities; and
- Determine the approximate location of the old landfill at SWMU 46 - Montford Point Dump Site.

### 3.2 Soil Sample Collection

Surface and subsurface soil samples were collected at many of the SWMUs to determine if soil in the vicinity of the SWMU has been impacted during SWMU-related operations. Samples were collected from borings advanced by a direct-push soil sampler (i.e., Geoprobe) attached to a drill rig, or by a hand unit supplied and operated by Parrott Wolff, Inc. of Hillsboro, North Carolina. The hand unit was used in instances where access to the borings was not obtainable by the truck-mounted unit. Prior to sampling, utility clearance was completed at all locations by Locating Contractors, Inc. of Jacksonville, North Carolina. In cases where utilities were discovered in close proximity to proposed sample locations, the sample point was moved to a different location. No utilities were disrupted during this investigation.

Baker personnel supervised approximately 157 soil borings advanced to the water table at the 47 SWMUs. One boring from each SWMU was typically advanced for soil classification purposes and to identify sample depths for all borings advanced at the SWMU. The selected boring was continuously sampled and logged by the site geologist. Additional borings advanced at any SWMU were used for sample collection purposes. However, the site geologist may have decided to collect soil samples to confirm the elevation of specific geologic units throughout the SWMU. Selection of the soil boring locations were based on previous investigation results (Phase I CSI) and observations made during the site visit conducted by Baker in March 2002. The selected sampling locations were documented in the Final Project Plans (Baker, 2002).

The surface and subsurface soil samples were collected from each boring using a direct push sampler. A 4-foot long geoprobe sampler was continuously driven from ground surface to the water table by a hydraulic drive assembly or by a hand-held drive hammer. Once the desired depth was obtained, the sampler was pulled from the hole. The sampler was dissembled and handed to the geologist for

logging, photoionization detector (PID) measurements and soil samples were collected as necessary. The sampler was decontaminated following procedures outlined in Section 3.8 and reassembled prior to use.

The soil was removed from the split-spoon sampler using a stainless steel spoon or spatula. The portion of the sample selected for volatile organic analysis (VOA) was collected using an Encore sampler to minimize loss of volatile organic compounds (VOCs) in the sample. The samples were placed into appropriate, laboratory-supplied sample containers and stored on ice in a cooler at a minimum temperature of 4° Celsius (C) until shipped to the laboratory. To minimize the potential for cross-contamination, new stainless steel spoons and/or spatulas were used to handle each soil sample as it was removed from the acetate liner and placed into the sample container(s).

Subsequent to sampling, borings not converted to temporary monitoring wells were backfilled with sodium bentonite. The surface was plugged with asphalt or material similar to the existing surface.

Up to two soil samples from each boring were collected and submitted to the laboratory for chemical analyses. The samples were selected based on sample depth, lithologic location, and field observations (e.g., elevated PID readings, discoloration, etc.). In general, samples from the 0 to 1-foot interval (surface soil) and samples from the soil/groundwater interface were selected for chemical analyses.

All soil samples retained for analysis were prepared and handled according to USEPA Region IV Standard Operating Procedures (SOPs) as outlined in the Final Project Plans (Baker, 2002). Chain-of-Custody documentation, which included information such as sample numbers, date, time of sampling, and sampling party accompanied the samples to the laboratory and is provided in Appendix C. Samples were shipped via Carolina Couriers to CompuChem Laboratories in Cary, North Carolina, for analysis.

## 3.3 Temporary Monitoring Well Installation

Temporary monitoring wells were installed in 124 of the borings to sample the shallow water-bearing zone. The wells were constructed as follows:

After soil sampling as described in Section 3.2, the borehole was reamed to approximately 7 to 13 feet below the groundwater table using 3-1/4-inch ID hollow-stem augers. Ten to fifteen feet of 1-inch ID Schedule 80, 0.010-slot, polyvinyl chloride (PVC) screen with a bottom cap was set at the bottom of the borehole. The screen was connected to threaded, flush-jointed, PVC riser. A PVC riser slip-cap was placed at the top of the casing. The annular space around the well screen was backfilled with a well graded, fine to medium sand. The sand was extended to approximately 2 feet above the top of the screened interval.

A sodium bentonite seal was placed above the sand pack and extended to just below ground surface to prevent surface and near subsurface water from infiltrating into the screened groundwater monitoring zone. The bentonite was hydrated with potable water, as necessary.

Upon completion of the sand pack, the depth intervals of all backfilled materials were measured with a weighted measuring tape to the nearest 0.1-foot. Well construction details were recorded in the field logbooks and on Test Boring and Well Construction Records (Appendix A).

## 3.4 Groundwater Sampling

Groundwater samples were collected from the temporary monitoring wells between April 2 and 10, 2002. Prior to purging/sampling, static water levels were measured in the wells. The wells were sampled using a peristaltic pump (with new tubing for each location) and low-flow purge/sampling procedures, as follows:

- The pump intake (new, 1/4-inch inside diameter [ID], polyethylene tubing) was set approximately 2 to 3 feet below the top of the well screen or the top of the water level, whichever is greater.

- The sampling rate was set to create a sustainable flow (approximately 1 liter/minute or less) without causing a significant drop in water level in the well.

- Water quality parameters (WQPs) including pH, specific conductance, temperature, turbidity, and dissolved oxygen were measured for each well volume purged. WQPs for all wells sampled are presented in Appendix D.

- Purging was considered complete when a minimum of three well volumes were removed and three successive WQP readings stabilized within 10 percent (0.1 Standard Units for pH), or there was no further discernable upward or downward trend (see Appendix D).

- Upon WQP stabilization, groundwater samples were collected from the end of the tubing and placed into appropriate laboratory-prepared sample containers with appropriate preservatives. If VOCs were being analyzed at the temporary well, they were collected prior to other parameters. The sample containers were stored on ice in a cooler at approximately 4°C (or less) until shipped to the laboratory for analysis.

## 3.5 Surface Water Sampling

Three surface water samples were collected on April 9, 2002 from the unnamed tributary at SWMU 362. The samples were collected near mid-stream by dipping the unpreserved, laboratory-supplied sample containers directly into the water. Containers with preservative were filled by pouring water from an unpreserved container into the preserved ones. Care was taken to ensure that the containers did not contact and/or stir up the sediments, while still being relatively close to the sediment-water interface.

Samples at the furthest downstream station were collected first. Subsequent samples were collected at the next upstream station(s). Unpreserved sample containers were rinsed with the sample water prior to sample collection. In addition, the sampling container used to transfer the water into sample bottles containing preservatives were rinsed once with sample water. The sample containers were temporarily stored on ice in a cooler at approximately at a minimum of 4°C until shipped to the laboratory.

## 3.6 Sediment Sampling

Three sediment samples were collected on April 9, 2002 from the unnamed tributary at SWMU 362. Samples at the furthest downstream station were collected first. Subsequent samples were collected at the next upstream station(s). In general, the samples were collected from the upper 2 to 3 inches of sediment using a decontaminated, stainless steel spoon. The sediment samples were collected after the corresponding surface water samples had been collected.

As with all samples, sediment collected for VOA was collected using EnCore™ samplers to minimize loss of VOCs in the sample. Sediment collected for all other analyses was placed into an aluminum pan, thoroughly homogenized, and placed into the appropriate sample containers. As with all samples, these samples were stored on ice in a cooler at approximately 4°C (or less) until shipped to the laboratory for analysis.

### 3.7 Field Quality Assurance/Quality Control

Field QA/QC samples included 9 equipment rinsate blanks, 4 field blanks, 14 trip blanks, 46 field duplicates, and 23 matrix spike/matrix spike duplicate (MS/MSD samples). The analytical results for QA/AC samples are presented in Appendix E.

Common laboratory contaminants (i.e., acetone, 2-butanone, chloroform, methylene chloride, and phthalate esters) were considered as positive results only when observed concentrations exceeded ten times the maximum concentration detected in any blank. If the concentration of a common laboratory contaminant was less than ten times the maximum blank concentration, then it was concluded that the chemical was not detected in that particular sample (USEPA, 1989a). Organic constituents contained in blanks that were not considered common laboratory contaminants were considered as positive results only when observed concentrations exceeded five times the maximum concentration detected in any blank (USEPA, 1989b).

Equipment rinsate blanks were collected by running laboratory-supplied deionized water over/through the decontaminated sampling equipment and placing it into the appropriate sample containers for laboratory analyses. The results were used to verify that the equipment used for sampling had been properly decontaminated and did not contribute to contamination of the samples. There were no compounds detected within any of the equipment rinsate samples submitted for analysis.

One field blank was collected from each source water used in decontamination of equipment (sampling and drilling). Field blanks were collected as part of the field program by pouring the water from the temporary holding container directly into sample bottles. Samples FB01, FB02, FB03, and FB04 were collected from the laboratory supplied deionized water, distilled water, potable water from the DRMO area, and potable water from the Hadnot point area, respectively. The deionized water was used for equipment rinsates, the distilled water was used for decontamination of sampling equipment, and the two sources of potable water were used for decontamination equipment (i.e., geoprobe rig, sampling rods) during this field investigation. The results were used to verify that the water used in decontamination had not contributed to contamination of the samples.

Trip blanks were prepared by the laboratory and were included in each cooler containing samples for volatile organics analysis. The results were used to verify that the sample containers and handling procedures used throughout the sampling program did not contribute to contamination of the samples. There were no compounds detected within any of the tripblanks submitted for analysis.

Field duplicate samples consisted of one unique sample, split into two aliquots, and analyzed independently. Duplicate soil samples analyzed for parameters other than VOCs were homogenized, and split. Samples for VOC analyses were not mixed, but representative portions of the soil were collected from the length of the core using Encore samplers. Duplicate water samples were collected simultaneously. The duplicate samples were analyzed to verify the reproducibility of the laboratory results and degree of variability of reported concentrations. Duplicate samples were collected at a frequency of 10 percent. The analytical results for duplicate samples are presented in Appendix F.

MS/MSD samples were collected in the field to address aliquot reproducibility and to provide information on matrix reproducibility otherwise unobtainable from samples reported below analytically reproducible and statistically valid levels. Due to the limited number of samples at each SWMU, MS/MSD samples were prepared at a frequency of 5 percent for each group of samples of a similar matrix.

### 3.8 Decontamination

Reusable sampling equipment (i.e., stainless steel spatulas, stainless steel spoons, etc.) was decontaminated, as follows:

- Equipment was washed thoroughly with non-phosphate laboratory detergent and potable water using a brush to remove any particulate matter or surface film.
- Equipment was rinsed thoroughly with tap water.
- Equipment was rinsed a second time with distilled water.
- The equipment was then rinsed with propanol and allowed to air dry.

Drilling equipment and materials were decontaminated by scrapping or brushing gross particulate matter off equipment and using a high-pressure steam cleaner.

### 3.9 Temporary Monitoring Well Abandonment

Subsequent to completion of the groundwater sampling activities, the temporary monitoring wells were abandoned using the following procedures as outlined in the Final Project Plans (Baker, 2002):

- To the extent feasible, the well casing and screen materials were removed.
- The borehole was backfilled with bentonite and hydrated with potable water.
- The surface was completed with like material (e.g., grass, dirt, asphalt).
- Waste materials (e.g., well casing/screen) were disposed in an on-site trash dumpster.

### 3.10 Investigation Derived Waste Management

Soil was field-screened using a PID. Soil containing no PID readings above background or evidence of gross contamination was mixed with bentonite and placed back into the respective borehole. Excess soil was spread on the ground surface at the boring/well head, as appropriate. Soil containing elevated PID readings or evidence of gross contamination was containerized in Department of Transportation (DOT) approved 55-gallon drums. All drums containing investigation derived waste (IDW) were temporarily staged at Lot 203, Piney Green Road or the former Defense Reutilization Marketing Office (DRMO) at Camp Geiger until proper disposal arrangements are made. One composite sample was collected from the drums containing soil cuttings. This composite sample was analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, TCLP SVOCs, TCLP Metals, TCLP Pesticides and RCRA hazardous waste characteristics including ignitability, corrosivity, and reactive cyanide and sulfide.

Monitoring well purge water and decontamination fluids from all mainside SWMUs were temporarily containerized in DOT-approved 55-gallon drums and transferred to a temporary holding tank located at the groundwater treatment plant near Lot 203. All monitoring well purge water and decontamination fluids from the Marine Corps Air Station (MCAS) SWMUs were containerized in DOT-approved 55-gallon drums and were temporarily staged at the former DRMO at Camp Geiger. All fluids will be temporarily containerized until proper disposal arrangements are made. Two composite samples were collected from the monitoring well purge water and decontamination fluids as follows: 1) drums staged at the former DRMO and 2) temporary holding tank located at the groundwater treatment plant near Lot 203. These composite samples were analyzed for RCRA Hazardous Waste Characteristics including ignitability, corrosivity, and reactive cyanide and sulfide, and analyzed for Total Suspended Solids, Total Dissolved Solids and target analyte list (TAL) Metals.

General trash, personal protective equipment, and used PVC well casings were disposed of in an on-site trash dumpster.

### 3.11 Laboratory Analytical Program

Table 3-1 presents a summary of the sampling and analytical program. The laboratory analytical reports are presented in Appendix G. The samples were analyzed for one or more of the following analytical suites:

- Target Compound List (TCL) VOCs
- TCL SVOCs
- TCL Pesticides
- RCRA Metals
- Total Organic Carbon (TOC)
- TCLP VOCs (IDW characterization)
- TCLP SVOCs (IDW characterization)
- TCLP Metals (IDW characterization)
- TCLP Pesticides (IDW characterization)
- Total Suspended Solids (IDW characterization)
- Total Dissolved Solids (IDW characterization)
- TAL Metals (IDW characterization)
- RCRA Hazardous Waste Characteristics - ignitability, corrosivity, and reactive cyanide and sulfide (IDW characterization)

The analytical parameters for each SWMU were selected based on historic/current SWMU operations, findings of the Phase I CSI, and/or requirements for IDW characterization.

Samples collected for chemical analyses were stored on ice in a cooler(s) and were delivered by laboratory courier to CompuChem, Inc. in Cary, North Carolina. Chain-of-custody forms were completed and enclosed in the shipping package. Chain-of-custody seals were attached to the package prior to shipping. Chain-of-custody and sample tracking forms are included in Appendix C.

### 3.12 Site Survey

The proposed sampling locations were initially surveyed and staked prior to sampling/drilling by Baker using a Trimble Pro XR Global Positioning System (GPS). Following completion of the sampling, locations that were adjusted in the field due to the presence of utilities were resurveyed using the GPS. In addition, the temporary monitoring wells were resurveyed by Lanier Surveying of Jacksonville, North Carolina for horizontal position within the North Carolina State Plane Coordinate

System (NAD 83 coordinates). Furthermore, the wells were surveyed for topographic elevation relative to MSL. The vertical accuracy of the survey was within 0.01 feet and the horizontal accuracy was within 0.1 feet.

### 3.13 Geophysical Survey

A geophysical survey was conducted at SWMU 46 - Montford Point Dump Site in an attempt to identify the location of a historical landfill. The survey was conducted by NAEVA Geophysics, Inc. of Charlottesville, Virginia between April 2 and 3, 2002. Baker supervised the survey which included a magnetic survey, conductivity survey, and ground penetrating radar (GPR) survey. The geophysical survey methods and results are detailed in Section 4.3. NAEVA's final figures and report presenting the geophysical results can be found in Appendix H.

### 3.14 Data Validation

Data validation was performed by VALIDATA Chemical Services, Inc. of Duluth, Georgia. Laboratory analytical results were evaluated to assess the technical adequacy and usability of the data. Level M-2 (organics) and IM-1 (inorganics) technical reviews, which were performed for all of the samples, included a review/evaluation of all laboratory reporting forms. Level M-3 (organics) and IM-2 (inorganics) technical reviews, which were performed for approximately 10 percent of the samples, included a review/evaluation of the laboratory reporting forms, raw data, instrument printouts, run logs, and supporting data provided by the laboratories. A detailed description and summary of these efforts are provided in the technical review reports provided in Appendix I.

The data were technically reviewed based on the specifications set forth in the following documents:

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, 1994

- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 1994

# TABLES

Revised: April 2005

**TABLE 3-1**

**SUMMARY OF THE PHASE II ANALYTICAL PROGRAM**
**MCB CAMP LEJEUNE, NORTH CAROLINA**
**SWMU CONFIRMATORY SAMPLING INVESTIGATION, CTO - 0143**

| SWMU Number[a] | SWMU Name | Number of Samples | Media Tested | Analyses and Method[b] |
|---|---|---|---|---|
| 43 | SWMU 43<br>Pest Control Shop<br>(IR Site No. 11) | 16 | Soil/Water | SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals |
| 46 | SWMU 46<br>Montford Point Dump Site<br>(IR Site No. 15) | 18 | Soil/Water | RCRA Metals |
| 53/296 | SWMU 53/296<br>Coal Storage Area and Collection Basin<br>(IR Site No. 26) | 10 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 253 | SWMU 253<br>1205 Above Ground Storage Tank | 9 | Soil/Water | VOAs - 8020<br>SVOAs - 8270<br>RCRA Metals |
| 254 | SWMU 254<br>1408 Dumpster | 10 | Soil/Water | SVOAs - 8270 |
| 255 | SWMU 255<br>1502 Oil/Water Separator No. 1 | 3 | Soil/Water | SVOAs - 8270 |
| 256/257 | SWMU 256/257<br>1700 Oil/Water Separator No. 1 & 2 | 14 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 258 | SWMU 258<br>S1745 Oil/Water Separator | 10 | Soil/Water | VOAs - 8240<br>RCRA Metals |
| 261/297 | SWMU 261/297<br>1780 Underground Storage Tank No. 1 and Oil/Water Separator | 10 | Soil/Water | RCRA Metals |
| 264 | SWMU 264<br>2611 Container | 9 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 265 | SWMU 265<br>2615 Oil/Water Separator | 9 | Soil/Water | SVOAs - 8270 |
| 269 | SWMU 269<br>816 Oil/Water Separator | 10<br><br>15 (2003) | Soil/Water<br><br>Soil/Water | VOAs - 8240<br>RCRA Metals<br><br>VOAs – 8240<br>SVOAs - 8270<br>RCRA Metals |
| 272 | SWMU 272<br>AS137 Oil/Water Separator | 13 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 279 | SWMU 279<br>FC200 Oil/Water Separator | 6 | Soil/Water | SVOAs - 8270 |
| 285 | SWMU 285<br>S947 Oil/Water Separator | 7 | Soil/Water | VOAs - 8240/8020<br>SVOAs - 8270 |
| 291 | SWMU 291<br>034 Ditch | 9 | Soil/Water | RCRA Metals |

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**TABLE 3-1**
***(Continued)***

**SUMMARY OF THE PHASE II ANALYTICAL PROGRAM**
**MCB CAMP LEJEUNE, NORTH CAROLINA**
**SWMU CONFIRMATORY SAMPLING INVESTIGATION, CTO - 0143**

| SWMU Number[a] | SWMU Name | Number of Samples | Media Tested | Analyses and Method[b] |
|---|---|---|---|---|
| 293 | SWMU 293<br>1106/1107 Oil/Water Separator | 9 | Soil/Water | RCRA Metals |
| 294 | SWMU 294<br>1203 Oil/Water Separator | 18 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 295 | SWMU 295<br>1601 Above Ground Storage Tank | 14 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 299 | SWMU 299<br>AS114 Above Ground Storage Tank | 20<br><br>14 (2003) | Soil/Water<br><br>Soil | SVOAs - 8270<br>RCRA Metals<br><br>SVOAs – 8270<br>RCRA Metals |
| 300 | SWMU 300<br>AS118 Above Ground Storage Tank | 9 | Soil/Water | SVOAs - 8270 |
| 302 | SWMU 302<br>AS563 Above Ground Storage Tank | 9 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 303 | SWMU 303<br>AS515 Above Ground Storage Tank | 14 | Soil/Water | VOAs - 8240/8020<br>SVOAs - 8270<br>RCRA Metals |
| 305 | SWMU 305<br>BB224 Pile | 9 | Soil/Water | RCRA Metals |
| 306 | SWMU 306<br>FC230 Oil/Water Separator | 9 | Soil/Water | RCRA Metals |
| 307 | SWMU 307<br>G649 Wash Rack | 9<br><br>4 (2003) | Soil/Water<br><br>Water | RCRA Metals<br><br>RCRA Metals |
| 308 | SWMU 308<br>GP109 Oil/Water Separator | 9 | Soil/Water | SVOAs - 8270 |
| 311 | SWMU 311<br>S1619 Oil/Water Separator | 15 | Soil/Water | VOAs - 8020<br>RCRA Metals |
| 312 | SWMU 312<br>Oil Water Separator<br>S-1735 (S-1698) | 13 | Soil/Water | VOAs - 8020<br>SVOAs - 8270<br>RCRA Metals |
| 313 | SWMU 313<br>S1753 Oil/Water Separator | 13 | Soil/Water | RCRA Metals |
| 314 | SWMU 314<br>SM187 Oil/Water Separator | 9<br><br>6 (2003) | Soil/Water<br><br>Soil/Water | SVOAs - 8270<br>RCRA Metals<br><br>SVOAs – 8270<br>RCRA Metals |

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**TABLE 3-1**
***(Continued)***

**SUMMARY OF THE PHASE II ANALYTICAL PROGRAM**
**MCB CAMP LEJEUNE, NORTH CAROLINA**
**SWMU CONFIRMATORY SAMPLING INVESTIGATION, CTO - 0143**

| SWMU Number[a] | SWMU Name | Number of Samples | Media Tested | Analyses and Method[b] |
|---|---|---|---|---|
| 315 | SWMU 315<br>SM269 Oil/Water Separator<br>Near Building M200 | 11 | Soil/Water | SVOAs - 8270<br>RCRA Metals |
| 316 | SWMU 316<br>TC773 Oil/Water Separator | 9 | Soil/water | SVOAs - 8270<br>RCRA Metals |
| 317 | SWMU 317<br>TT2453 Release | 9 | Soil/Water | RCRA Metals |
| 318 | SWMU 318<br>AS515 Oil/Water Separator | 11 | Soil/Water | VOAs - 8020<br>SVOAs - 8270<br>RCRA Metals |
| 319 | SWMU 319<br>Camp Geiger Wastewater Treatment Plant | 2 | Soil | SVOAs - 8270<br>RCRA Metals |
| 336 | SWMU 336<br>AS4106 Paint Stripper | 6<br><br><br><br>12 (2003) | Soil/Water<br><br><br><br>Soil/Water | VOAs - 8020<br>SVOAs - 8270<br>RCRA Metals<br><br>VOAs – 8240<br>RCRA Metals |
| 339 | SWMU 339<br>AS4146 Sand Blasting Area | 10 | Soil/Water | VOAs – 8240<br>SVOAs - 8270 |
| 359 | SWMU 359<br>Lot 201 Battery Dump | 4 | Soil/Water | VOAs - 8240<br>SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals |
| 360 | SWMU 360<br>Building 1817 UST | 12 | Soil/Water | VOAs - 8240<br>SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals |
| 361 | SWMU 361<br>UST Site 333-C | 18<br><br><br><br><br>14 (2003) | Soil/Water<br><br><br><br><br>Soil/Water | VOAs - 8240<br>SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals<br><br>Pesticides – 8080<br>RCRA Metals |

**TABLE 3-1**
***(Continued)***

**SUMMARY OF THE PHASE II ANALYTICAL PROGRAM**
**MCB CAMP LEJEUNE, NORTH CAROLINA**
**SWMU CONFIRMATORY SAMPLING INVESTIGATION, CTO - 0143**

| SWMU Number[a] | SWMU Name | Number of Samples | Media Tested | Analyses and Method[b] |
|---|---|---|---|---|
| 362 | SWMU 362<br>Dog 11 Area | 11 | Soil<br>Sediment<br>Surface water | VOAs – 8240<br>SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals |
| | | 4 (2003) | Soil/Water | Pesticides – 8080 |
| 363 | SWMU 363<br>M-21 Arresting Gear | 6 | Soil/Water | VOAs - 8240<br>SVOAs - 8270<br>Pesticides - 8080<br>RCRA Metals |

Notes:

[a] SWMU = solid waste management unit
[b] VOA= volatile organic analysis
SVOA = semivolatile organic analysis
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act

## 4.0 SWMU-SPECIFIC INFORMATION AND INVESTIGATION RESULTS

This section discusses the SWMU-specific information with respect to the Phase II CSI. Each SWMU (or SWMU grouping) is presented in one of the following subsections. The SWMU description and history, confirmatory investigation activities, investigation findings, and conclusions are discussed for each SWMU. Due to the large number of individual SWMUs (47) covered under this investigation, the figures and tables associated with each SWMU or grouping are presented directly behind the SWMU text for clarity purposes. This provides the reader with a complete package of information for each SWMU or grouping. The following paragraphs discuss the screening criteria used to evaluate the data.

Surface and Subsurface Soil

Contaminant concentrations detected in surface and subsurface soil samples collected at the SWMUs were compared to established, contaminant-specific Federal and state criteria and standards. These criteria and standards included the United States Environmental Protection Agency (USEPA) Region IX Residential/Industrial Preliminary Remediation Goals (PRGs) and the North Carolina Department of Environment and Natural Resources (NC DENR) soil to groundwater screening criteria. As a secondary comparison criteria, metals detected at concentrations exceeding the USEPA Region IX Residential/Industrial PRGs and/or NC DENR soil to groundwater screening criteria were compared to Area of Concern (AOC) and Base background concentrations (Baker, 2001).

USEPA Region IX Residential/Industrial PRGs are risk-based screening criteria developed to be protective of human health. Toxicity factors were combined with standard residential or industrial exposure scenarios to calculate the PRGs, which are chemical concentrations corresponding to fixed levels of risk. The PRGs can be used to screen contaminants in environmental media, trigger further investigation, and/or provide an initial cleanup goal if applicable. Contaminant concentrations above a PRG would not automatically designate a SWMU as "dirty" or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate.

NC DENR soil to groundwater criteria are soil screening levels (SSLs) developed to address the potential for contaminants to leach from the soil into the groundwater. The SSLs primarily are based on protection of the current 2L or Interim 2L groundwater standards. Default SSLs were initially used as the primary screening criteria. These SSLs were established by NC DENR using default input parameters (e.g., Kd, Koc, TOC, Henry's Law Constant, etc.) and the fate and transport model for calculation of soil target concentrations presented in "Guidelines for Determining Soil and Groundwater Clean-Up Levels at RCRA Hazardous Waste Sites" (NC DENR, 2000). If contaminant concentrations (for organics only) exceed the default SSLs, then site-specific soil to groundwater criteria were calculated by Baker using the transport model (NC DENR, 2000) and averaged, SWMU-specific total organic carbon (TOC) concentrations. The SWMU-specific TOC concentrations were substituted for the default concentrations. The remaining input parameters used in the model were default factors used by NC DENR. It should be noted that default SSLs were not established for some of the contaminants detected in the samples [e.g., benzo(b)fluoranthene, benzo(k)fluoranthene]. As a result, site-specific criteria were also calculated using the SWMU-specific TOC concentrations and Interim 2L standards. If site-specific criteria were calculated for contaminants detected in soils at a particular SWMU, the comparison tables were footnoted indicating the TOC concentration used in the calculation. Samples from each SWMU were collected and analyzed for TOC during the Phase I and Phase II CSIs. The TOC analytical results are presented in Appendix J.

AOC and Base background concentrations were compiled to evaluate concentrations of naturally occurring metals in surface and subsurface soils. The background investigations were conducted in June and July 2000 and are summarized in the reports titled "Area of Concern Background Study" and "Base Background Study", which were submitted to LANTDIV on April 25, 2001 (Baker, 2001). The comparison of SWMU data to the background mean concentration plus two standard deviations only occurred if the particular metal(s) exceeded the USEPA Region IX residential/industrial PRGs and/or NC DENR soil to groundwater screening criteria. Therefore, the background concentrations were considered "secondary" comparison criteria.

Groundwater

Contaminant concentrations detected in groundwater samples collected at the SWMUs were compared to the North Carolina 2L standards. In general, these standards are consistent with the USEPA Maximum Contaminant Levels (MCLs) used for potable drinking water supplies. If a 2L standard was not established for a particular contaminant, the Interim 2L standard, MCL, secondary MCL, or Region III tap water standard (in that hierarchy) was used as the primary screening criteria. As a secondary comparison criteria, metals detected at concentrations exceeding the North Carolina 2L standards (or other primary screening criteria) were compared to Base background concentrations (Baker, 2002).

The Base background concentrations were compiled to evaluate concentrations of naturally occurring metals in groundwater. The background groundwater investigation was conducted in coincidence with this Phase II CSI and is summarized in the report titled "Draft Base Background Groundwater Study" (Baker, 2002). The comparison of SWMU data to the background mean concentration plus two standard deviations only occurred if the particular metal(s) exceeded the North Carolina 2L standards (or other primary screening criteria). Therefore, the background concentrations were considered "secondary" comparison criteria.

Surface Water and Sediment

Surface water and sediment samples were only collected at SWMU 362. Contaminant concentrations detected in surface water samples were compared to the USEPA Region IV Surface Water Screening Values (Chronic Screening Values).

Contaminant concentrations detected in sediment samples were compared to Region IV Sediment Screening Criteria where applicable. Many contaminants detected in the sediment samples did not have screening criteria established. As a result, referenced literature sources were reviewed to determine if toxicological benchmarks have been established for these contaminants. A detailed discussion of the surface water and sediment screening criteria is presented in the text for SWMU 362.

## 4.1 53 (Coal Storage Area) and 296 (Coal Runoff Collection Basin); 256 (Oil/Water Separator 1700-1) and 257 (Oil/Water Separator 1700-2)

This section discusses a set of four separate SWMUs that are all located adjacent to one another near the coal storage area at the Hadnot Point Industrial Area. For organizational purposes, SWMUs 53 and 296 will be discussed together and SWMUs 256 and 257 will be discussed together. For the purpose of determining groundwater flow, the water level/elevation data from both sets of SWMUs was used due to their close proximity to one another. In addition, it should be noted that the soil and groundwater samples from well SWMU256-TW03 are being "shared" with the samples from SWMUs 53/296 (i.e., well SWMU256-TW03 is serving as the third well for SWMUs 53/256).

### 4.1.1 SWMUs 53 and 296 - Coal Storage Area and Coal Runoff Collection Basin

The following sections present the SWMU descriptions and histories, the investigation activities conducted during the Phase II CSIs, investigation findings, and conclusions.

#### 4.1.1.1 SWMU Description and History

SWMUs 53 (Coal Storage Area) and 296 (Coal Runoff Collection Basin) are located within the central portion of the Hadnot Point Industrial Area southwest of Gum Street near SWMUs 256, and 257. SWMU 53 consists of a 300-foot by 300-foot concrete pad used to store coal for the steam plant. SWMU 296 is a concrete in-ground basin surrounding SWMU 53 and is used for collection of surface water runoff associated with the coal storage area. Both SWMUs are still in operation. A SWMU investigation plan is presented as Figure 1.

The Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if the coal management facility has impacted surface and subsurface soils in the vicinity of the SWMUs. Surface and subsurface soil samples were collected from seven soil borings advanced around the perimeter of the coal storage area and runoff collection basin (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for SVOCs and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 53/296 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that these two SWMUs were located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

#### 4.1.1.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMUs and determine if groundwater has been impacted as a result of a release(s) from the SWMUs. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two temporary well borings and two soil borings
- Groundwater sampling at two temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 3.7 to 8.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 19.4 to 25.9 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow east/southeast.

4.1.1.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Twenty-six SVOCs (mostly PAHs) were detected in the sample set. Benzo(a)pyrene was detected in surface soil samples SMWU53-TW01-00 and SWMU53-TW02-00 at concentrations exceeding USEPA Region IX industrial PRGs. Benzo(b)fluoranthene was also detected in surface soil sample SWMU53-TW02-00 at a concentration exceeding USEPA Region IX industrial PRGs. None of the other SVOCs detected in the surface soil samples exceeded the applicable screening criteria. In addition, none of the SVOCs detected in the subsurface soil samples exceeded the applicable screening criteria.

Eight metals were detected in the sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Arsenic was detected at concentrations exceeding the AOC and Base background screening criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX industrial PRG in one or more of the surface soil samples, but only exceeded the Base background screening criteria in one of the subsurface soil samples. Mercury was detected at concentrations exceeding the NC DENR soil to groundwater screening criteria in the majority of surface samples collected. However, only in sample SWMU53-SB02-00 did mercury exceed the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria. Mercury was not detected above the laboratory reporting limits in any of the subsurface soil samples. Barium, cadmium, lead, selenium and silver exceeded the AOC and/or Base background screening criteria in

the surface and subsurface samples but, the concentrations were below the NC DENR soil to groundwater screening criteria and the USEPA Region IX industrial PRGs. Chromium did not exceed the applicable screening criteria in any of the samples.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Three metals were detected in the groundwater samples, as follows: barium, chromium, and lead. Lead exceeded the Base background screening criteria in the sample from well SWMU53-TW02. However, the concentration did not exceed the North Carolina 2L standards. None of the other metals detected in the samples exceeded the applicable screening criteria.

4.1.1.4 Conclusions

A few SVOCs and metals were detected in soil at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or Region IX industrial PRGs in soil were as follows:

- SVOCs - Benzo(a)pyrene, Benzo(b)fluoranthene
- Metals - arsenic and mercury

None of the compounds detected in groundwater exceeded the background criteria and 2L standards.

Based on evaluation of the results, no further action is warranted at SWMU 53/296 because the COPCs appear to be ubiquitous in surface soil and likely related to combustion/storage of coal as indicated by detections only in surface soils. Furthermore, the steam plant is a permitted facility and is not prudent to cleanup these constituents due to the ongoing operations of the steam plant.

### 4.1.2 SWMUs 256 and 257 - Oil/Water Separators 1700-1 and 1700-2

The following sections present the SWMU descriptions and histories, the investigation activities conducted during the Phase II CSIs, investigation findings, and conclusions.

4.1.2.1 SWMU Description and History

SWMUs 256 and 257 are located within the central portion of the Hadnot Point Industrial Area southwest of Gum Street and adjacent to SWMUs 53 and 296. SWMU 256 consists of a 15-foot by 25-foot by 12-foot concrete oil/water separator that receives waste water/No. 6 fuel oil from the services loading area. SWMU 257 consists of a 15-foot by 15-foot by 10-foot concrete oil/water separator that receives waste water/No. 6 and No. 2 fuel oil from the services loading area. Both SWMUs have been in operation since 1984. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separators has impacted surface and subsurface soils in the vicinity of the SWMUs. Surface and subsurface soil samples were collected from four borings advanced around the

perimeter of each oil/water separator (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs and SVOCs. The analytical results were compared to NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene exceeded the regulatory driven criteria. Therefore, additional investigation at SWMUs 256/257 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that these two SWMUs were located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

4.1.2.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMUs and determine if groundwater has been impacted as a result of a release(s) from the SWMUs. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI.

The field investigation included the following:

- Surface and subsurface soil sampling at four temporary well borings and one soil boring
- Groundwater sampling at four temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 3.7 to 8.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 19.4 to 25.9 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow east/southeast.

4.1.2.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix G. It should be noted that the soil and groundwater samples from well SWMU256-TW03 were also analyzed for RCRA metals because this well is being "shared" between SWMUs 53/296 and SWMUs 256/257 due to their close proximity to one another. The metals data is presented with the other results from SWMUs 53/296 and is not discussed herein because metals were not identified in Phase I as COPCs for SWMUs 256/257.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 8 through 11:

- Default and site specific NC DENR soil to groundwater criteria

- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Nineteen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in surface soil samples. Benzo(a)pyrene was detected in surface soil sample SWMU 256-IS02-00 at concentrations exceeding the NC DENR soil to groundwater criteria and USEPA Region IX industrial PRG. None of the other SVOCs detected in the surface soil samples exceeded the applicable screening criteria. In addition, none of the SVOCs detected in the subsurface soil samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the North Carolina 2L standards and are presented in Tables 12 and 13:

Bis(2-ethylhexyl)phthalate was the only SVOC detected in the groundwater samples. The concentration was below the North Carolina 2L standard.

### 4.1.3 Conclusions

One SVOC [benzo(a)pyrene] was detected in soil at a concentration exceeding applicable screening criteria. None of the detected compounds in groundwater exceeded the applicable screening criteria.

Based on evaluation of the analytical results, additional action at SWMU 256/257 is warranted. The additional activities are presented in Section 5.0.

Based on evaluation of the results, no further action is warranted at SWMU 256/257 because the COPCs appear to be ubiquitous in surface soil and likely related to combustion/storage of coal as indicated by detections only in surface soils. Furthermore, the steam plant is a permitted facility and is not prudent to cleanup these constituents due to the ongoing operations of the steam plant.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU53-TW01 | 3/21/02 | BAKER | 28.63 | 28.7 | 16 | 16 | 3 | 1 | 4.9 | 3.71 | 24.9 |
| SWMU53-TW02 | 3/21/02 | BAKER | 29.24 | 29.1 | 15 | 15 | 3 | 0.7 | 5 | 4.66 | 24.6 |
| SWMU256-TW01 | 3/21/02 | BAKER | 30.22 | 30.4 | 15 | 15 | 3 | 1 | 5 | 5.2 | 25.0 |
| SWMU256-TW02 | 3/21/02 | BAKER | 30.15 | 30.0 | 15 | 15 | 3 | 1 | 5 | 7.65 | 22.5 |
| SWMU256-TW03 | 3/21/02 | BAKER | 30.06 | 30.0 | 15 | 15 | 3 | 1 | 5 | 4.15 | 25.9 |
| SWMU256-TW04 | 3/21/02 | BAKER | 27.95 | 27.8 | 15 | 15 | 3 | 0.8 | 5 | 8.56 | 19.4 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU53 and SWMU 256

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-IS01-00 09-10-1997 0' - 2' | SWMU53-IS02-00 09-10-1997 0' - 2' | SWMU53-IS03-00 09-10-1997 0' - 2' | SWMU53-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 1,1'-Biphenyl | NE | NE | 8910 | 350000 | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NE | NE | 1150 | 18000000 | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 170 J | 220 J | 39 J | 93 J |
| 3,3'-Dichlorobenzidine | NE | NE | NE | 5500 | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | NA | NA | NA | NA |
| Anthracene | NE | NE | 995000 | 100000000 | ND | 39 J | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 7250 (2) | 2900 | 43 J | 53 J | ND | 100 J |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | ND | 41 J | ND | 100 J |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | 55 J | 88 J | ND | 110 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | 55 J | ND | 62 J |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | ND | 53 J | ND | 100 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 140 J | 160 J | 160 J | 120 J |
| Caprolactam | NE | NE | NE | 100000000 | NA | NA | NA | NA |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 73 J | 130 J | ND | 130 J |
| Dibenz(a,h)anthracene | NE | NE | 3560 (2) | 290 | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | ND | 56 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 74 J | 60 J | 51 J | 85 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | 53 J |
| Naphthalene | NE | NE | 10700 (2) | 190000 | 86 J | 110 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 170 J | 210 J | 37 J | 74 J |
| Pyrene | NE | NE | 286000 | 54000000 | 49 J | 72 J | ND | 94 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 6.4 | 2.8 | ND | 2.1 |
| Barium | 39 | 17 | 848 | 100000 | **22** | **28** | ND | ND |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 5.4 | 8.8 | 7.7 | 7.4 |
| Lead | 69 | 21 | 270 | 750 | 5.7 | 13.5 | 5.3 | 8.3 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.048 | 0.038 | ND | ND |
| Selenium | 1 | 0.46 | 12 | 10000 | 1.5 | **0.86** | **0.61** | **0.55** |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-IS05-00 09-10-1997 0' - 2' | SWMU53-IS06-00 09-11-1997 0' - 2' | SWMU53-IS07-00 09-11-1997 0' - 2' | SWMU53-SB01-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 1,1'-Biphenyl | NE | NE | 8910 | 350000 | NA | NA | NA | ND |
| 2,4-Dimethylphenol | NE | NE | 1150 | 18000000 | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 120 J | 56 J | ND | ND |
| 3,3'-Dichlorobenzidine | NE | NE | NE | 5500 | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | NA | NA | NA | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | 29 J |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | ND |
| Benzo(a)anthracene | NE | NE | 7250 (2) | 2900 | 20 J | ND | ND | 31 J |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | 53 J | 48 J | ND | 32 J |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | ND | ND | ND | 62 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | ND | ND | ND | 78 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 250 J | 100 J | 150 J | ND |
| Caprolactam | NE | NE | NE | 100000000 | NA | NA | NA | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | 38 J |
| Chrysene | NE | NE | 39800 | 290000 | 36 J | 88 J | ND | 62 J |
| Dibenz(a,h)anthracene | NE | NE | 3560 (2) | 290 | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | 38 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 10700 (2) | 190000 | 69 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 78 J | 130 J | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | 43 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | **1.1** | **1.2** | ND | ND |
| Barium | 39 | 17 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 5.8 | 3.8 | 7.4 | 4.5 |
| Lead | 69 | 21 | 270 | 750 | 4.7 | 3 | 3.2 | 20 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | ND | ND | 0.03 J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | ND | **0.7** | ND |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/l
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-SB02-00 03-21-2002 0' - 1' | SWMU53-TW01-00 03-21-2002 0' - 1' | SWMU53-TW02-00 03-21-2002 0' - 1' | SWMU256-TW03-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 1,1'-Biphenyl | NE | NE | 8910 | 350000 | 160 J | ND | ND | |
| 2,4-Dimethylphenol | NE | NE | 1150 | 18000000 | 44 J | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 2200 | 250 J | ND | ND |
| 3,3'-Dichlorobenzidine | NE | NE | NE | 5500 | ND | 34 J | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | 64 J | 170 J | ND |
| Acetophenone | NE | NE | NE | 1600 | 160 J | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | 160 J | 510 | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | 150 J | 54 J | 61 J | ND |
| Benzo(a)anthracene | NE | NE | 7250 (2) | 2900 | 120 J | 520 | 1200 | ND |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | 47 J | 400 | 810 | ND |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | 120 J | 750 | 3400 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 40 J | 110 J | 320 J | ND |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | 66 J | 720 | 1700 | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | ND |
| Caprolactam | NE | NE | NE | 100000000 | ND | ND | 100 J | ND |
| Carbazole | NE | NE | NE | 120000 | 67 J | 41 J | 210 J | ND |
| Chrysene | NE | NE | 39800 | 290000 | 160 J | 580 | 1600 | ND |
| Dibenz(a,h)anthracene | NE | NE | 3560 (2) | 290 | ND | 95 J | 230 J | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | 540 | 59 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 180 J | 500 | 1000 | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 35 J | 260 J | 820 | ND |
| Naphthalene | NE | NE | 10700 (2) | 190000 | 950 | 92 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 770 | 160 J | 160 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 190 J | 910 | 1400 | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 29.6 | 3.7 | **1.2** | 0.53 J |
| Barium | 39 | 17 | 848 | 100000 | 144 | 35.3 | 11.9 | 13.2 |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 0.13 J | ND | 0.07 J | 0.11 J |
| Chromium | 16 | 15 | 27 | 450 | 13.9 | 3.5 | 6.7 | 6.1 |
| Lead | 69 | 21 | 270 | 750 | 14.4 | 7 | 8.6 | **60.5** |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.23 | 0.03 J | 0.03 J | 0.08 |
| Selenium | 1 | 0.46 | 12 | 10000 | 5.3 | 1.1 | 1.2 | ND |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | ND | ND | ND | 0.1 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/l
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 1,1'-Biphenyl | NE | NE | 8910 | 350000 | 1/5 | 160 J | NA | NA | 0 | 0 |
| 2,4-Dimethylphenol | NE | NE | 1150 | 18000000 | 1/12 | 44 J | NA | NA | 0 | 0 |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 8/12 | 39 J - 2200 | NA | NA | 0 | 0 |
| 3,3'-Dichlorobenzidine | NE | NE | NE | 5500 | 1/12 | 34 J | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 2/12 | 64 J - 170 J | NA | NA | 0 | 0 |
| Acetophenone | NE | NE | NE | 1600 | 1/5 | 160 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 100000000 | 4/12 | 29 J - 510 | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 88000000 | 3/5 | 54 J - 150 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 7250 (2) | 2900 | 8/12 | 20 J - 1200 | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | 8/12 | 32 J - 810 | NA | NA | 0 | 2 |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | 7/12 | 55 J - 3400 | NA | NA | 0 | 1 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 5/12 | 40 J - 320 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | 6/12 | 53 J - 1700 | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 7/12 | 100 J - 250 J | NA | NA | 0 | 0 |
| Caprolactam | NE | NE | NE | 100000000 | 1/6 | 100 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 4/12 | 38 J - 210 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 9/12 | 36 J - 1600 | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 3560 (2) | 290 | 2/12 | 95 J - 230 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | 3/12 | 56 J - 540 | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 8/12 | 38 J - 1000 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 4/12 | 35 J - 820 | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 10700 (2) | 190000 | 5/12 | 69 J - 950 | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 9/12 | 37 J - 770 | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 7/12 | 43 J - 1400 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 8/11 | 0.53 - 29.6 | 5 | 8 | 2 | 4 |
| Barium | 39 | 17 | 848 | 100000 | 5/11 | 11.9 - 144 | 1 | 4 | 0 | 0 |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 2/11 | 0.07 J - 0.13 J | 2 | 3 | 0 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 11/11 | 3.5 - 13.9 | 0 | 0 | 0 | 0 |
| Lead | 69 | 21 | 270 | 750 | 11/11 | 3 - 60.5 | 0 | 1 | 0 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 6/11 | 0.03 J - 0.23 | 2 | 1 | 7 | 0 |
| Selenium | 1 | 0.46 | 12 | 10000 | 8/11 | 0.55 - 5.3 | 4 | 8 | 0 | 0 |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | 1/1 | 0.1 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg.
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-IS01-01 09-10-1997 2' - 4' | SWMU53-IS02-01 09-10-1997 2' - 4' | SWMU53-IS03-01 09-10-1997 2' - 4' | SWMU53-IS04-01 09-10-1997 2' - 4' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 40 J | 78 J | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | 80 J | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | 120 J | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 7250 (3) | 2900 | ND | 110 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | ND | 38 J | 42 J | ND |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | ND | 73 J | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 140 J | 220 J | 250 J | 110 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | 98 J | ND | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | ND | 84 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 45 J | 310 J | 47 J | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | 110 J | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | ND | 64 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | 540 | 52 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | 310 J | 42 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 6.9 | 8.5 | 5.5 | 5.1 |
| Lead | 8.6 | 8.2 | 270 | 750 | 3.6 | 4.7 | 5.3 | 3 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/1/2002
SWMU053_SOIL

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-IS05-01 09-10-1997 2' - 4' | SWMU53-IS06-01 09-11-1997 2' - 4' | SWMU53-IS07-01 09-11-1997 2' - 4' | SWMU53-SB01-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 100 J | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | 410 J |
| Benzo(a)anthracene | NE | NE | 7250 (3) | 2900 | 33 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | 41 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | 42 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 240 J | 120 J | 140 J | 130 J |
| Chrysene | NE | NE | 39800 | 290000 | 52 J | ND | ND | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 60 J | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | 51 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 87 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 85 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | **1.7** | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 7.1 | 6.6 | 4.4 | 5.8 |
| Lead | 8.6 | 8.2 | 270 | 750 | 5.1 | 4.6 | 2.9 | 3.5 J |
| Selenium | 0.43 | 0.69 | 12 | 10000 | **0.78** | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/1/2002
SWMU053_SOIL

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU53-SB02-04 03-21-2002 7' - 9' | SWMU53-TW01-03 03-21-2002 5' - 7' | SWMU53-TW02-03 03-21-2002 5' - 7' | SWMU256-TW03-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | ND | 240 J | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | 43 J | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | 31 J | ND | ND |
| Benzo(a)anthracene | NE | NE | 7250 (3) | 2900 | ND | 150 J | 34 J | ND |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | ND | 120 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | ND | 230 J | 63 J | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | 47 J | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | ND | 210 J | 56 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | 180 J | 45 J | ND |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | ND | 57 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | 120 J | 25 J | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | 100 J | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | ND | 79 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | 140 J | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | 280 J | 73 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | ND | ND | 0.54 J |
| Chromium | 12 | 16 | 27 | 450 | 6.1 | 3.8 | 5.8 | 2 |
| Lead | 8.6 | 8.2 | 270 | 750 | 3.5 | 2.4 | 25.2 | 1.5 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/1/2002
SWMU053_SOIL

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 26700 (3) | 41000000 (1) | 4/12 | 40 J - 240 J | NA | NA | 0 | 0 |
| Acenaphthene | NE | NE | 8160 | 38000000 | 1/12 | 80 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 22000000 | 2/12 | 43 J - 120 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 88000000 | 2/5 | 31 J - 410 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 7250 (3) | 2900 | 4/12 | 33 J - 150 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 1930 (2) | 290 | 4/12 | 38 J - 120 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 24500 (3) | 2900 | 4/12 | 42 J - 230 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/12 | 47 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 245000 (3) | 29000 | 2/12 | 56 J - 210 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 8/12 | 110 J - 250 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 4/12 | 45 J - 180 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 96400 (3) | 5100000 | 2/12 | 57 J - 84 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 6/12 | 25 J - 310 J | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/12 | 110 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/12 | 100 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 585 | 190000 | 3/12 | 51 J - 79 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 4/12 | 52 J - 540 | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 5/12 | 42 J - 310 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 2/12 | 0.54 J - 1.7 | 0 | 1 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 12/12 | 2 - 8.5 | 0 | 0 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 12/12 | 1.5 - 25.2 | 1 | 1 | 0 | 0 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | 1/12 | 0.78 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 21150 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 21150mg/kg.
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU53-TW01 04-04-2002 | SWMU53-TW02 04-04-2002 | SWMU256-GW03 04-04-2002 |
|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | |
| Barium | 145 | 2000 | 31.9 J | 44 J | 23 J |
| Chromium | 5.8 | 50 | 4.8 J | 4.6 J | 0.74 J |
| Lead | 3.6 | 15 | 2.6 J | 1.2 J | ND |

**No SVOCs were detected in the samples**

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.

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SWMU053_WATER

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 053
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 31.9 J - 44 J | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 0.74 J - 4.8 J | 0 | 0 |
| Lead | 3.6 | 15 | 2/3 | 2.6 J - 11.2 J | 1 | 0 |

**No SVOCs were detected in the samples**

J - Analyte detected. Report value is estimated.

(1) - If NC 2L Standard not available, Interim Standard was used.

9/12/2002
SWMU053_WATER

TABLE 8

DETECTION SUMMARY
SURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-IS01-00 09-10-1997 0' - 2' | SWMU256-IS02-00 09-10-1997 0' - 2' | SWMU256-IS03-00 09-10-1997 0' - 2' | SWMU256-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | ND | 89 J | ND |
| Acenaphthylene | 11400 | NE | ND | 94 J | ND | ND |
| Anthracene | 995000 | 100000000 | ND | 210 J | 38 J | ND |
| Benzo(a)anthracene | 1020 (2) | 2900 | ND | 440 | 94 J | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | 400 | 110 J | 42 J |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | 530 | 150 J | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | 130 J | ND | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | 560 | 120 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 130 J | 120 J | 200 J | 160 J |
| Carbazole | NE | 120000 | ND | 72 J | ND | ND |
| Chrysene | 39800 | 290000 | ND | 580 | 140 J | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | 44 J | 440 | 150 J | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | 130 J | ND | ND |
| Naphthalene | 585 | 190000 | ND | ND | 53 J | ND |
| Phenanthrene | 59600 | NE | ND | 57 J | 110 J | ND |
| Pyrene | 286000 | 54000000 | ND | 530 | 220 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 8

DETECTION SUMMARY
SURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-SB01-00 03-21-2002 0' - 1' | SWMU256-TW01-00 03-21-2002 0' - 1' | SWMU256-TW02-00 03-21-2002 0' - 1' | SWMU256-TW03-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | ND | ND | ND |
| Acenaphthylene | 11400 | NE | ND | ND | ND | ND |
| Anthracene | 995000 | 100000000 | ND | ND | 38 J | ND |
| Benzo(a)anthracene | 1020 (2) | 2900 | ND | ND | 32 J | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | ND | 55 J | ND |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | ND | 91 J | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | 84 J | 43 J | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | ND | 74 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 160 J | ND | ND | ND |
| Carbazole | NE | 120000 | ND | ND | ND | ND |
| Chrysene | 39800 | 290000 | ND | ND | 39 J | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | 25 J | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | 59 J | ND |
| Naphthalene | 585 | 190000 | ND | ND | ND | ND |
| Phenanthrene | 59600 | NE | ND | ND | ND | ND |
| Pyrene | 286000 | 54000000 | ND | 64 J | 45 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 8

DETECTION SUMMARY
SURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-TW04-00 03-21-2002 0' - 1' | SWMU257-IS01-00 09-11-1997 0' - 2' | SWMU257-IS02-00 09-11-1997 0' - 2' | SWMU257-IS03-00 09-11-1997 0' - 2' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | 160 J | 160 J | ND |
| Acenaphthylene | 11400 | NE | ND | ND | ND | ND |
| Anthracene | 995000 | 100000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | 1020 (2) | 2900 | ND | ND | 43 J | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | ND | 36 J | 37 J |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | ND | 47 J | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND | 42 J |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 60 J | 100 J | 130 J | 120 J |
| Carbazole | NE | 120000 | ND | ND | ND | ND |
| Chrysene | 39800 | 290000 | ND | 38 J | 50 J | 41 J |
| Di-n-octyl phthalate | 10000000 | 10000000 | 27 J | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | 49 J | 46 J |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | 585 | 190000 | ND | 84 J | 81 J | ND |
| Phenanthrene | 59600 | NE | ND | 91 J | 86 J | 44 J |
| Pyrene | 286000 | 54000000 | ND | 40 J | 55 J | 43 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 8

DETECTION SUMMARY
SURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU257-IS04-00 09-11-1997 0' - 2' |
|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND |
| Acenaphthylene | 11400 | NE | ND |
| Anthracene | 995000 | 100000000 | ND |
| Benzo(a)anthracene | 1020 (2) | 2900 | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 71 J |
| Carbazole | NE | 120000 | ND |
| Chrysene | 39800 | 290000 | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND |
| Fluoranthene | 276000 | 30000000 | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND |
| Naphthalene | 585 | 190000 | ND |
| Phenanthrene | 59600 | NE | ND |
| Pyrene | 286000 | 54000000 | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 9

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | 3/13 | 89 J - 160 J | NA | NA | 0 | 0 |
| Acenaphthylene | 11400 | NE | 1/13 | 94 J | NA | NA | 0 | 0 |
| Anthracene | 995000 | 100000000 | 3/13 | 38 J - 210 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | 1020 (2) | 2900 | 4/13 | 32 J - 440 | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 270 (2) | 290 | 6/13 | 36 J - 400 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | 4/13 | 47 J - 530 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 4/13 | 42 J - 130 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | 34,300 (3) | 29000 | 3/13 | 74 J - 560 | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 10/13 | 60 J - 200 J | NA | NA | 0 | 0 |
| Carbazole | NE | 120000 | 1/13 | 72 J | NA | NA | 0 | 0 |
| Chrysene | 39800 | 290000 | 6/13 | 38 J - 580 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 1/13 | 27 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 30000000 | 6/13 | 25 J - 440 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 2/13 | 59 J - 130 J | NA | NA | 0 | 0 |
| Naphthalene | 585 | 190000 | 3/13 | 53 J - 84 J | NA | NA | 0 | 0 |
| Phenanthrene | 59600 | NE | 5/13 | 44 J - 110 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 54000000 | 7/13 | 40 J - 530 | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 10

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-IS01-01 09-10-1997 2' - 4' | SWMU256-IS02-01 09-10-1997 2' - 4' | SWMU256-IS03-01 09-10-1997 2' - 4' | SWMU256-IS04-01 09-10-1997 2' - 4' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | ND | ND | ND |
| Anthracene | 995000 | 100000000 | ND | ND | 36 J | ND |
| Benzaldehyde | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | 1020 (3) | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 190 J | 120 J | 180 J | 180 J |
| Chrysene | 39800 | 290000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenzofuran | 13600 (3) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | 52 J | 49 J | 67 J | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | 585 | 190000 | ND | ND | ND | ND |
| Phenanthrene | 59600 | NE | ND | ND | 39 J | ND |
| Pyrene | 286000 | 54000000 | ND | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 10

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-SB01-03 03-21-2002 5' - 7' | SWMU256-TW01-03 03-21-2002 5' - 7' | SWMU256-TW02-03 03-21-2002 5' - 7' | SWMU256-TW03-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | 51 J | 220 J | ND |
| Anthracene | 995000 | 100000000 | ND | ND | ND | ND |
| Benzaldehyde | NE | 88000000 | ND | ND | 30 J | ND |
| Benzo(a)anthracene | 1020 (3) | 2900 | ND | ND | 80 J | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | ND | 100 J | ND |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | ND | 130 J | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | 59 J | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | ND | 130 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 64 J | 220 J | 280 J | ND |
| Chrysene | 39800 | 290000 | ND | ND | 100 J | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | 90 J | ND |
| Dibenzofuran | 13600 (3) | 5100000 | ND | ND | 71 J | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | 110 J | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | 85 J | ND |
| Naphthalene | 585 | 190000 | ND | ND | 92 J | ND |
| Phenanthrene | 59600 | NE | ND | ND | 99 J | ND |
| Pyrene | 286000 | 54000000 | ND | ND | 150 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 10

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU256-TW04-03 03-21-2002 5' - 7' | SWMU257-IS01-02 09-11-1997 4' - 6' | SWMU257-IS02-01 09-11-1997 2' - 4' | SWMU257-IS03-01 09-11-1997 2' - 4' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND | ND | 61 J | ND |
| Anthracene | 995000 | 100000000 | ND | ND | ND | ND |
| Benzaldehyde | NE | 88000000 | ND | NA | NA | NA |
| Benzo(a)anthracene | 1020 (3) | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND | ND | 46 J | 73 J |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 52 J | 120 J | 130 J | 80 J |
| Chrysene | 39800 | 290000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenzofuran | 13600 (3) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | 585 | 190000 | ND | ND | ND | ND |
| Phenanthrene | 59600 | NE | ND | ND | 42 J | ND |
| Pyrene | 286000 | 54000000 | ND | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 10

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU257-IS04-02<br>09-11-1997<br>4' - 6' |
|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | ND |
| Anthracene | 995000 | 100000000 | ND |
| Benzaldehyde | NE | 88000000 | NA |
| Benzo(a)anthracene | 1020 (3) | 2900 | ND |
| Benzo(a)pyrene | 270 (2) | 290 | ND |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 110 J |
| Chrysene | 39800 | 290000 | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND |
| Dibenzofuran | 13600 (3) | 5100000 | ND |
| Fluoranthene | 276000 | 30000000 | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND |
| Naphthalene | 585 | 190000 | ND |
| Phenanthrene | 59600 | NE | ND |
| Pyrene | 286000 | 54000000 | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 11

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | 3830 (3) | 41000000 (1) | 3/13 | 51 J - 220 J | NA | NA | 0 | 0 |
| Anthracene | 995000 | 100000000 | 1/13 | 36 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | 88000000 | 1/5 | 30 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | 1020 (3) | 2900 | 1/13 | 80 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 12100 (2) | 290 | 3/13 | 46 J -100 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | 3430 (3) | 2900 | 1/13 | 130 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 1/13 | 59 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | 34300 (3) | 29000 | 1/13 | 130 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 12/13 | 52 J - 280 J | NA | NA | 0 | 0 |
| Chrysene | 39800 | 290000 | 1/13 | 100 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 1/13 | 90 J | NA | NA | 0 | 0 |
| Dibenzofuran | 13700 (3) | 5100000 | 1/13 | 71 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 30000000 | 4/13 | 49 J - 110 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 1/13 | 85 J | NA | NA | 0 | 0 |
| Naphthalene | 585 | 190000 | 1/13 | 92 J | NA | NA | 0 | 0 |
| Phenanthrene | 59600 | NE | 3/13 | 39 J - 99 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 54000000 | 1/13 | 150 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2965 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2965mg/kg.

TABLE 12

DETECTION SUMMARY
GROUNDWATER - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | SWMU256-GW01 04-04-2002 | SWMU256-GW02 4/4/2002 | SWMU256-GW03 04-04-2002 | SWMU256-GW04 04-04-2002 |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | ND | 1 | J D | ND |

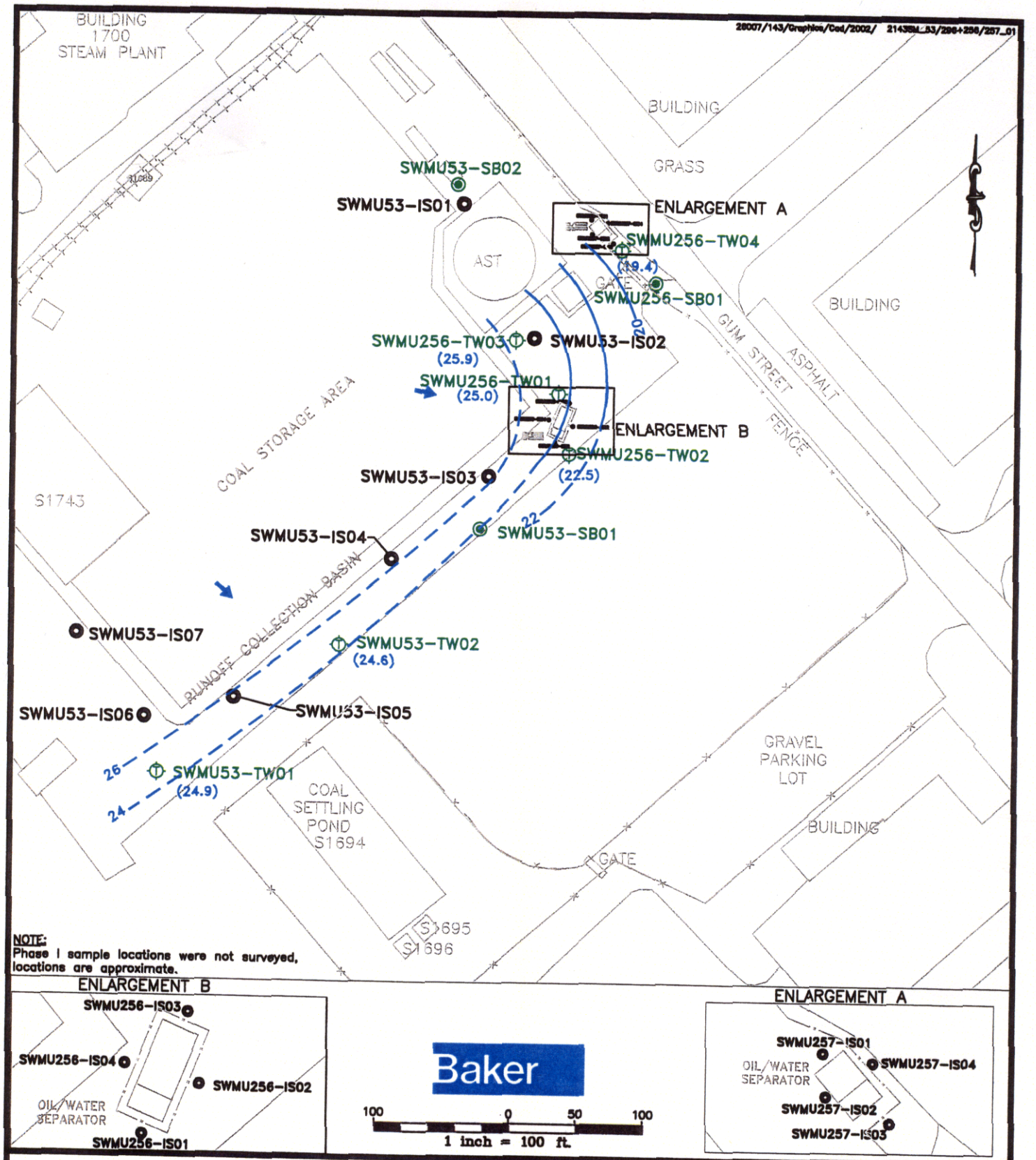
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
NA - Not analyzed
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

TABLE 13

STATISTICAL SUMMARY
GROUNDWATER - SWMU 256/257
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | 1/4 | 0.7 J | NA | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.



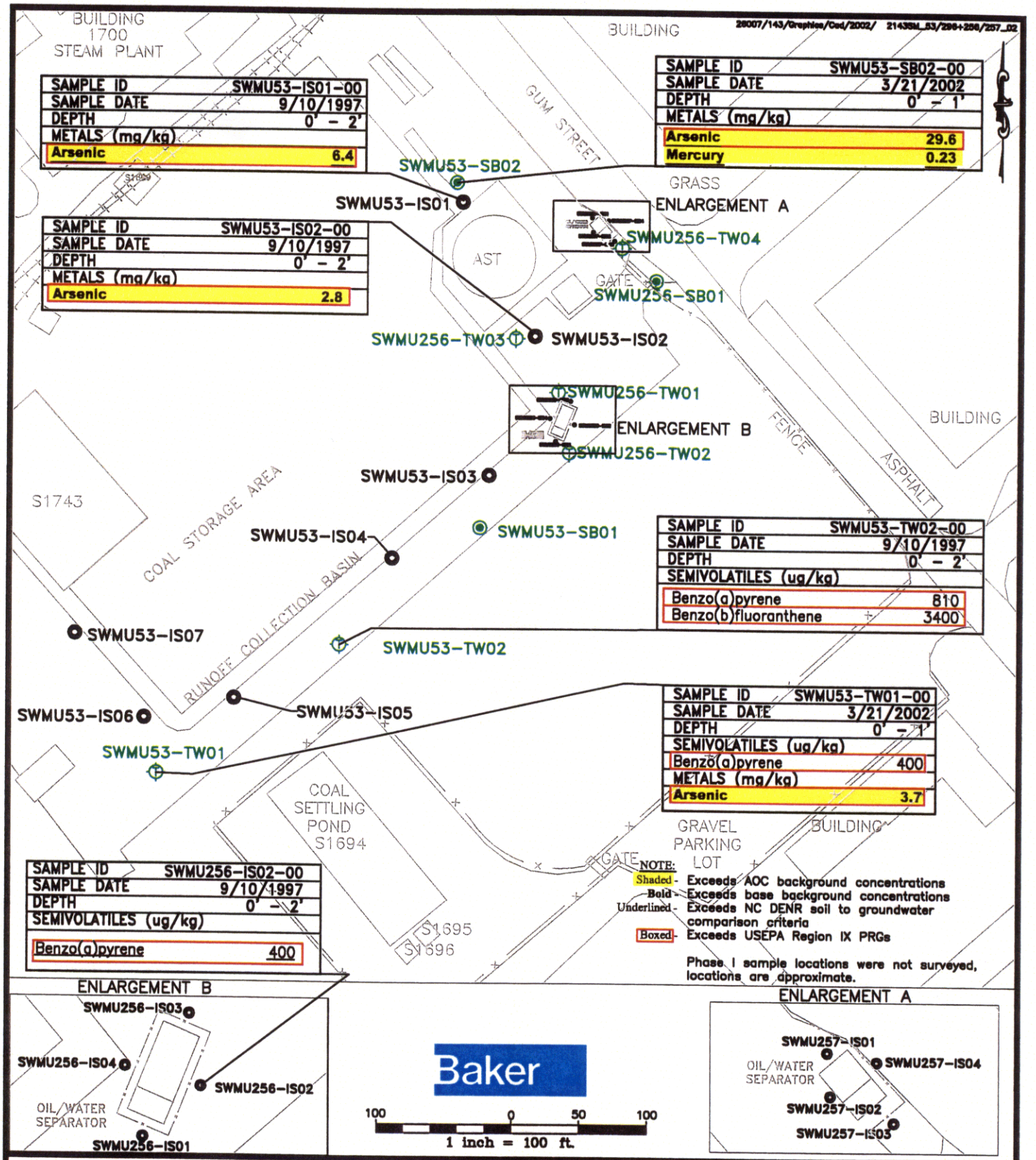

## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 23.0 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 53/296+256/257
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753ER3Y




## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 53/296+256/257
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.2 SWMU 46 - Former IR Site No. 15, Montford Point Dump Site

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.2.1 SWMU Description and History

SWMU 46, also considered as Former IR Site 15, is the Montford Point Dump Site. The site was previously used to dispose sewage treatment sludge and other materials including litter, asphalt, and sand. The dumpsite was operated between 1948 and 1958. During the site visit conducted by Baker in October 1996, it was noted that a number of soil mounds were located throughout the site. However, during the Phase I and Phase II CSI, most of the mounded material had been removed. The SWMU is covered with grass and surrounded by trees. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if material disposed at the site during operation or in the recent past has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the portion of the SWMU where mounded material had been observed (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for SVOCs and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on the evaluation of the results, arsenic, lead, and cadmium exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 46 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.2.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 23, and April 2 through 6, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to: (1) further evaluate potential impacts to soil at the SWMU, (2) determine if groundwater has been impacted as a result of a release(s) from the SWMU, and (3) attempt to determine the boundaries and approximate depth of the old landfill. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0. Detailed procedures used for the geophysical investigation are included as Appendix H.

The field investigation included the following:

- Surface and subsurface soil sampling at six temporary well borings
- Groundwater sampling at six temporary wells
- Geophysical survey

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 10.3 to 11.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 4.8 to 6.7 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southeast.

### 4.2.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

All eight RCRA metals were detected in the sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver These eight metals exceeded the background criteria in the surface and/or subsurface soil samples. Chromium, lead, mercury, and silver exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria and/or Region IX industrial PRGs in one or more of the surface soil samples. Arsenic, cadmium, and lead exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria and/or Region IX industrial PRGs in one or more of the subsurface soil samples. Mercury also exceeded the Region IX industrial PRGs in a few of the subsurface soil samples; however, the concentrations were below the background criteria and NC DENR soil to groundwater criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Four metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, and lead. Lead exceeded the Base background criteria and North Carolina 2L standard in the sample from well SWMU 46-TW06. It should be noted that turbidity was elevated in the groundwater samples from this well and may have caused artificially high metals concentrations in the sample. The elevated turbidity may be attributable to clay layers that were encountered during

drilling and installation of this well. Barium and chromium also exceeded the background criteria; however, the concentrations were below the 2L standards.

**Geophysical Survey Results**

Naeva Geophysics Inc. conducted a geophysical survey at SWMU 46 on April 2 and 3, 2002. The summary results of the survey is discussed herein. A detailed discussion of the geophysical survey is presented in the report title "Results of Geophysical Investigation" (Appendix H).

Prior to the geophysical survey, a 25-foot grid was established across the open field at the SWMU. The survey included an electromagnetic survey (EM), conductivity survey, and Ground Penetrating Radar (GPR) survey. Preliminary results were evaluated in the field and an area of anomalous response was identified with both EM and total geophysical methods. The anomalous response was located near the central portion of the field and extended southwest and northeast beyond the limits of the established grid area. As a result, additional lines were cut into the woods to the east and west. Results showed a significant anomaly consistent with that of a small landfill (see Appendix H). This large anomaly is approximately 200 feet wide and trends southwest and northeast beyond the limits of the area investigated. The amplitude of the results suggests a significant concentration of metals exists in the subsurface. Two additional anomalies were observed in the northern portion of the survey area. These isolated anomalies are not necessarily associated with the potential landfill feature.

GPR data showed significant subsurface disturbances consistent with the horizontal limits defined by the other geophysical methods. The GPR data also suggested varying concentrations of metallic debris exist within the fill area. The depth of landfilled material was not clear but may terminate shallower than approximately 10 feet.

### 4.2.4 Conclusions

Several metals were detected in soil at concentrations exceeding the applicable screening criteria. Metals that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or Region IX industrial PRGs in soil were as follows:

- Arsenic, mercury, chromium, cadmium, lead and silver

Lead was the only metal that exceeded the Base background screening criteria and 2L standards in groundwater.

The geophysical survey results showed a significant anomaly consistent with that of a small landfill. The anomalous response was located near the central portion of the field and trends southwest and northeast beyond the limits of the area investigated.

Based on evaluation of the analytical results and results from the geophysical survey, additional investigation at SWMU 46 is warranted. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU46-TW01 | 3/23/02 | BAKER | 17.57 | 17.4 | 17 | 17 | 5 | 3 | 7 | 11.6 | 6.0 |
| SWMU46-TW02 | 3/23/02 | BAKER | 17.39 | 17.1 | 16 | 16 | 4 | 2 | 6 | 11 | 6.4 |
| SWMU46-TW03 | 3/23/02 | BAKER | 18.06 | 17.8 | 17 | 17 | 5 | 3 | 7 | 11.33 | 6.7 |
| SWMU46-TW04 | 3/23/02 | BAKER | 17.22 | 16.9 | 17 | 17 | 5 | 3 | 7 | 11.28 | 5.9 |
| SWMU46-TW05 | 3/23/02 | BAKER | 16.46 | 16.1 | 16 | 16 | 4 | 2 | 6 | 10.62 | 5.8 |
| SWMU46-TW06 | 3/23/02 | BAKER | 15.12 | 14.6 | 16 | 16 | 4 | 2 | 6 | 10.32 | 4.8 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU46

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-IS01-00 09-09-1997 0' - 2' | SWMU46-IS02-00 09-09-1997 0' - 2' | SWMU46-IS03-00 09-09-1997 0' - 2' | SWMU46-IS04-00 09-09-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 2.7 | 1.3 | 2 | ND | **1.1** |
| Barium | 25 | 17 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.07 | 0.06 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 6.2 | 15 | 27 | 450 | 9.3 | 7.1 | 3.5 | 4.1 |
| Lead | 12 | 21 | 270 | 750 | **38.6** | 8 | **28.9** | 5.7 |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 0.048 | ND | 0.053 | ND |
| Selenium | 0.53 | 0.46 | 12 | 10000 | ND | ND | ND | ND |
| Silver | 0.09 | 0.07 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-TW01-00 03-23-2002 0' - 1' | SWMU46-TW02-00 03-23-2002 0' - 1' | SWMU46-TW03-00 03-23-2002 0' - 1' | SWMU46-TW04-00 03-23-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 2.7 | ND | **0.89** J | 0.59 J | **1.7** |
| Barium | 25 | 17 | 848 | 100000 | 14.3 | 13.2 | 10.5 | **38.3** |
| Cadmium | 0.07 | 0.06 | 2.7 | 810 | ND | 0.051 J | **0.13** J | **0.51** J |
| Chromium | 6.2 | 15 | 27 | 450 | 4 | 4.6 | 4.2 | **60.6** |
| Lead | 12 | 21 | 270 | 750 | 4.7 | 16.5 | 11.4 | **1950** |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 0.5 J | 0.061 J | 0.04 J | 0.075 J |
| Selenium | 0.53 | 0.46 | 12 | 10000 | ND | ND | 0.6 | **0.53** J |
| Silver | 0.09 | 0.07 | 0.22 | 10000 | ND | ND | ND | 0.55 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-TW05-00 03-23-2002 0' - 1' | | SWMU46-TW06-00 03-23-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 2.7 | 0.62 | J | **1.9** | |
| Barium | 25 | 17 | 848 | 100000 | 8.1 | | 15.6 | |
| Cadmium | 0.07 | 0.06 | 2.7 | 810 | **0.12** | J | **0.25** | J |
| Chromium | 6.2 | 15 | 27 | 450 | 4.9 | | 8 | |
| Lead | 12 | 21 | 270 | 750 | **34.9** | | **242** | |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 0.04 | J | 0.047 | J |
| Selenium | 0.53 | 0.46 | 12 | 10000 | ND | | **0.68** | |
| Silver | 0.09 | 0.07 | 0.22 | 10000 | ND | | ND | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 2.7 | 8/10 | 0.59 J - 2 | 4 | 6 | 0 | 0 |
| Barium | 25 | 17 | 848 | 100000 | 6/10 | 8.1 - 38.3 | 1 | 1 | 0 | 0 |
| Cadmium | 0.07 | 0.06 | 2.7 | 810 | 5/10 | 0.051 J - 0.51 J | 4 | 4 | 0 | 0 |
| Chromium | 6.2 | 15 | 27 | 450 | 10/10 | 3.5 - 60.6 | 4 | 1 | 1 | 0 |
| Lead | 12 | 21 | 270 | 750 | 10/10 | 4.7 - 1950 | 6 | 5 | 1 | 1 |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 8/10 | 0.04 J - 0.5 J | 6 | 1 | 8 | 0 |
| Selenium | 0.53 | 0.46 | 12 | 10000 | 3/10 | 0.53 J - 0.68 | 2 | 3 | 0 | 0 |
| Silver | 0.09 | 0.07 | 0.22 | 10000 | 1/10 | 0.55 | 1 | 1 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 3 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-IS01-04 09-09-1997 8' - 10' | SWMU46-IS02-04 09-09-1997 8' - 10' | SWMU46-IS03-04 09-09-1997 8' - 10' | SWMU46-IS04-04 09-09-1997 8' - 10' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 2.7 | ND | **1.7** | 6.1 | ND |
| Barium | 38 | 22 | 848 | 100000 | ND | **36.6** | **25.3** | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | 4.5 | ND | ND |
| Chromium | 20 | 16 | 27 | 450 | 3.5 | 7.4 | **21.5** | 3 |
| Lead | 21 | 8.2 | 270 | 750 | 1 | 12300 | 7.2 | 1.8 |
| Mercury | 0.06 | 0.08 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 0.78 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-TW01-05 03-23-2002 9' - 11' | SWMU46-TW02-04 03-23-2002 7' - 9' | SWMU46-TW03-04 03-23-2002 7' - 9' | SWMU46-TW04-04 03-23-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 38 | 22 | 848 | 100000 | 1.1 | 2.7 | 3.6 | 3.6 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 20 | 16 | 27 | 450 | 0.72 | 2 | 2.6 | 3.2 |
| Lead | 21 | 8.2 | 270 | 750 | 1.2 | 1.8 | 2.8 | 3.7 |
| Mercury | 0.06 | 0.08 | 0.015 | 610 | 0.018 J | 0.025 J | 0.026 J | 0.025 J |
| Selenium | 0.78 | 0.69 | 12 | 10000 | ND | ND | ND | 0.55 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU46-TW05-05 03-23-2002 9' - 11' | SWMU46-TW06-04 03-23-2002 7' - 9' |
|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 2.7 | ND | ND |
| Barium | 38 | 22 | 848 | 100000 | ND | 2.5 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND |
| Chromium | 20 | 16 | 27 | 450 | 0.69 | 3.1 |
| Lead | 21 | 8.2 | 270 | 750 | 1.1 | 2.1 |
| Mercury | 0.06 | 0.08 | 0.015 | 610 | ND | 0.024 J |
| Selenium | 0.78 | 0.69 | 12 | 10000 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 2.7 | 2/10 | 1.7 - 6.1 | 1 | 2 | 1 | 1 |
| Barium | 38 | 22 | 848 | 100000 | 7/10 | 1.1 - 36.6 | 0 | 2 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 1/10 | 4.5 | 1 | 1 | 1 | 0 |
| Chromium | 20 | 16 | 27 | 450 | 10/10 | 0.69 - 21.5 | 1 | 1 | 0 | 0 |
| Lead | 21 | 8.2 | 270 | 750 | 10/10 | 1 - 12300 | 1 | 1 | 1 | 1 |
| Mercury | 0.06 | 0.08 | 0.015 | 610 | 5/10 | 0.018 J - 0.026 J | 0 | 0 | 5 | 0 |
| Selenium | 0.78 | 0.69 | 12 | 10000 | 1/10 | 0.55 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 3 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU46-TW01 04-06-2002 | | SWMU46-TW02 04-06-2002 | | SWMU46-TW03 04-06-2002 | | SWMU46-TW04 04-06-2002 | | SWMU46-TW05 04-06-2002 | | SWMU46-TW06 04-06-2002 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | | | | | | | |
| Arsenic | 12 | 50 | ND | | ND | | 4.2 | J | ND | | ND | | 5.7 | J |
| Barium | 145 | 2000 | 152 | | 92.3 | | 59.4 | | 68.4 | | 87.5 | | 78.4 | |
| Chromium | 5.8 | 50 | 4.7 | J | 0.83 | J | 2.1 | J | 1 | J | 3 | J | 31.4 | |
| Lead | 3.6 | 15 | 4 | J | 4.6 | J | ND | | 4.4 | J | 2.2 | J | 21.9 | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

9/5/02
SWMU046_WATER.xls

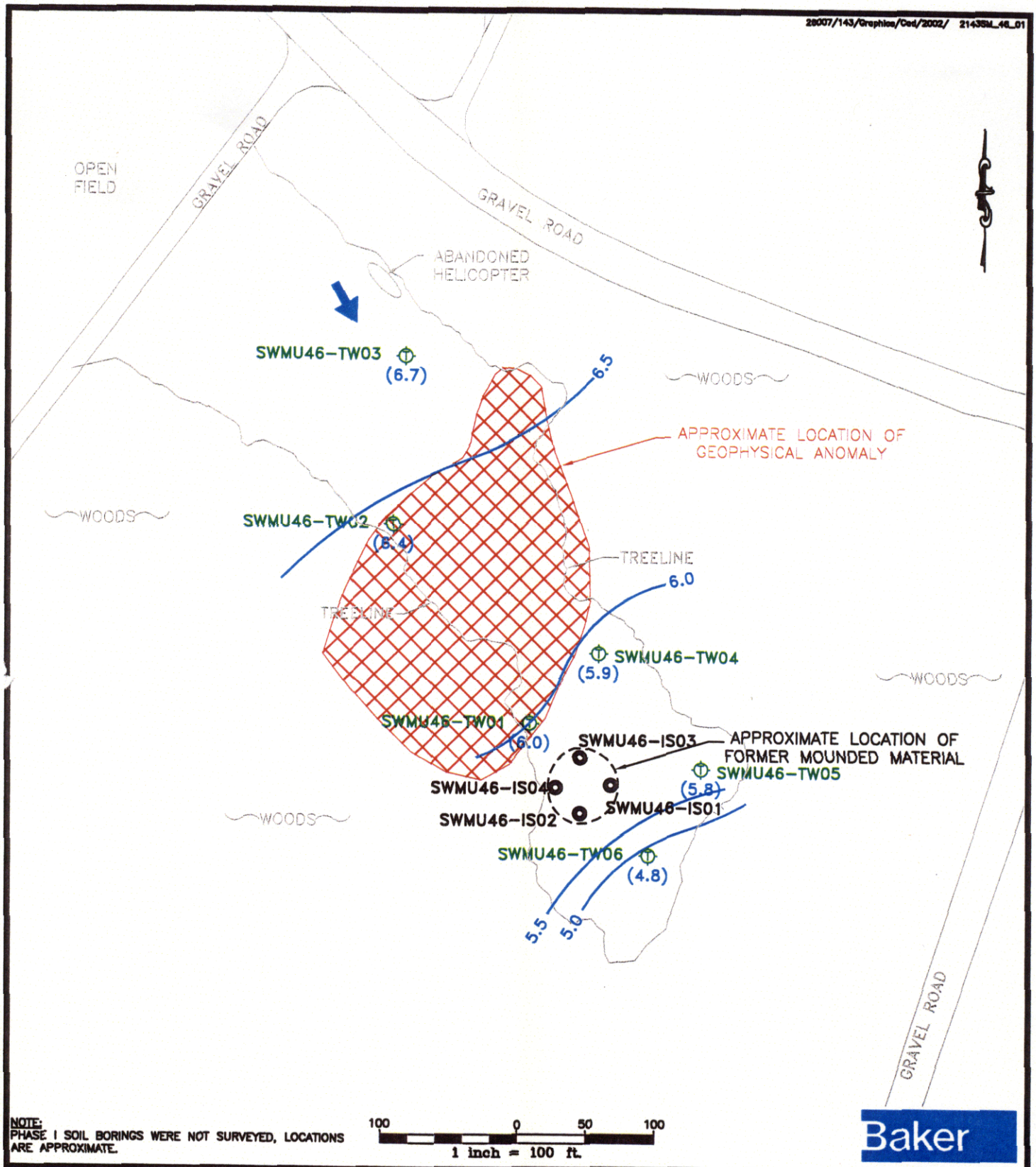
TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 046
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 50 | 2/6 | 4.2 J - 5.7 J | 0 | 0 |
| Barium | 145 | 2000 | 6/6 | 59.4 - 152 | 1 | 0 |
| Chromium | 5.8 | 50 | 6/6 | 0.83 J - 31.4 | 1 | 0 |
| Lead | 3.6 | 15 | 5/6 | 2.2 J - 21.9 | 4 | 1 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.

9/5/02
SWMU046_WATER.xls



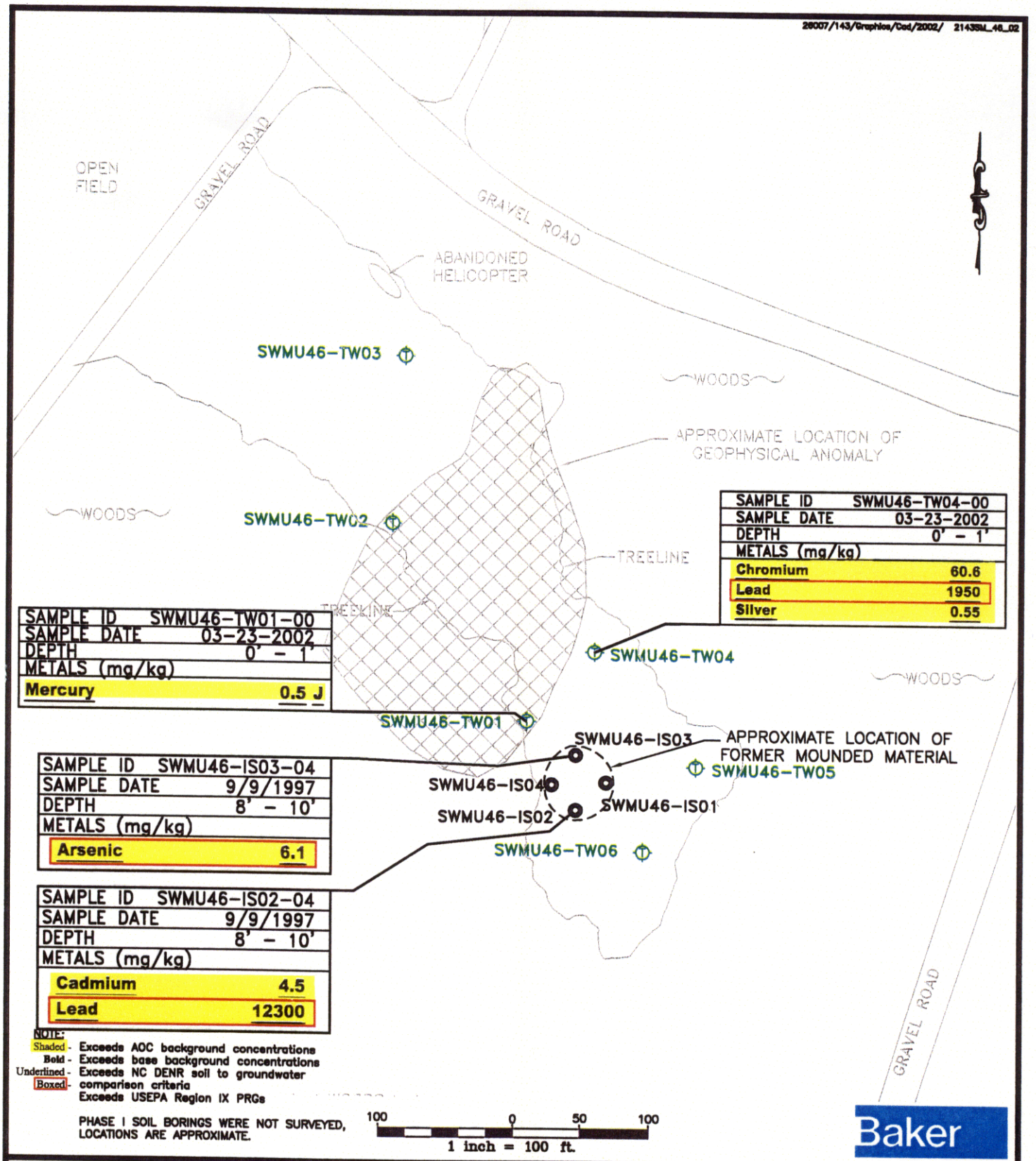

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 6.0 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 46
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037528 RUV

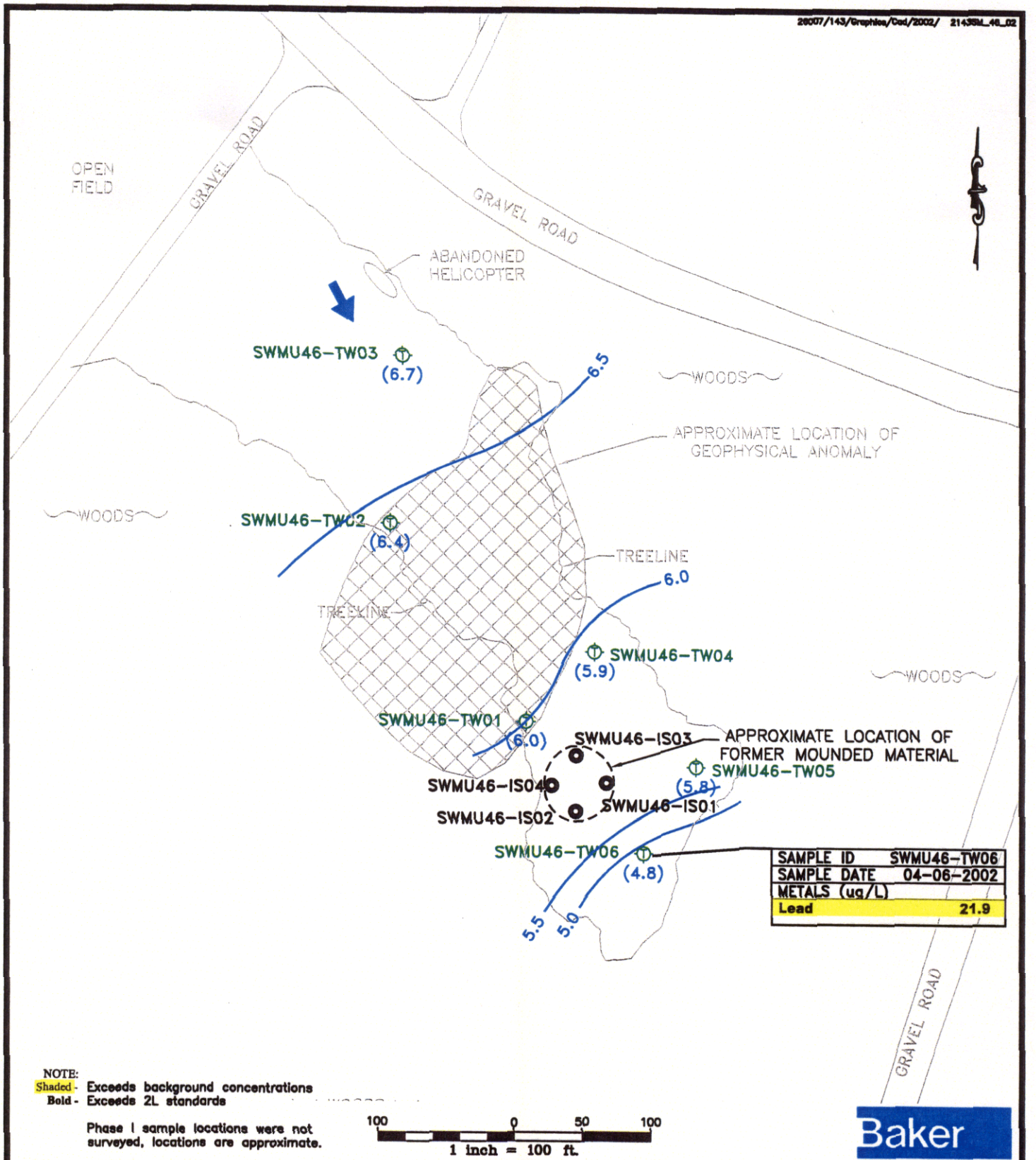



## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 46
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 6.0 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
## SWMU 46
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.3 SWMU 43 - Former IR Site No. 11; Pest Control Shop

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.3.1 SWMU Description and History

SWMU 43 was an oil/water separator located east of Holcomb Boulevard near former IR Site 11, which was used as a pesticide/herbicide management area. In addition to pesticide/herbicide storage, the IR Site 11 area was used for mixing, filling, cleaning, and maintenance of equipment used for application purposes. Water used to clean the pesticide/herbicide equipment was collected in the wash area and transported via underground piping to the oil/water separator. Prior to 1976, IR Site 11 was used as a disposal area for radioactive-contaminated animal carcasses. The site was remedied of this problem in 1977. A drainage ditch is located directly south of the SWMU and would have collected spilled product (if any) that escaped the collection system. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operations pertaining to the wash area and the oil/water separator have impacted: (1) surface and subsurface soils surrounding the SWMU and (2) surface soils within the drainage ditch immediately south of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the oil/water separator (see Figure 1). Three additional surface soil samples were collected from the drainage ditch located directly south of the SWMU. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, pesticides, herbicides, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, several SVOCs, pesticides, and metals exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 43 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs Phase I identification should be re-evaluated against the industrial PRGs.

### 4.3.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 8 and 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three soil borings and three temporary well borings
- Surface soil sampling at one location in the drainage ditch
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix C.

The water table was measured in the wells at depths ranging from approximately 16.1. to 16.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 3.9 to 4.1 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south/southeast.

### 4.3.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs, pesticides, and RCRA metals. A summary of the laboratory analytical results are included in Appendix E.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 6 and 7 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Nineteen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in surface soil sample SWMU43-IS01-00. Benzo(a)anthracene and benzo(a)pyrene were detected in this sample at concentrations exceeding the NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Eleven pesticides were detected in the sample set. 4,4'-DDD; 4,4'-DDT; alpha-chlordane; dieldrin; gamma-chlordane and heptachlor epoxide exceeded NC DENR soil to groundwater screening criteria and/or USEPA Region IX PRGs in one or more of the surface soil samples. None of the pesticides detected in the subsurface soil samples exceeded the applicable screening criteria.

Seven metals were detected in the sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Most of the metals exceeded the background screening criteria. Arsenic and chromium exceeded the AOC and Base background screening criteria and the NC DENR soil to groundwater screening criteria or USEPA Region IX industrial PRGs in one or more of the surface soil samples. Mercury exceeded the AOC background screening criteria and the NC DENR soil to groundwater screening criteria. However, the concentrations were below the Base background screening criteria and the USEPA Region IX industrial PRG. None of the metals detected in the subsurface soil samples exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria or USEPA Region IX PRGs.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

One SVOC (4-methylphenol) was detected in the groundwater sample from well SWMU43-TW01. The concentration was below the 2L standard. No SVOCs were detected in samples from the remaining two wells.

Six pesticides were detected in groundwater samples from one or more of the wells, as follows: 4,4'-DDD, alpha-chlordane, dieldrin, endosulfan I, gamma-chlordane, and heptachlor epoxide. The majority of pesticides were detected in the sample from well SWMU43-TW02. All of the detected pesticides (except 4,4'-DDD and endosulfan I) exceeded the 2L standards in one or more of the samples.

Four metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, and selenium. Selenium exceeded the Base background screening criteria. However, the concentrations were below the 2L standards. None of the other metals detected in the samples exceeded the established screening criteria.

Most of the compounds detected in the groundwater (except for 4-methylphenol and endosulfan I) were detected in soils at the SWMU.

### 4.3.4 Conclusions

Several SVOCs, pesticides, and metals were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- SVOCs - benzo(a)anthracene, benzo(a)pyrene
- Pesticides - 4,4'-DDD, 4,4-DDT, alpha chlordane, dieldrin, gamma-chlordane, and heptachlor epoxide.
- Metals - arsenic, chromium

Compounds the exceeded the base background screening criteria and 2L standards in groundwater were as follows:

- Pesticides - alpha-chlordane, gamma-chlordane, dieldrin, and heptachlor epoxide

Based on evaluation of the analytical results, additional investigation at SWMU 43 is warranted. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU43-TW01 | 3/25/02 | BAKER | 20.01 | 20.0 | 20 | 20 | 3 | 1.5 | 5 | 16.1 | 3.9 |
| SWMU43-TW02 | 3/25/02 | BAKER | 20.53 | 20.6 | 20 | 20 | 3 | 1.5 | 5 | 16.45 | 4.1 |
| SWMU43-TW03 | 3/24/02 | BAKER | 20.46 | 20.1 | 22 | 22 | 0.5 | 0 | 2 | 16.58 | 3.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU43

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-IS01-00 09-10-1997 0' - 2' | SWMU43-IS02-00 09-10-1997 0' - 2' | SWMU43-IS03-00 09-10-1997 0' - 2' | SWMU43-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 150 J | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 940 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 910 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1160 (2) | 2900 | 660 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 440 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 11600 (2) | 29000 | 990 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 390 J | ND | 45 J | ND |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND | ND | 65 J |
| Carbazole | NE | NE | NE | 120000 | 140 J | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 1100 J | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 120 J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1500 | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | 39 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 470 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 670 | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 580 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 3.8 | 4.1 | **1.8** | ND |
| Barium | 39 | 17 | 848 | 100000 | 39.7 | **24.1** | ND | ND |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 2.3 | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 7.4 | 28.2 | 14.1 | 4.9 |
| Lead | 69 | 21 | 270 | 750 | **25.9** | 8.6 | 8 | 4.5 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 1.0 | 0.46 | 12 | 10000 | ND | **0.64** | ND | ND |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-IS01-00 09-10-1997 0' - 2' | SWMU43-IS02-00 09-10-1997 0' - 2' | SWMU43-IS03-00 09-10-1997 0' - 2' | SWMU43-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129(1) | 17000 | 17000 | ND | 5.9 | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | ND | 40 | 3.9 | ND |
| 4,4'-DDT | NE | NE | 1360 (1) | 12000 | 25000 | 35 | ND | ND |
| alpha-BHC | NE | NE | NE | 590 | ND | ND | ND | ND |
| alpha-Chlordane | NE | NE | 28 (3) | 11000 | NA | NA | NA | NA |
| delta-BHC | NE | NE | 6.2 | 2900 | ND | ND | ND | ND |
| Dieldrin | NE | NE | 1.1 | 150 | ND | ND | ND | ND |
| gamma-Chlordane | NE | NE | 28 (3) | 11000 | NA | NA | NA | NA |
| Heptachlor epoxide | NE | NE | 6.7 | 270 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1000mg/kg.
(3) - Value for chlordane was used for alpha-chlordane and gamma-chlordane
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-SB01-00 03-25-2002 0' - 1' | | SWMU43-SB02-00 03-25-2002 0' - 1' | | SWMU43-SB03-00 03-25-2002 0' - 1' | | SWMU43-SS01-00 09-17-1997 0' - 2' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | | ND | | ND | | ND | |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | | ND | | ND | | NA | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | | ND | | ND | | ND | |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | | ND | | ND | | ND | |
| Benzo(b)fluoranthene | NE | NE | 1160 (2) | 2900 | ND | | ND | | ND | | ND | |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | | ND | | ND | | ND | |
| Benzo(k)fluoranthene | NE | NE | 11600 (2) | 29000 | ND | | ND | | ND | | ND | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 55 | J | 110 | J | ND | | 59 | J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | | ND | | ND | | ND | |
| Carbazole | NE | NE | NE | 120000 | ND | | ND | | ND | | ND | |
| Chrysene | NE | NE | 39800 | 290000 | ND | | ND | | ND | | ND | |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | | ND | | ND | | ND | |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | | ND | | ND | | ND | |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | | ND | | ND | | ND | |
| Fluorene | NE | NE | 44300 | 33000000 | ND | | ND | | ND | | ND | |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | | ND | | ND | | ND | |
| Phenanthrene | NE | NE | 59600 | NE | ND | | ND | | ND | | ND | |
| Pyrene | NE | NE | 286000 | 54000000 | ND | | ND | | ND | | ND | |
| **METALS (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | **2.1** | J | **1.6** | J | **2.6** | J | **2.2** | |
| Barium | 39 | 17 | 848 | 100000 | 12.9 | J | **39.4** | J | **17.6** | J | ND | |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | ND | | ND | | ND | | ND | |
| Chromium | 16 | 15 | 27 | 450 | 4.1 | J | **15.1** | J | 12.3 | J | 6.9 | |
| Lead | 69 | 21 | 270 | 750 | 17.7 | J | 6.9 | J | 7.2 | J | 11.5 | |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.05 | J | 0.04 | J | 0.05 | J | 0.048 | |
| Selenium | 1.0 | 0.46 | 12 | 10000 | 0.22 | J | **0.49** | J | **0.52** | J | ND | |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-SB01-00 03-25-2002 0' - 1' | | SWMU43-SB02-00 03-25-2002 0' - 1' | | SWMU43-SB03-00 03-25-2002 0' - 1' | | SWMU43-SS01-00 09-17-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PESTICIDES (ug/kg)** | | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 129(1) | 17000 | ND | | 0.88 | J | 1.1 | J | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | 100 | | 9.4 | J | 6 | J | 92 |
| 4,4'-DDT | NE | NE | 1360 (1) | 12000 | 420 | | 2.5 | J | 4.7 | J | 120 |
| alpha-BHC | NE | NE | NE | 590 | ND | | ND | | ND | | ND |
| alpha-Chlordane | NE | NE | 28 (3) | 11000 | 270 | J | ND | | 6.9 | J | NA |
| delta-BHC | NE | NE | 6.2 | 2900 | ND | | ND | | ND | | ND |
| Dieldrin | NE | NE | 1.1 | 150 | 130 | J | ND | | ND | | ND |
| gamma-Chlordane | NE | NE | 28 (3) | 11000 | 160 | | ND | | 1.5 | J | NA |
| Heptachlor epoxide | NE | NE | 6.7 | 270 | 35 | J | ND | | ND | | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1000mg/kg.
(3) - Value for chlordane was used for alpha-chlordane and gamma-chlordane
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-SS02-00 09-17-1997 0' - 2' | SWMU43-SS03-00 09-17-1997 0' - 2' | SWMU43-SS04-00 03-25-2002 0' - 1' | SWMU43-TW01-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | 33 J | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1160 (2) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 11600 (2) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 100 J | 190 J | 250 J | 83 J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND | 46 J | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 2.2 | 1.3 | 2.7 J | ND |
| Barium | 39 | 17 | 848 | 100000 | 31 | ND | 24.9 J | 8.9 J |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 20.4 | 6.1 | 7.8 J | 1.9 J |
| Lead | 69 | 21 | 270 | 750 | 7.1 | 12.1 | 22.4 J | 4.5 J |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | ND | 0.09 J | 0.04 J |
| Selenium | 1.0 | 0.46 | 12 | 10000 | 0.92 | ND | 0.46 J | 0.27 J |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-SS02-00 09-17-1997 0' - 2' | SWMU43-SS03-00 09-17-1997 0' - 2' | SWMU43-SS04-00 03-25-2002 0' - 1' | SWMU43-TW01-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129(1) | 17000 | ND | ND | ND | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | ND | 46 | 310 | 74 |
| 4,4'-DDT | NE | NE | 1360 (1) | 12000 | ND | 110 | 210 | 78 |
| alpha-BHC | NE | NE | NE | 590 | ND | ND | ND | ND |
| alpha-Chlordane | NE | NE | 28 (3) | 11000 | NA | NA | 110 J | 68 J |
| delta-BHC | NE | NE | 6.2 | 2900 | ND | ND | ND | ND |
| Dieldrin | NE | NE | 1.1 | 150 | ND | ND | ND | ND |
| gamma-Chlordane | NE | NE | 28 (3) | 11000 | NA | NA | 14 J | 17 |
| Heptachlor epoxide | NE | NE | 6.7 | 270 | ND | ND | ND | 6.6 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1000mg/kg.
(3) - Value for chlordane was used for alpha-chlordane and gamma-chlordane
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-TW02-00 03-25-2002 0' - 1' | SWMU43-TW03-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1160 (2) | 2900 | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 11600 (2) | 29000 | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 120 J | 400 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 100 J | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 4.4 J | ND |
| Barium | 39 | 17 | 848 | 100000 | 13.1 J | 12 J |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 0.1 J | ND |
| Chromium | 16 | 15 | 27 | 450 | 4.7 | 2 |
| Lead | 69 | 21 | 270 | 750 | 9.5 | 3.6 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.04 J | 0.04 J |
| Selenium | 1.0 | 0.46 | 12 | 10000 | ND | ND |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-TW02-00 03-25-2002 0' - 1' | SWMU43-TW03-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **PESTICIDES (ug/kg)** | | | | | | |
| 4,4'-DDD | NE | NE | 129(1) | 17000 | 330 J | 1.4 J |
| 4,4'-DDE | NE | NE | NE | 12000 | 210 J | 3.7 |
| 4,4'-DDT | NE | NE | 1360 (1) | 12000 | 7200 | 22 |
| alpha-BHC | NE | NE | NE | 590 | ND | 0.88 J |
| alpha-Chlordane | NE | NE | 28 (3) | 11000 | 870 J | 1.5 J |
| delta-BHC | NE | NE | 6.2 | 2900 | ND | 3.8 J |
| Dieldrin | NE | NE | 1.1 | 150 | ND | ND |
| gamma-Chlordane | NE | NE | 28 (3) | 11000 | 550 | 1 J |
| Heptachlor epoxide | NE | NE | 6.7 | 270 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1000mg/kg.
(3) - Value for chlordane was used for alpha-chlordane and gamma-chlordane
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 1/14 | 150 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 88000000 | 1/7 | 33 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/14 | 940 J | NA | NA | 1 | 0 |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 1/14 | 910 J | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 1160 (2) | 2900 | 1/14 | 660 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/14 | 440 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 11600 (2) | 29000 | 1/14 | 990 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 11/14 | 30 J - 400 | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 2/14 | 46 J - 65 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/14 | 140 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/14 | 1100 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/14 | 100 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/14 | 120 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/14 | 1500 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/14 | 39 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/14 | 470 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/14 | 670 | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/14 | 580 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 11/14 | 1.3 - 4.4 J | 8 | 11 | 0 | 3 |
| Barium | 39 | 17 | 848 | 100000 | 10/14 | 8.9 J - 39.7 | 2 | 6 | 0 | 0 |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 2/14 | 0.1 J - 2.3 | 2 | 2 | 0 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 14/14 | 1.9 J - 28.2 | 2 | 3 | 1 | 0 |
| Lead | 69 | 21 | 270 | 750 | 14/14 | 3.6 - 25.9 | 0 | 2 | 0 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 8/14 | 0.04 J - 0.09 J | 1 | 0 | 8 | 0 |
| Selenium | 1.0 | 0.46 | 12 | 10000 | 7/14 | 0.22 J - 0.92 | 0 | 4 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 (1) | 17000 | 6/14 | 0.88 J - 17000 | NA | NA | 1 | 0 |
| 4,4'-DDE | NE | NE | NE | 12000 | 11/14 | 3.7 - 310 | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 (1) | 12000 | 14/14 | 2.5 J - 25000 | NA | NA | 2 | 1 |
| alpha-BHC | NE | NE | NE | 590 | 1/14 | 0.88 J | NA | NA | 0 | 0 |
| alpha-Chlordane | NE | NE | 28 (3) | 11000 | 6/7 | 1.5 J - 870 J | NA | NA | 4 | 0 |
| delta-BHC | NE | NE | 6.2 | 2900 | 1/14 | 3.8 J | NA | NA | 0 | 0 |
| Dieldrin | NE | NE | 1.1 | 150 | 1/14 | 130 J | NA | NA | 1 | 0 |
| gamma-Chlordane | NE | NE | 28 (3) | 11000 | 6/7 | 1 J - 550 | NA | NA | 2 | 0 |
| Heptachlor epoxide | NE | NE | 6.7 | 270 | 2/14 | 6.6 J - 35 J | NA | NA | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1000mg/kg.
(3) - Value for chlordane was used for alpha-chlordane and gamma-chlordane
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-IS01-01 09-10-1997 2' - 4' | SWMU43-IS02-01 09-10-1997 2' - 4' | SWMU43-IS03-01 09-10-1997 2' - 4' | SWMU43-IS04-01 09-10-1997 2' - 4' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | ND |
| Caprolactam | NE | NE | NE | 100000000 | NA | NA | NA | NA |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 11 | 5.24 | 2.7 | 2.1 | 3.3 | 2.6 | 1.6 |
| Barium | 26 | 29 | 848 | 100000 | **31.3** | ND | ND | ND |
| Chromium | 12 | 27 | 27 | 450 | 16.8 | 17.3 | 14.3 | 15.1 |
| Lead | 8.6 | 14 | 270 | 750 | 7.4 | 6.8 | 4.4 | 6.9 |
| Selenium | 0.43 | 1.7 | 12 | 10000 | ND | ND | ND | ND |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 17000 | 42 | ND | ND | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | ND | 17 | ND | 2.2 |
| 4,4'-DDT | NE | NE | 1360 | 12000 | 300 | 34 | ND | 8.1 |
| alpha-Chlordane | NE | NE | 27.8 | 11000 | NA | NA | NA | NA |
| Aldrin | NE | NE | NE | 150 | ND | ND | ND | ND |
| gamma-Chlordane | NE | NE | 27.8 | 11000 | NA | NA | NA | NA |
| Methoxychlor | NE | NE | 56100 | 4400000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-SB01-06 03-25-2002 11' - 13' | SWMU43-SB02-06 03-25-2002 11' - 13' | SWMU43-SB03-06 03-25-2002 11' - 13' | SWMU43-TW01-06 03-25-2002 11' - 13' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 61 J | ND | ND | ND |
| Caprolactam | NE | NE | NE | 100000000 | ND | 24 J | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 11 | 5.24 | 2.7 | 1.9 J | ND | 0.38 J | ND |
| Barium | 26 | 29 | 848 | 100000 | 11 J | ND | 6.7 J | 2.6 J |
| Chromium | 12 | 27 | 27 | 450 | 11.4 J | 3.9 | 6.1 J | 2.5 J |
| Lead | 8.6 | 14 | 270 | 750 | 5.3 J | 2.6 | 4 J | 3.4 J |
| Selenium | 0.43 | 1.7 | 12 | 10000 | 0.41 J | ND | 0.38 J | 0.25 J |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 17000 | ND | ND | ND | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | ND | ND | ND | 0.71 J |
| 4,4'-DDT | NE | NE | 1360 | 12000 | 2.2 J | ND | ND | 1.5 J |
| alpha-Chlordane | NE | NE | 27.8 | 11000 | 1.1 J | ND | ND | 0.78 J |
| Aldrin | NE | NE | NE | 150 | 0.31 J | ND | ND | ND |
| gamma-Chlordane | NE | NE | 27.8 | 11000 | 0.7 J | ND | ND | ND |
| Methoxychlor | NE | NE | 56100 | 4400000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU43-TW02-06 03-25-2002 11' - 13' | SWMU43-TW03-06 03-25-2002 11' - 13' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 52 J | 150 J |
| Caprolactam | NE | NE | NE | 100000000 | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | 110 J |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.9 | 11 | 5.24 | 2.7 | ND | ND |
| Barium | 26 | 29 | 848 | 100000 | 1.5 J | ND |
| Chromium | 12 | 27 | 27 | 450 | 1.5 J | 3.4 |
| Lead | 8.6 | 14 | 270 | 750 | 2.7 J | 5 |
| Selenium | 0.43 | 1.7 | 12 | 10000 | ND | ND |
| **PESTICIDES (ug/kg)** | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 17000 | ND | ND |
| 4,4'-DDE | NE | NE | NE | 12000 | ND | ND |
| 4,4'-DDT | NE | NE | 1360 | 12000 | ND | 4.2 J |
| alpha-Chlordane | NE | NE | 27.8 | 11000 | ND | ND |
| Aldrin | NE | NE | NE | 150 | ND | 0.75 J |
| gamma-Chlordane | NE | NE | 27.8 | 11000 | ND | ND |
| Methoxychlor | NE | NE | 56100 | 4400000 | ND | 3.4 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 5/10 | 52 J - 250 J | NA | NA | 0 | 0 |
| Caprolactam | NE | NE | NE | 100000000 | 1/6 | 24 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/10 | 110 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 11 | 5.24 | 2.7 | 6/10 | 0.38 J - 3.3 | 3 | 0 | 0 | 1 |
| Barium | 26 | 29 | 848 | 100000 | 5/10 | 1.5 J - 31.3 | 1 | 1 | 0 | 0 |
| Chromium | 12 | 27 | 27 | 450 | 10/10 | 1.5 J - 17.3 | 4 | 0 | 0 | 0 |
| Lead | 8.6 | 14 | 270 | 750 | 10/10 | 2.6 - 7.4 | 0 | 0 | 0 | 0 |
| Selenium | 0.43 | 1.7 | 12 | 10000 | 3/10 | 0.25 J - 0.41 J | 0 | 0 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 17000 | 1/10 | 42 | NA | NA | 0 | 0 |
| 4,4'-DDE | NE | NE | NE | 12000 | 3/10 | 0.71 J - 17 | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 | 12000 | 6/10 | 1.5 J - 300 | NA | NA | 0 | 0 |
| alpha-Chlordane | NE | NE | 27.8 | 11000 | 2/6 | 0.78 J - 1.1 J | NA | NA | 0 | 0 |
| Aldrin | NE | NE | NE | 150 | 2/10 | 0.31 J - 0.75 J | NA | NA | 0 | 0 |
| gamma-Chlordane | NE | NE | 27.8 | 11000 | 1/6 | 0.7 J | NA | NA | 0 | 0 |
| Methoxychlor | NE | NE | 56100 | 4400000 | 1/10 | 3.4 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Clay Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU43-TW01 04-08-2002 | | SWMU43-TW02 04-09-2002 | | SWMU43-TW03 04-08-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 4-Methylphenol | NE | 3.5 | 0.9 | J | ND | | ND | |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 18.4 | | 17.2 | | 43.8 | |
| Chromium | 5.8 | 50 | ND | | ND | | 0.81 | J |
| Lead | 3.6 | 15 | ND | | ND | | 1.1 | J |
| Selenium | 2.8 | 50 | ND | | 3 | J | 4.2 | J |
| **PESTICIDES (ug/L)** | | | | | | | | |
| 4,4'-DDD | NE | 0.14 | ND | | 0.049 | J | ND | |
| alpha-Chlordane | NE | 0.027 | **0.056** | J | **0.19** | J | **0.039** | J |
| Dieldrin | NE | 0.0022 | **0.02** | J | **0.076** | J | ND | |
| Endosulfan I | NE | 220 (2) | ND | | 0.082 | J | ND | |
| gamma-chlordane | NE | 0.027 | ND | | **0.054** | | ND | |
| Heptachlor epoxide | NE | 0.004 | **0.11** | | **0.16** | | ND | |

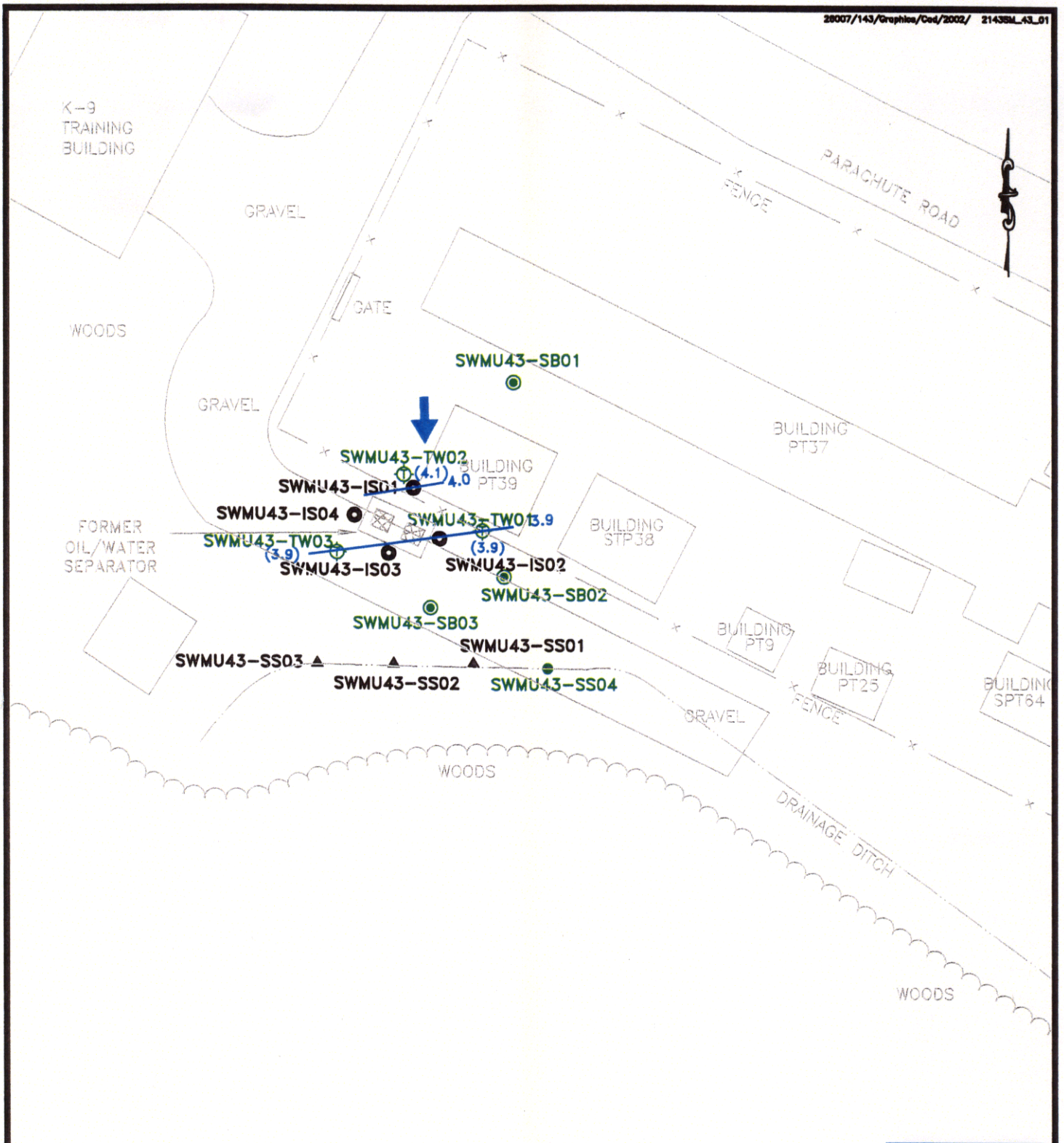
Shaded - Exceeds background concentrations.
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 043
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 4-Methylphenol | NE | 3.5 | 1/3 | 0.9 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 17.2 - 43.8 | 0 | 0 |
| Chromium | 5.8 | 50 | 1/3 | 0.81 J. | 0 | 0 |
| Lead | 3.6 | 15 | 1/3 | 1.1 J | 0 | 0 |
| Selenium | 2.8 | 50 | 2/3 | 3 J - 4.2 J | 2 | 0 |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDD | NE | 0.14 | 1/3 | 0.049 J | NA | 0 |
| alpha-Chlordane | NE | 0.027 | 3/3 | 0.039 J - 0.19 J | NA | 3 |
| Dieldrin | NE | 0.0022 | 2/3 | 0.02 J - 0.076 J | NA | 2 |
| Endosulfan I | NE | 220 (2) | 1/3 | 0.082 J | NA | 0 |
| gamma-chlordane | NE | 0.027 | 1/3 | 0.054 | NA | 1 |
| Heptachlor epoxide | NE | 0.004 | 2/3 | 0.11 - 0.16 | NA | 2 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

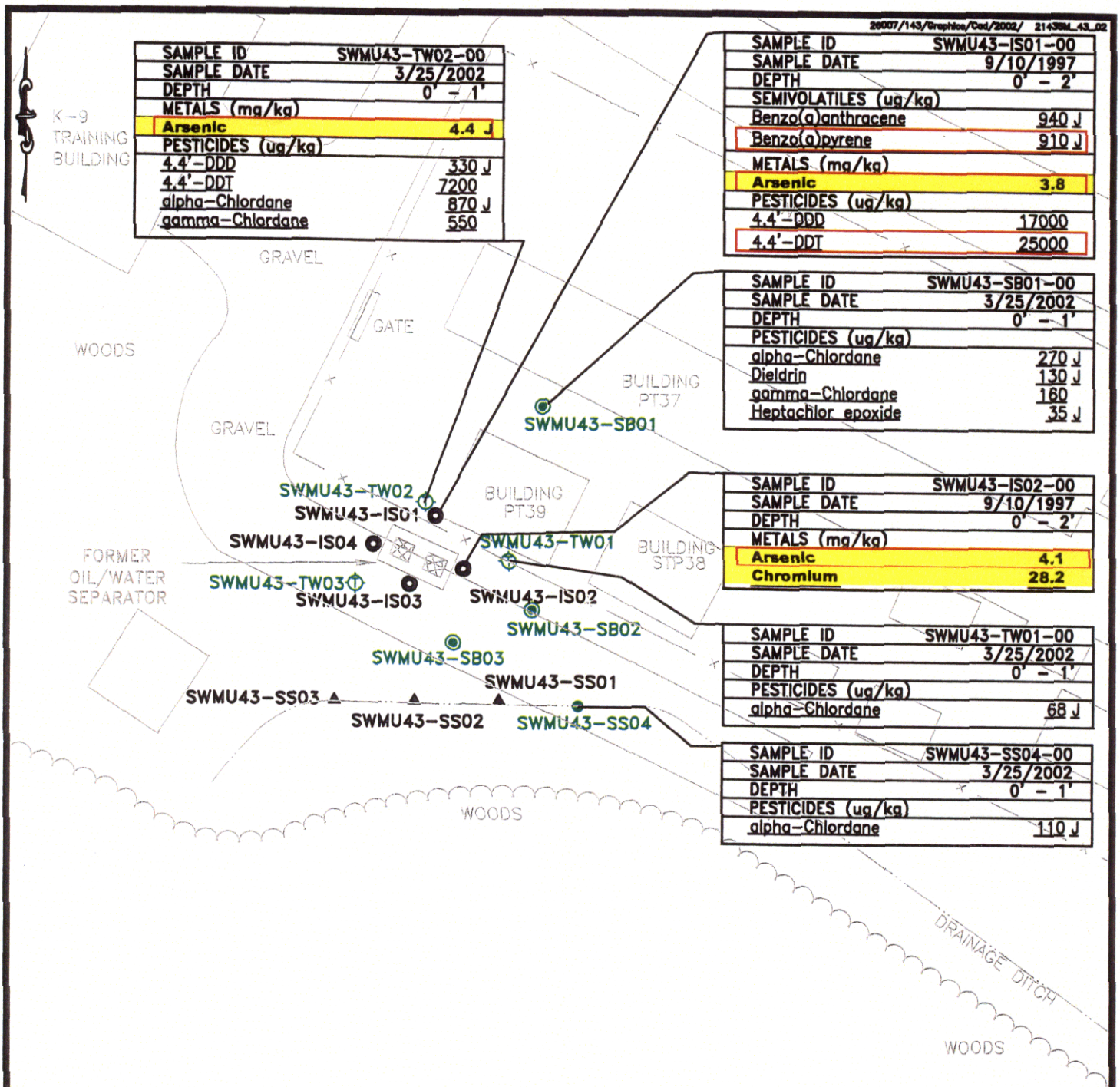
Baker

**LEGEND**

- TEMPORARY WELL
- SOIL BORING
- SURFACE SOIL SAMPLE
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 4.0 — GROUNDWATER CONTOUR
- INDICATES DRAINAGE DITCH AND FLOW DIRECTION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 43
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU43-TW02-00 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Arsenic** | 4.4 J |
| PESTICIDES (ug/kg) | |
| 4,4'-DDD | 330 J |
| 4,4'-DDT | 7200 |
| alpha-Chlordane | 870 J |
| gamma-Chlordane | 550 |

| SAMPLE ID | SWMU43-IS01-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 940 J |
| Benzo(a)pyrene | 910 J |
| METALS (mg/kg) | |
| **Arsenic** | 3.8 |
| PESTICIDES (ug/kg) | |
| 4,4'-DDD | 17000 |
| 4,4'-DDT | 25000 |

| SAMPLE ID | SWMU43-SB01-00 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 0' - 1' |
| PESTICIDES (ug/kg) | |
| alpha-Chlordane | 270 J |
| Dieldrin | 130 J |
| gamma-Chlordane | 160 |
| Heptachlor epoxide | 35 J |

| SAMPLE ID | SWMU43-IS02-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Arsenic** | 4.1 |
| **Chromium** | 28.2 |

| SAMPLE ID | SWMU43-TW01-00 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 0' - 1' |
| PESTICIDES (ug/kg) | |
| alpha-Chlordane | 68 J |

| SAMPLE ID | SWMU43-SS04-00 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 0' - 1' |
| PESTICIDES (ug/kg) | |
| alpha-Chlordane | 110 J |

**NOTE:**

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

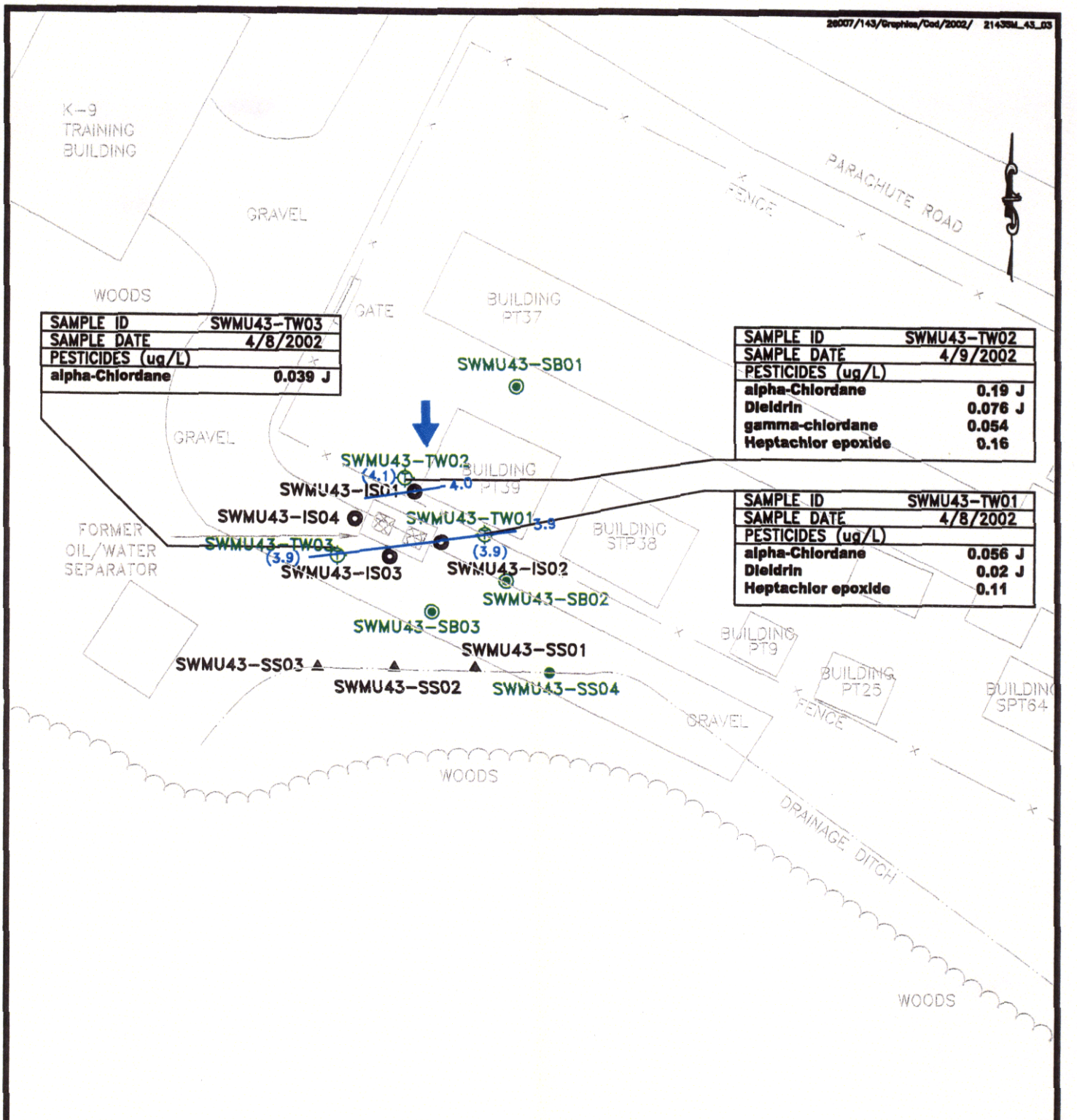
Baker

**LEGEND**

- TEMPORARY WELL
- SOIL BORING
- SURFACE SOIL SAMPLE
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- INDICATES DRAINAGE DITCH AND FLOW DIRECTION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 43
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

LEGEND

- TEMPORARY WELL
- SOIL BORING
- SURFACE SOIL SAMPLE
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 4.0 — GROUNDWATER CONTOUR
- INDICATES DRAINAGE DITCH AND FLOW DIRECTION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 43
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.4 SWMU 253 - 1205 Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.4.1 SWMU Description and History

SWMU 253 consists of a former steel, 500-gallon, used oil aboveground storage tank (AST). The SWMU was located south of the intersection of Birch and Hammond Roads in Hadnot Point behind Building 1205. The perimeter around the SWMU is secured with a fence. The ground surface around the SWMU is covered with asphalt. No evidence of contamination/spills were observed during the Confirmatory Investigation. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if historic operation of the former AST has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected at one soil boring advanced in the general vicinity of the former AST location (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 253 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.4.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 10.6 to 10.9 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 19.4 to 19.7 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southwest.

### 4.4.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs, and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summary for positive detections from the two phases were compared to the following screening criteria and are presented on Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Fourteen SVOCs (mostly PAHs) were detected in the sample set. None of the concentrations exceeded the established screening criteria.

Three metals were detected in the surface soil sample set, as follows: barium, chromium, and lead. None of the concentrations exceeded the established screening criteria.

Four metals were detected in the subsurface soil sample set, as follows: arsenic, barium, chromium, and lead. Barium exceeded the AOC background screening criteria in two of the samples, however, the concentrations were below all other criteria. Arsenic exceeded the AOC and Base background criteria, as well as the USEPA Region IX industrial PRG, in sample SWMU 253-IS01-04. It should be noted that this sample was collected from a depth of 8-10 feet during the Phase I CSI conducted in September 1997. None of the other detected metals exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

One SVOC (bis-2-ethylhexyl phthalate) was detected in the groundwater sample from well SWMU253-TW03. The concentration was below the 2L standard. No SVOCs were detected in samples from the remaining two wells.

Four metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, and selenium. Barium did not exceed the applicable screening criteria. Chromium, lead, and selenium exceeded the Base background screening criteria, however, the concentrations were below the 2L standards.

All of the compounds detected in groundwater, except for selenium, were detected in soils at the SWMU.

### 4.4.4 Conclusions

Arsenic was the only compound that exceeded both the AOC and Base background criteria and NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs in soil.

None of the compounds detected in groundwater exceeded the applicable screening criteria.

Based on the lack of consistent detections in the soil and groundwater samples collected at the SWMU, it was determined that the arsenic detection was a isolated, anomalous detection. Arsenic is often endemic/anthropogenic on the Base and its detection does not readily correlate with past or present activity at SWMU 253. Therefore, no further action is recommended.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU253-TW01 | 3/22/02 | BAKER | 30.37 | 30.5 | 19 | 19 | 7 | 5 | 9 | 10.92 | 19.4 |
| SWMU253-TW02 | 3/22/02 | BAKER | 30.24 | 30.3 | 18 | 18 | 6 | 4 | 8 | 10.56 | 19.7 |
| SWMU253-TW03 | 3/22/02 | BAKER | 30.25 | 30.4 | 20 | 19 | 7 | 5 | 9 | 10.75 | 19.5 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU253

TAL

DETECTION SUMMARY
SURFACE SOIL - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU253-IS01-00 09-15-1997 0' - 2' | SWMU253-TW01-00 03-22-2002 0' - 1' | SWMU253-TW02-00 03-22-2002 0' - 1' | SWMU253-TW03-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 23 J | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 88 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 84 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (1) | 2900 | 110 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 67 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (1) | 29000 | 110 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 88 J | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 130 J | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | 89 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 320 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 68 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 190 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 220 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 12 | 17 | 848 | 100000 | ND | ND | ND | 8 |
| Chromium | 6.4 | 15 | 27 | 450 | 5.4 | 2.3 | 1.6 | 0.91 |
| Lead | 20 | 21 | 270 | 750 | 1.8 | 2.8 J | 1.3 J | 2.1 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 1/4 | 23 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/4 | 88 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 1/4 | 84 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 2320 (1) | 2900 | 1/4 | 110 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/4 | 67 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 23200 (1) | 29000 | 1/4 | 110 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 1/4 | 88 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/4 | 130 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/4 | 89 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/4 | 320 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/4 | 68 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/4 | 190 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/4 | 220 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 12 | 17 | 848 | 100000 | 1/4 | 8 | 0 | 0 | 0 | 0 |
| Chromium | 6.4 | 15 | 27 | 450 | 4/4 | 0.91 - 5.4 | 0 | 0 | 0 | 0 |
| Lead | 20 | 21 | 270 | 750 | 4/4 | 1.3 J - 2.8 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
AOC comparison - AOC 6 Surface Soil
Base comparison - Fine Sand Surface Soil

TAI

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU253-IS01-04 09-15-1997 8' - 10' | SWMU253-TW01-06 03-22-2002 11' - 13' | SWMU253-TW02-05 03-22-2002 9' - 11' | SWMU253-TW03-06 03-22-2002 11' - 13' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 74 J | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 150 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 79 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (1) | 2900 | 140 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 58 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (1) | 29000 | 93 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 140 J | ND | ND | ND |
| Carbazole | NE | NE | NE | 120000 | 110 J | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 180 J | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | 44 J | 59 J | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 670 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 59 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 400 | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 450 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | 3.2 | ND | ND | ND |
| Barium | 10 | 22 | 848 | 100000 | ND | ND | 13.9 | 10.5 |
| Chromium | 11 | 16 | 27 | 450 | 5.3 | 1.9 | 4.1 | 3.6 |
| Lead | 6.9 | 8.2 | 270 | 750 | 2.6 | 1.7 J | 4.6 J | 3.6 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/1/2002
SWMU253_SOIL

TA

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 1/4 | 74 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/4 | 150 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 1/4 | 79 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 2320 (1) | 2900 | 1/4 | 140 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/4 | 58 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 23200 (1) | 29000 | 1/4 | 93 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 1/4 | 140 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/4 | 110 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/4 | 180 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 2/4 | 44 J - 59 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/4 | 670 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/4 | 59 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/4 | 400 | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/4 | 450 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | 1/4 | 3.2 | 1 | 1 | 0 | 1 |
| Barium | 10 | 22 | 848 | 100000 | 2/4 | 10.5 - 13.9 | 2 | 0 | 0 | 0 |
| Chromium | 11 | 16 | 27 | 450 | 4/4 | 1.9 - 5.3 | 0 | 0 | 0 | 0 |
| Lead | 6.9 | 8.2 | 270 | 750 | 4/4 | 1.7 J - 4.6 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
AOC comparison - AOC 6 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU253-TW01 04-05-2002 | | SWMU253-TW02 04-05-2002 | | SWMU253-TW03 04-05-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | ND | | ND | | 1 | J |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 19.7 | J | 21.6 | J | 37.2 | |
| Chromium | 5.8 | 50 | 3.9 | J | 1.2 | J | 13 | |
| Lead | 3.6 | 15 | 3.2 | J | ND | | 7.5 | |
| Selenium | 2.8 | 50 | ND | | ND | | 5.5 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

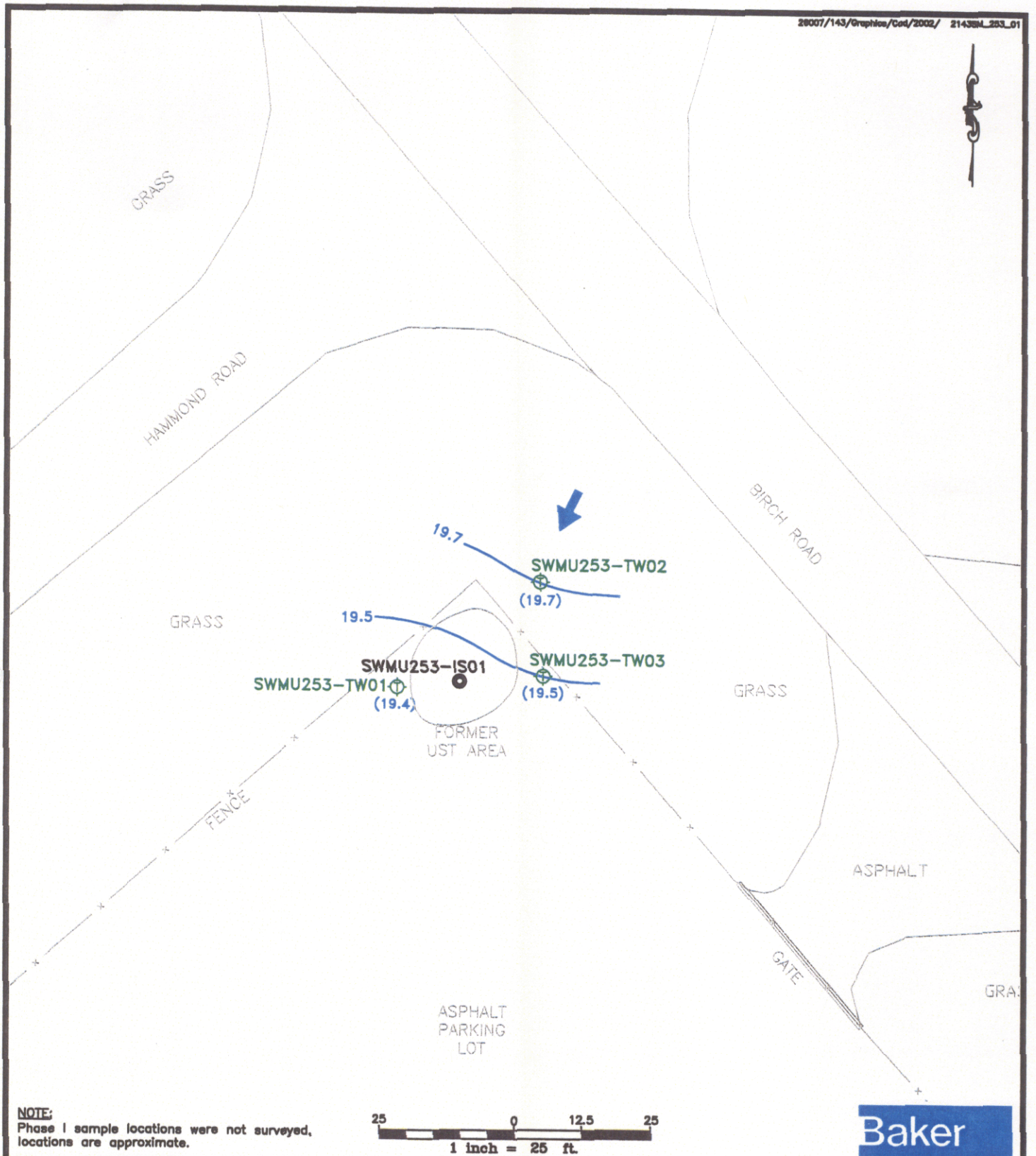
9/3/02
SWMU253_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 253
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 1/3 | 1 J | NA | 0 |
| **METALS (ug/L)** | | | 0/0 | | | |
| Barium | 145 | 2000 | 3/3 | 19.7 J - 37.2 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 1.2 J - 13 | 1 | 0 |
| Lead | 3.6 | 15 | 2/3 | 3.2 J - 7.5 | 1 | 0 |
| Selenium | 2.8 | 50 | 1/3 | 5.5 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

Baker

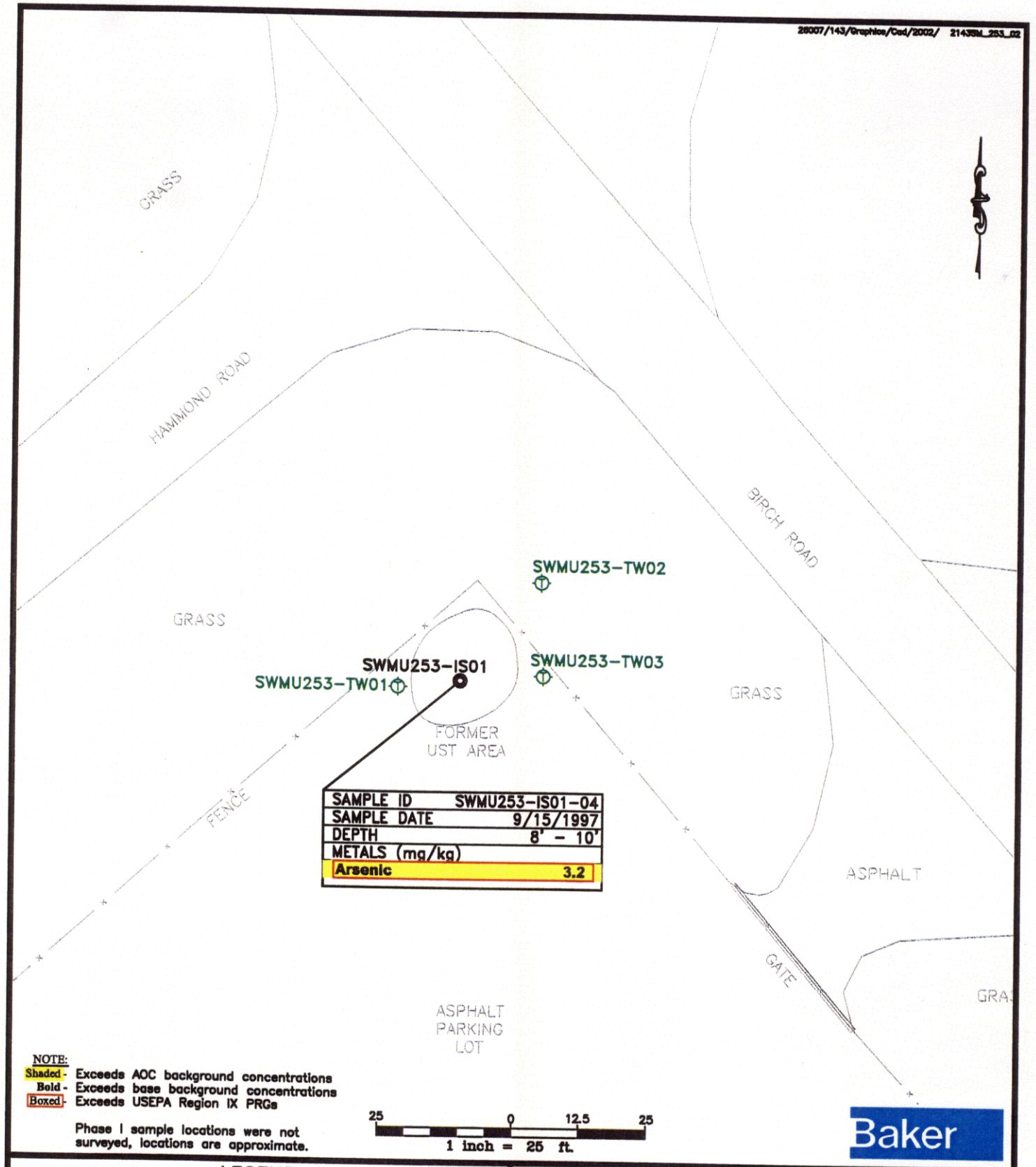
## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 19.5 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 253
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB6Y




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 253
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.5 SWMU 254 - 1408 Dumpster

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.5.1 SWMU Description and History

SWMU 254 consists of a dumpster identified in the RFA Report (EnSafe, 1996) as containing unpunched paint cans and approximately one gallon of Citrakleen. The SWMU is located northwest of the intersection of Elm Street and Michael Road in Hadnot Point, west of Building 1408. The dumpster could not be located during the Phase I CSI. The ground surface in the vicinity the SWMU is covered with grass and did not show evidence of contamination and/or spills during the investigation. A surface water drainage ditch begins in the vicinity of the SWMU and travels northwest and connects to another surface water drainage ditch is located directly southwest of the SWMU. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if materials placed in the dumpster during past practices had impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from one soil boring advanced in the general vicinity of the former dumpster (see Figure 1). One additional surface soil sample was collected from the drainage ditch. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, several SVOCs exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 254 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.5.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Surface soil sampling at one location from the drainage ditch
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 9.1 to 9.5 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 15.3 to 15.4 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southeast.

### 4.5.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and a statistical summary for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- Default and site-specific NC DENR soil to groundwater values
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Twenty SVOCs (mostly PAHs) were detected in the surface soil sample set. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded NC DENR soil to groundwater screening criteria and/or Region IX industrial PRGs in one or more of the surface soil samples. None of the other detected SVOCs exceeded the established screening criteria.

There were no exceedances of established screening criteria in the subsurface soil sample set.

Groundwater

No SVOCs were detected above laboratory reporting limits or established screening criteria in the groundwater samples collected from the three temporary wells at SWMU 254.

### 4.5.4 Conclusions

Several SVOCs were detected in surface soil at concentrations exceeding established screening criteria. Compounds that exceeded either the NC DENR soil to groundwater screening criteria or Region IX industrial PRGs in surface soil were as follows:

- SVOCs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h) anthracene, and indeno(1,2,3-cd)pyrene.

Based on evaluation of the analytical results, additional action at SWMU 254 is warranted. The additional activities are presented in Section 5.0.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU254-TW01 | 3/22/02 | BAKER | 24.71 | 25.0 | 18 | 18 | 6 | 4.5 | 8 | 9.35 | 15.4 |
| SWMU254-TW02 | 3/22/02 | BAKER | 24.44 | 24.9 | 18 | 18 | 6 | 4.5 | 8 | 9.05 | 15.4 |
| SWMU254-TW03 | 3/22/02 | BAKER | 24.78 | 25.2 | 18 | 18 | 6 | 4.5 | 8 | 9.48 | 15.3 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU254

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 254
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU254-IS01-00 09-12-1997 0' - 2' | SWMU254-SS01-00 09-12-1997 0' - 2' | SWMU254-SS02-00 03-22-2002 0' - 1' | SWMU254-TW01-00 03-22-2002 0' - 1' | SWMU254-TW02-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Acenaphthene | 8160 | 38000000 | NA | NA | 170 J | ND | ND |
| Acenaphthylene | 11400 | NE | 1000 J | 76 J | 1200 J | ND | ND |
| Anthracene | 995000 | 100000000 | 1600 J | 100 J | 2400 | ND | ND |
| Benzo(a)anthracene | 938 (1) | 2900 | 6000 | 370 | 14000 | 57 J | ND |
| Benzo(a)pyrene | 249 (1) | 290 | 9000 | 500 | 24000 J | 78 J | ND |
| Benzo(b)fluoranthene | 3160 (2) | 2900 | 15000 | 770 | 43000 J | 130 J | ND |
| Benzo(ghi)perylene | 6720000 | NE | 7700 | 520 | 17000 J | 60 J | ND |
| Benzo(k)fluoranthene | 31600 (2) | 29000 | 7200 | 420 | 21000 J | 49 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 1000 J | 280 J | 2600 | ND | ND |
| Butyl benzyl phthalate | 27800 | 100000000 | ND | ND | 490 J | ND | ND |
| Carbazole | NE | 120000 | 2100 J | 110 J | 2600 | ND | ND |
| Chrysene | 39800 | 290000 | 9900 | 540 | 27000 | 86 J | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | 240 J | ND | ND |
| Dibenz(a,h)anthracene | 460 (1) | 290 | 2800 | ND | 5900 J | ND | ND |
| Dibenzofuran | 12600 (2) | 5100000 | ND | ND | 220 J | ND | ND |
| Fluorene | 44300 | 33000000 | ND | ND | 290 J | ND | ND |
| Fluoranthene | 276000 | 30000000 | 17000 | 910 | 44000 | 130 J | ND |
| Indeno(1,2,3-cd)pyrene | 8920 (1) | 2900 | 7400 | 480 | 33000 J | 86 J | ND |
| Phenanthrene | 59600 | NE | 5000 | 270 J | 9800 | 43 J | ND |
| Pyrene | 286000 | 54000000 | 13000 | 690 | 35000 | 100 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2735 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 2735mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 254
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU254-TW03-00 03-22-2002 0' - 1' | |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | |
| Acenaphthene | 8160 | 38000000 | ND | |
| Acenaphthylene | 11400 | NE | ND | |
| Anthracene | 995000 | 100000000 | ND | |
| Benzo(a)anthracene | 938 (1) | 2900 | ND | |
| Benzo(a)pyrene | 249 (1) | 290 | ND | |
| Benzo(b)fluoranthene | 3160 (2) | 2900 | ND | |
| Benzo(ghi)perylene | 6720000 | NE | ND | |
| Benzo(k)fluoranthene | 31600 (2) | 29000 | ND | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | ND | |
| Butyl benzyl phthalate | 27800 | 100000000 | ND | |
| Carbazole | NE | 120000 | ND | |
| Chrysene | 39800 | 290000 | ND | |
| Di-n-octyl phthalate | 10000000 | 10000000 | 48 | J |
| Dibenz(a,h)anthracene | 460 (1) | 290 | ND | |
| Dibenzofuran | 12600 (2) | 5100000 | ND | |
| Fluorene | 44300 | 33000000 | ND | |
| Fluoranthene | 276000 | 30000000 | ND | |
| Indeno(1,2,3-cd)pyrene | 8920 (1) | 2900 | ND | |
| Phenanthrene | 59600 | NE | ND | |
| Pyrene | 286000 | 54000000 | ND | |

Underlined - Exceeds NC DENR soil tc
Boxed - Exceeds USEPA Region I
(1) - Detected concentrations e:
soil-to-water criteria. The
calculated using a 2L or in
(2) - Site-specific criteria calcu
J - Analyte detected. Report
NA - Not analyzed. Not on the
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 254
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Acenaphthene | 8160 | 38000000 | 1/4 | 170 J | NA | NA | 0 | 0 |
| Acenaphthylene | 11400 | NE | 3/6 | 76 J - 1200 J | NA | NA | 0 | 0 |
| Anthracene | 995000 | 100000000 | 3/6 | 100 J - 2400 | NA | NA | 0 | 0 |
| Benzo(a)anthracene | 938 (1) | 2900 | 4/6 | 57 J - 14000 | NA | NA | 2 | 2 |
| Benzo(a)pyrene | 249 (1) | 290 | 4/6 | 78 J - 24000 J | NA | NA | 3 | 3 |
| Benzo(b)fluoranthene | 3160 (2) | 2900 | 4/6 | 130 J - 43000 J | NA | NA | 2 | 2 |
| Benzo(ghi)perylene | 6720000 | NE | 4/6 | 60 J - 17000 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | 31600 (2) | 29000 | 4/6 | 49 J - 21000 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 3/6 | 280 J - 2600 | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | 27800 | 100000000 | 1/6 | 490 J | NA | NA | 0 | 0 |
| Carbazole | NE | 120000 | 3/6 | 110 J - 2600 | NA | NA | 0 | 0 |
| Chrysene | 39800 | 290000 | 4/6 | 86 J - 27000 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 2/6 | 48 J - 240 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | 460 (1) | 290 | 2/6 | 2800 - 5900 J | NA | NA | 2 | 2 |
| Dibenzofuran | 12600 (2) | 5100000 | 1/6 | 220 J | NA | NA | 0 | 0 |
| Fluorene | 44300 | 33000000 | 1/6 | 290 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 30000000 | 4/6 | 130 J - 44000 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 8920 (1) | 2900 | 4/6 | 86 J - 33000 J | NA | NA | 1 | 2 |
| Phenanthrene | 59600 | NE | 4/6 | 43 J - 9800 | NA | NA | 0 | 0 |
| Pyrene | 286000 | 54000000 | 4/6 | 100 J - 35000 | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2735 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 2735mg/kg.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 254
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU254-IS01-03 09-12-1997 6' - 8' | SWMU254-TW01-04 03-22-2002 7' - 9' | SWMU254-TW02-04 03-22-2002 7' - 9' | SWMU254-TW03-04 03-22-2002 7' - 9' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 240 J | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | 33 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

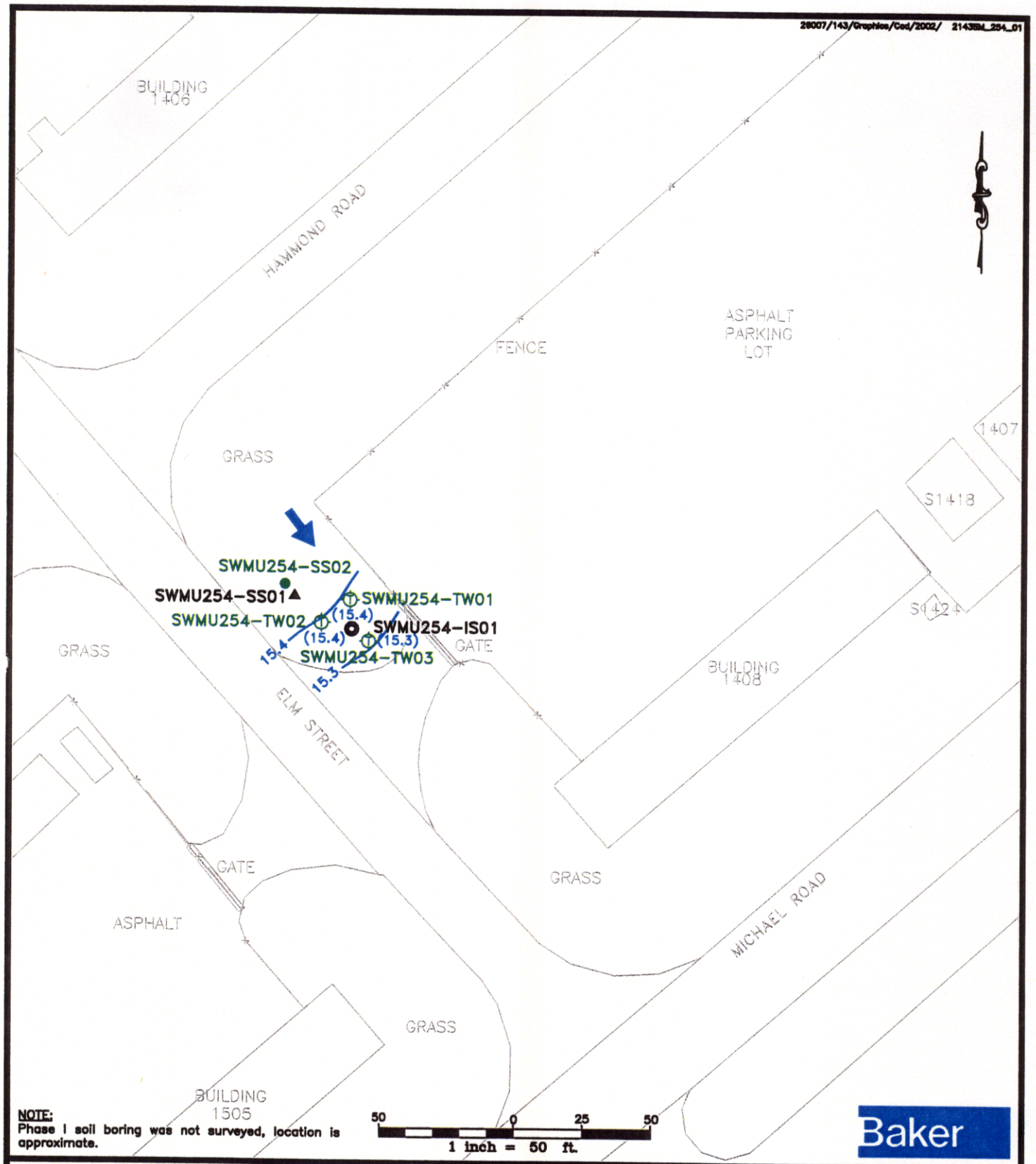
9/11/02
SWMU254_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 254
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 1/4 | 240 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 1/4 | 33 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established




**NOTE:**
Phase I soil boring was not surveyed, location is approximate.

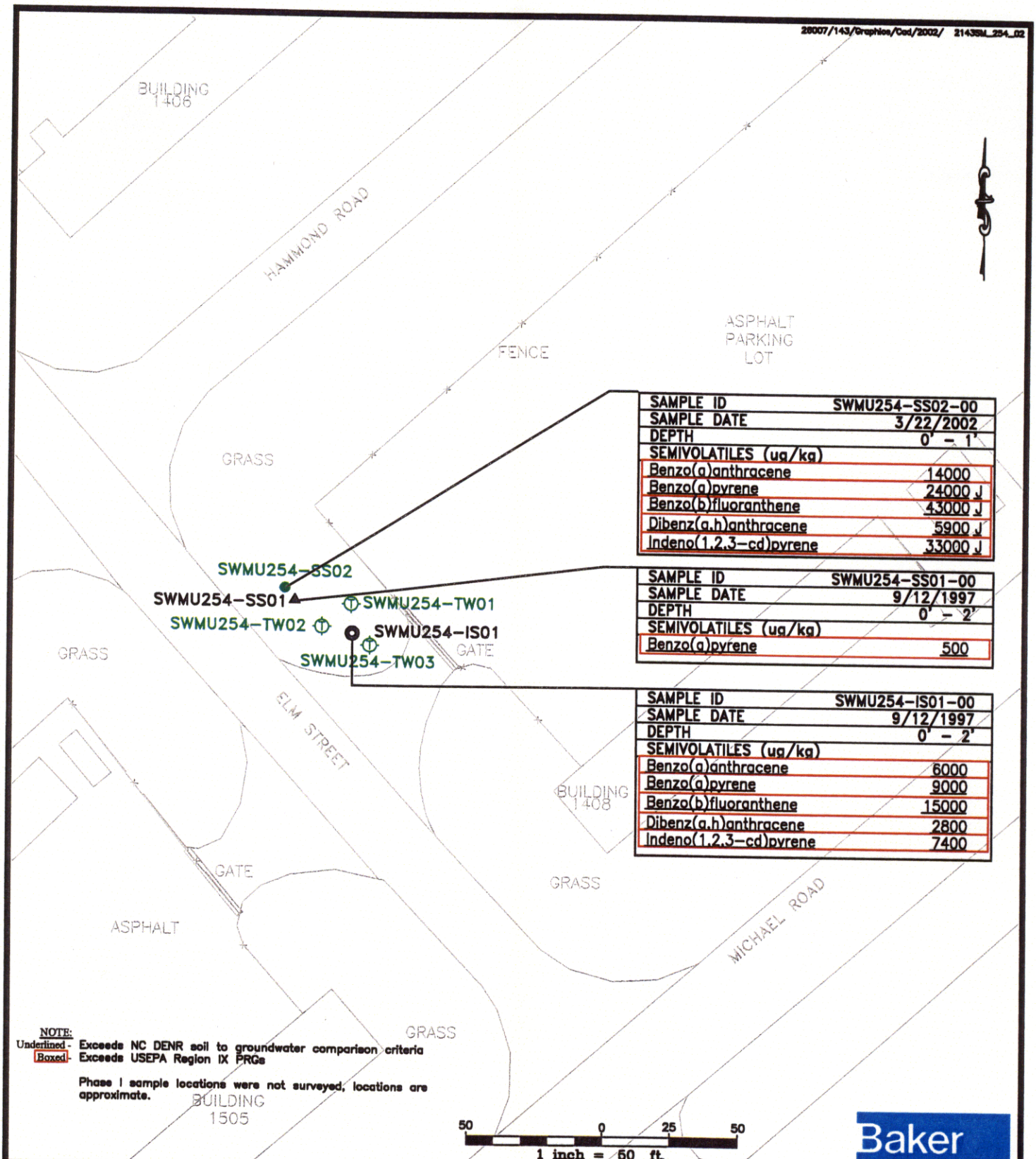
## LEGEND

- TEMPORARY WELL
- SURFACE SOIL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL
- GROUNDWATER FLOW DIRECTION
- —15.3— GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 254
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753 & 374




| SAMPLE ID | SWMU254-SS02-00 |
|---|---|
| SAMPLE DATE | 3/22/2002 |
| DEPTH | 0' - 1' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 14000 |
| Benzo(a)pyrene | 24000 J |
| Benzo(b)fluoranthene | 43000 J |
| Dibenz(a,h)anthracene | 5900 J |
| Indeno(1,2,3-cd)pyrene | 33000 J |

| SAMPLE ID | SWMU254-SS01-00 |
|---|---|
| SAMPLE DATE | 9/12/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 500 |

| SAMPLE ID | SWMU254-IS01-00 |
|---|---|
| SAMPLE DATE | 9/12/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 6000 |
| Benzo(a)pyrene | 9000 |
| Benzo(b)fluoranthene | 15000 |
| Dibenz(a,h)anthracene | 2800 |
| Indeno(1,2,3-cd)pyrene | 7400 |

NOTE:
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- TEMPORARY WELL
- SURFACE SOIL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
# PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 254
## CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.6 SWMU 255 - Building 1502 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.6.1 SWMU Description and History

SWMU 255 is a 4-foot by 8-foot, covered, concrete oil/water separator associated with Building 1502 (a vehicle maintenance facility). The SWMU is located southwest of the intersection of Elm Street and Gibb Road in Hadnot Point. A surface water drainage ditch is located west of the SWMU and parallels Gibb Road. The area surrounding the SWMU is covered with grass. The grit chamber associated with the SWMU is detached and offset to the northeast. During the site visit conducted by Baker in 1996, it was evident that the grit chamber had overflowed in the past causing contamination of the surface soils. Additionally, evidence that a spill may have occurred was observed in the adjacent concrete drainage channel. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if historic operations associated with the oil/water separator have impacted the surface and subsurface soils in the vicinity of the SWMU or the drainage ditch adjacent to the SWMU. Surface and subsurface samples were collected from four soil borings advanced around the perimeter of the SWMU (Figure 1). Three additional surface soil samples were collected from the drainage ditch. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, Benzo(a)pyrene and pentachlorophenol exceeded the regulatory driven criteria in one of the surface soil samples collected from the concrete-lined drainage ditch. Therefore, additional investigation at SWMU 255 was recommended in the form of a Phase II CSI. During the site visit conducted by Baker in March 2002, it was noted that the sediment in the drainage ditch appeared to have been "cleaned out."

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.6.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at one temporary well boring
- Groundwater sampling at one temporary well

It should be noted that the samples were proposed to be collected beneath the concrete-lined drainage ditch; however, the terrain around the ditch prevented sampling at this location. As a result, the temporary well boring was moved to a location between the SWMU and the ditch.

Table 1 provides a summary of the temporary well construction details and static groundwater level measurement. A summary of the groundwater sampling field parameters is included in Appendix C.

The water table was measured in the well at a depth of approximately 9.5 feet below the ground surface. The groundwater elevation in the well was 14.7 feet above mean MSL.

### 4.6.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix E.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summary for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- Default NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Twelve SVOCs (mostly PAHs) were detected in the surface soil sample set. The majority of SVOCs were detected in surface soil sample SWMU255-SS01-00, which was collected from the concrete drainage channel in September 1997. Pentachlorophenol exceeded the NC DENR soil to groundwater screening criteria in this sample. None of the other SVOCs detected in the surface soil samples exceeded the applicable screening criteria.

One SVOC, bis(2-ethylhexyl)phthalate, was detected in the subsurface soil sample set. None of the screening criteria were exceeded.

Groundwater

No SVOCs were detected above the laboratory reporting limits in the groundwater sample collected from the temporary well at SWMU 255.

### 4.6.4 Conclusions

Pentachlorophenol was the only SVOC that exceeded the applicable screening criteria in soils at the SWMU. It should be noted that this compound exceeded the screening criteria in one of the surface soil samples collected from the concrete drainage ditch in September 1997 during the Phase I CSI. The sediment in the ditch has since been removed. No SVOCs exceeded the applicable screening criteria in soils immediately surrounding the SWMU or in groundwater.

Based on evaluation of the analytical results, no further action is recommended at SWMU 255. Results from SWMU255-TW01 did not contain pentachlorophenol therefore indicating that the compound is not originating from SWMU 255.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU255-TW01 | 3/22/02 | BAKER | 24.18 | 24.2 | 18 | 18 | 6 | 4.5 | 8 | 9.48 | 14.7 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU255

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 255
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU255-IS01-00 09-14-1997 0' - 2' | SWMU255-IS02-00 09-14-1997 0' - 2' | SWMU255-IS03-00 09-14-1997 0' - 2' | SWMU255-IS04-00 09-14-1997 0' - 2' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)anthracene | 358 | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | 91 | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | 11600 (1) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 160 J | 79 J | 160 J | 140 |
| Chrysene | 39800 | 290000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | ND | ND |
| Pentachlorophenol | 23 | 11000 | ND | ND | ND | ND |
| Phenanthrene | 59600 | NE | ND | ND | ND | ND |
| Pyrene | 286000 | 54000000 | ND | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.

J - Analyte detected. Report value is estimated.

ND - Analyte not detected.

NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 255
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU255-SS01-00 09-17-1997 0' - 2' | SWMU255-SS02-00 09-17-1997 0' - 2' | 'MU255-SS03-00 09-17-1997 0' - 2' | WMU255-TW01-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)anthracene | 358 | 2900 | 63 J | ND | ND | ND |
| Benzo(a)pyrene | 91 | 290 | 91 J | 43 J | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 2900 | 120 J | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | 47 J | ND | ND | ND |
| Benzo(k)fluoranthene | 11600 (1) | 29000 | 130 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 J | 300 J | 89 J | 65 J | ND |
| Chrysene | 39800 | 290000 | 100 J | 45 J | ND | ND |
| Fluoranthene | 276000 | 30000000 | 160 J | 49 J | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 47 J | ND | ND | ND |
| Pentachlorophenol | 23 | 11000 | 210 J | ND | ND | ND |
| Phenanthrene | 59600 | NE | 72 J | ND | ND | ND |
| Pyrene | 286000 | 54000000 | 190 J | 89 J | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.

J - Analyte detected. Report value is estimated.

ND - Analyte not detected.

NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 255
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | 358 | 2900 | 1/8 | 63 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 91 | 290 | 2/8 | 43 J - 91 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | 1160 (1) | 2900 | 1/8 | 120 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 1/8 | 47 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | 11600 (1) | 29000 | 1/8 | 130 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 7/8 | 65 J - 300 J | NA | NA | 0 | 0 |
| Chrysene | 39800 | 290000 | 2/8 | 45 J - 100 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 30000000 | 2/8 | 49 J - 160 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 1/8 | 47 J | NA | NA | 0 | 0 |
| Pentachlorophenol | 23 | 11000 | 1/8 | 210 J | NA | NA | 1 | 0 |
| Phenanthrene | 59600 | NE | 1/8 | 72 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 54000000 | 2/8 | 89 J - 190 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
However, site-specific critieria were not calculated because the TOC was 1000 mg/kg,
which is the same concentration used to calculate the default criteria.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 255
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU255-IS01-04 09-14-1997 8' - 10' | SWMU255-IS02-04 09-14-1997 8' - 10' | SWMU255-IS03-03 09-14-1997 6' - 8' | SWMU255-IS04-02 09-14-1997 4' - 6' | SWMU255-TW01-04 03-21-2002 7' - 9' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 130 J | 100 J | 140 J | 460 | 79 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NE - Not established

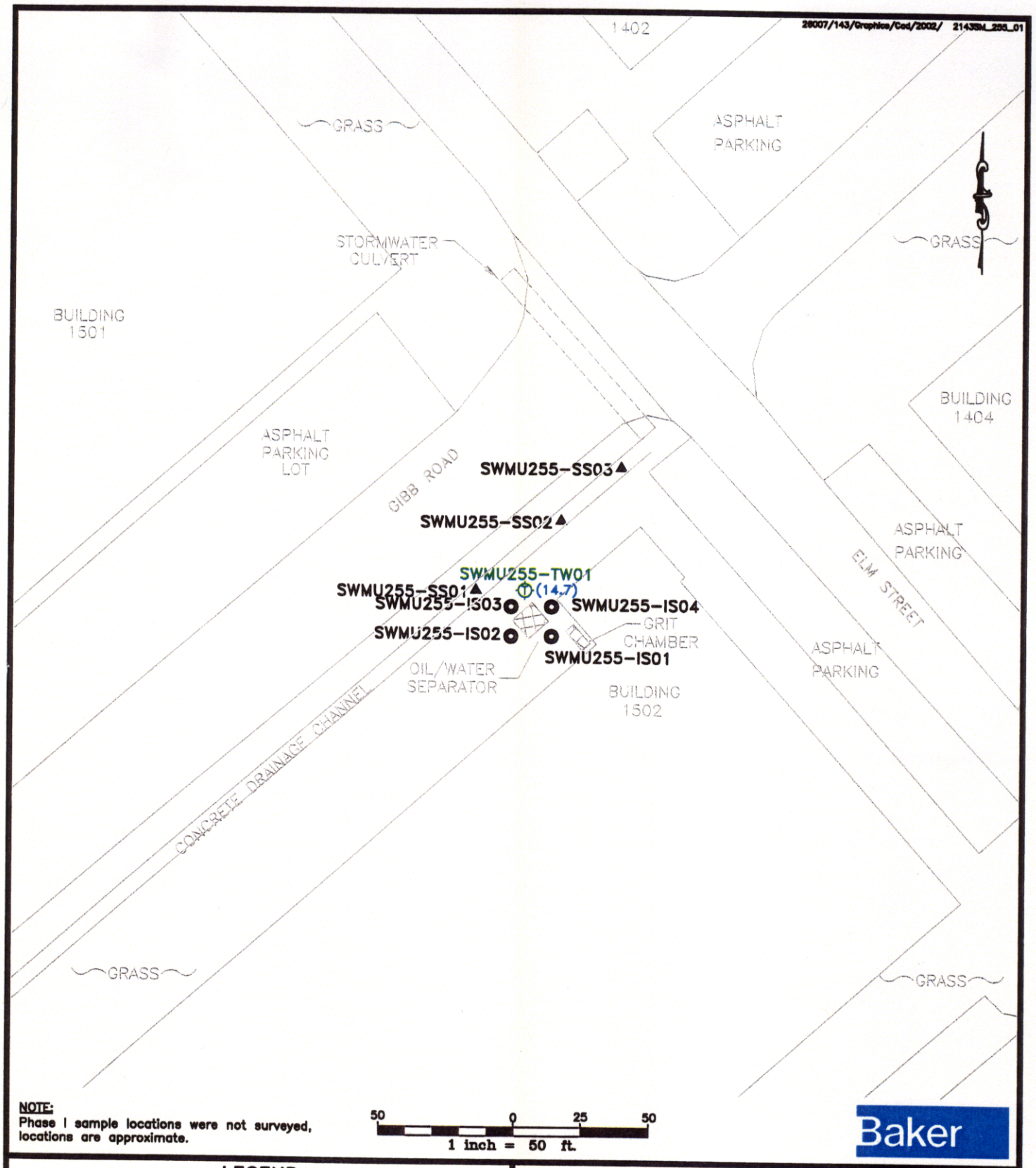
9/11/02
SWMU255_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 255
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 5/5 | 79 J - 460 | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

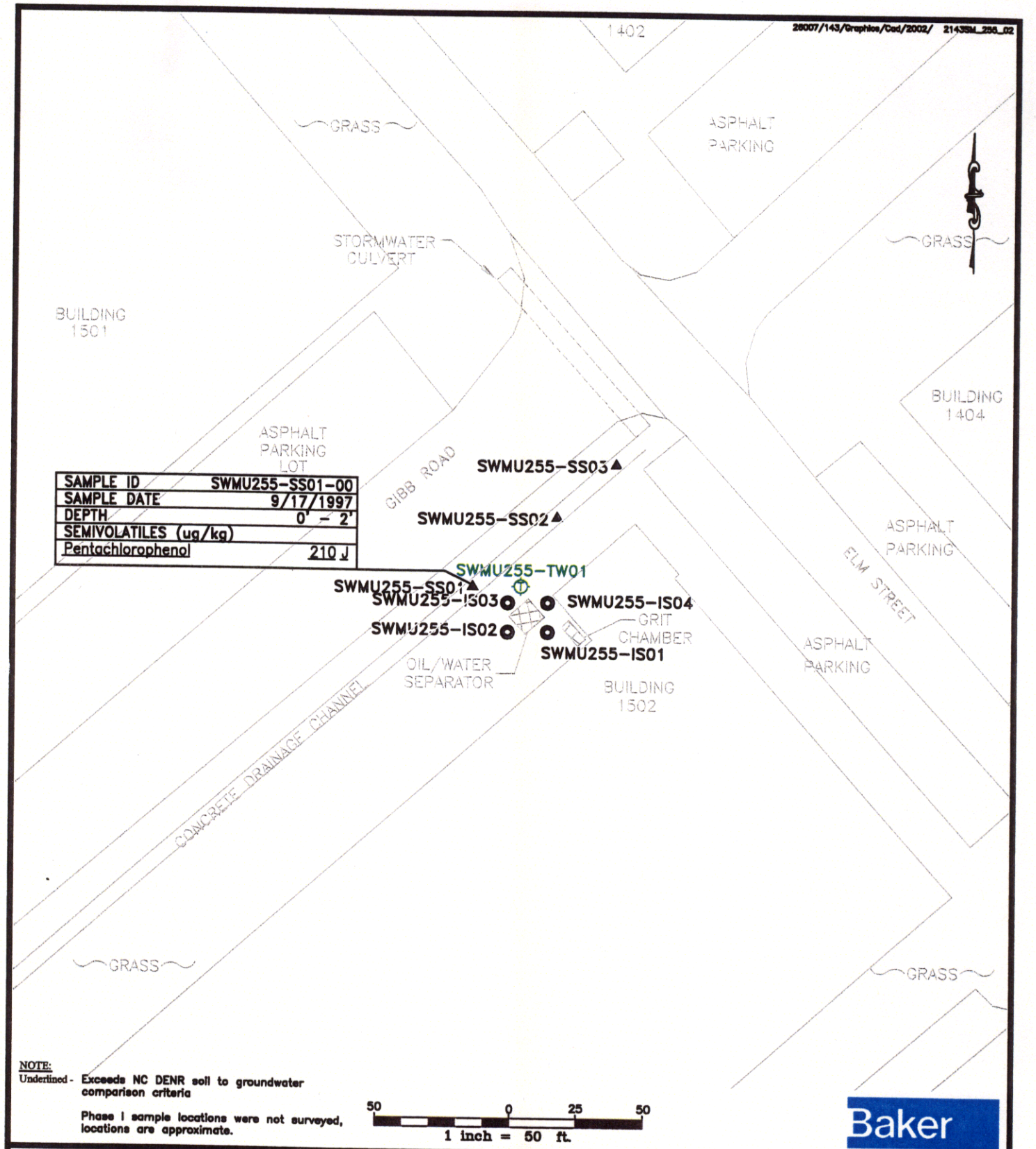
## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL
- (8.2) – GROUNDWATER ELEVATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 255
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753 E389




| SAMPLE ID | SWMU255-SS01-00 |
|---|---|
| SAMPLE DATE | 9/17/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Pentachlorophenol | 210 J |

NOTE:
Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 255
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.7 SWMU 258 - S1745 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.7.1 SWMU Description and History

SWMU 258 is located within the central portion of the Hadnot Point Industrial Area adjacent to Michael Road and Building 1711. The SWMU consists of a concrete oil/water separator and grit chamber. The grit chamber receives a mixture of solids and fluids from the adjacent vehicle wash rack. The solid fraction is retained while the fluids which contain water, waste oil, and grease are passed to the oil/water separator. The SWMU currently is in use. It is unknown when the SWMU started operations. The perimeter around the SWMU is secured with a fence and locking gate. The ground surface is covered with asphalt and grass. During the site visit conducted by Baker in 1996, paint and petroleum stains were observed on the concrete walls of the system. A SWMU investigation plan is presented on Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator and grit chamber has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected at six soil borings advanced around the perimeter of the SWMU (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, one VOC (acetone) and two metals (cadmium and mercury) exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 258 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.7.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and April 6, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Resampling of surface soil at soil boring SWMU258-IS05-00 (to confirm the presence of acetone)
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 3.0 to 3.2 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 25.7 to 26.0 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northwest.

### 4.7.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. One surface soil sample (SWMU258-IS05-00) was also analyzed for VOCs. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Six VOCs were detected in the surface soil sample set, as follows: 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, and methylene chloride. Most of the VOCs were detected in sample SWMU258-IS05-00. Acetone (3100 ug/kg) exceeded the NC DENR soil to groundwater criteria (2890 ug/kg) in surface soil sample SWMU258-IS05-00, which was collected in September 1997 during the Phase I CSI. The presence of acetone was suspect and likely attributable to laboratory preparation/cleaning because this SWMU has not had a history of accepting acetone-contaminated waste. This location was resampled during Phase II to confirm the presence of acetone and the resultant concentration was 28 ug/kg, which is well below the applicable screening criteria. Therefore, acetone is not considered a COPC for SWMU 258. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

Seven metals were detected in the surface soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. All of the metals exceeded background screening criteria in one or more of the samples. Arsenic exceeded AOC and Base background criteria, NC DENR soil to groundwater criteria and the USEPA Region IX industrial PRG. Cadmium, chromium, lead and mercury exceeded AOC and Base background criteria and the NC DENR soil to groundwater screening criteria.

Four metals were detected in the subsurface soil sample set, as follows: barium, chromium, lead and mercury. Lead exceeded the AOC and Base background criteria, however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX industrial PRG. Mercury was the only inorganic that exceeded the NC DENR soil to groundwater values; however, the

concentrations were below the AOC and Base background criteria. None of the other metals detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Four metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, and lead. Arsenic exceeded the background criteria and 2L standard. Chromium and lead exceeded the Base background criteria; however, the concentrations were below the 2L standards. None of the barium concentrations exceeded the established screening criteria.

All of the compounds detected in the groundwater were detected in soils at the SWMU.

### 4.7.4 Conclusions

Several metals were detected in soil at concentrations exceeding applicable screening criteria. Metals that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- Arsenic, cadmium, chromium, lead, and mercury

Arsenic also exceeded the Base background criteria and 2L standard in groundwater.

Based on evaluation of the analytical results, additional activities at SWMU 258 are warranted. The additional activities are presented in Section 5.0.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU258-TW01 | 3/22/02 | BAKER | 29.02 | 29.1 | 13 | 13 | 1 | 0 | 3 | 3.04 | 26.0 |
| SWMU258-TW02 | 3/22/02 | BAKER | 28.84 | 29.0 | 13 | 13 | 1 | 0 | 3 | 3.1 | 25.7 |
| SWMU258-TW03 | 3/22/02 | BAKER | 28.93 | 29.1 | 13 | 13 | 1 | 0 | 3 | 3.25 | 25.7 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU258

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU258-IS01-00 09-11-1997 0' - 2' | SWMU258-IS02-00 09-11-1997 0' - 2' | SWMU258-IS03-00 09-11-1997 0' - 2' | SWMU258-IS04-00 09-11-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | ND | ND | ND |
| Acetone | NE | NE | 2890 (1) | 6200000 | ND | ND | ND | ND |
| Benzene | NE | NE | 5.6 | 1500 | ND | ND | ND | ND |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | ND | ND | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | ND | ND | ND |
| Methylene chloride | NE | NE | 33 (1) | 21000 | 5 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | ND | NA | ND |
| Barium | 39 | 17 | 848 | 100000 | ND | ND | NA | ND |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 3.2 | 1.3 | NA | ND |
| Chromium | 16 | 15 | 27 | 450 | 19 | 19.2 | NA | 10.9 |
| Lead | 69 | 21 | 270 | 750 | **36.2** | **62.7** | NA | 4.5 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | 0.099 | NA | ND |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | ND | NA | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 11379 mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU258-IS05-00 09-11-1997 0' - 2' | SWMU258-IS05-00 03-22-2002 0' - 1' | SWMU258-IS06-00 09-11-1997 0' - 2' | SWMU258-TW01-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | 9 J | ND | NA |
| Acetone | NE | NE | 2890 (1) | 6200000 | 3100 | 28 | ND | NA |
| Benzene | NE | NE | 5.6 | 1500 | ND | 1 J | ND | NA |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | 1 J | ND | NA |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | 2 J | ND | NA |
| Methylene chloride | NE | NE | 33 (1) | 21000 | 6 | 31 | ND | NA |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | NA | ND | 20.4 |
| Barium | 39 | 17 | 848 | 100000 | ND | NA | ND | **35.8** |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | ND | NA | ND | 0.17 J |
| Chromium | 16 | 15 | 27 | 450 | 11.1 | NA | 9.6 | 14.7 J |
| Lead | 69 | 21 | 270 | 750 | 3.6 | NA | 8.7 | **24.4** |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | NA | ND | 0.12 J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | NA | ND | **1** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 11379 mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU258-TW02-00 03-22-2002 0' - 1' | | SWMU258-TW03-00 03-22-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | NA | | NA | |
| Acetone | NE | NE | 2890 (1) | 6200000 | NA | | NA | |
| Benzene | NE | NE | 5.6 | 1500 | NA | | NA | |
| Carbon disulfide | NE | NE | 4940 | 720000 | NA | | NA | |
| Ethylbenzene | NE | NE | 241 | 230000 | NA | | NA | |
| Methylene chloride | NE | NE | 33 (1) | 21000 | NA | | NA | |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | **1.4** | | **2** | |
| Barium | 39 | 17 | 848 | 100000 | **34.3** | | **43.8** | |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | **1.2** | | **0.94** | |
| Chromium | 16 | 15 | 27 | 450 | **46.9** | J | 12 | J |
| Lead | 69 | 21 | 270 | 750 | **373** | | **79.5** | |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | **0.16** | J | 0.08 | J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | | ND | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 11379 mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | 1/7 | 9 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2890 (1) | 6200000 | 2/7 | 28 - 3100 | NA | NA | 1 | 0 |
| Benzene | NE | NE | 5.6 | 1500 | 1/7 | 1 J | NA | NA | 0 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/7 | 1 J | NA | NA | 0 | 0 |
| Ethylbenzene | NE | NE | 241 | 230000 | 1/7 | 2 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 33 (1) | 21000 | 3/7 | 5 J - 31 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 3/8 | 1.4 - 20.4 | 2 | 3 | 1 | 1 |
| Barium | 39 | 17 | 848 | 100000 | 3/8 | 34.3 - 43.8 | 1 | 3 | 0 | 0 |
| Cadmium | 0.08 | 0.06 | 2.7 | 810 | 5/8 | 0.17 J - 3.2 | 5 | 5 | 1 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 8/8 | 7.1 J - 46.9 J | 3 | 3 | 1 | 0 |
| Lead | 69 | 21 | 270 | 750 | 8/8 | 3.6 - 373 | 2 | 5 | 1 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 4/8 | 0.08 J - 0.16 J | 4 | 2 | 4 | 0 |
| Selenium | 1 | 0.46 | 12 | 10000 | 1/8 | 1 | 0 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 11379 mg/kg.
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU258-IS02-01 09-11-1997 2' - 4' | SWMU258-IS03-01 09-11-1997 2' - 4' | SWMU258-IS04-01 09-11-1997 2' - 4' | SWMU258-IS05-01 09-11-1997 2' - 4' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 26 | 22 | 848 | 100000 | ND | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 10.5 | 10 | 9.6 | 8.8 |
| Lead | 8.6 | 8.2 | 270 | 750 | 11.7 | 9.8 | 12.2 | 13.1 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 0.04 | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

8/26/02
SWMU258_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU258-IS06-01 09-11-1997 2' - 4' | SWMU258-TW01-02 03-22-2002 3' - 5' | SWMU258-TW02-02 03-22-2002 3' - 5' | SWMU258-TW03-02 03-22-2002 3' - 5' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 26 | 22 | 848 | 100000 | ND | ND | 7.7 | ND |
| Chromium | 12 | 16 | 27 | 450 | 8.2 | 6.6 J | 10.4 J | 8.2 J |
| Lead | 8.6 | 8.2 | 270 | 750 | 3.9 | 2.6 | 3.7 | 2.9 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | ND | 0.02 J | ND | 0.02 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

8/26/02
SWMU258_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 26 | 22 | 848 | 100000 | 1/8 | 7.7 | 0 | 0 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 8/8 | 6.6 J - 10.5 | 0 | 0 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 8/8 | 2.6 - 13.1 | 4 | 4 | 0 | 0 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 3/8 | 0.02 J - 0.04 | 0 | 0 | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU258-TW01 04-06-2002 | | SWMU258-TW02 04-06-2002 | | SWMU258-TW03 04-06-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | ND | | 12.2 | | 3.7 | J |
| Barium | 145 | 2000 | 24.9 | | 21.7 | | 36.4 | |
| Chromium | 5.8 | 50 | 2.4 | J | ND | | 14.3 | |
| Lead | 3.6 | 15 | ND | | ND | | 7.7 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

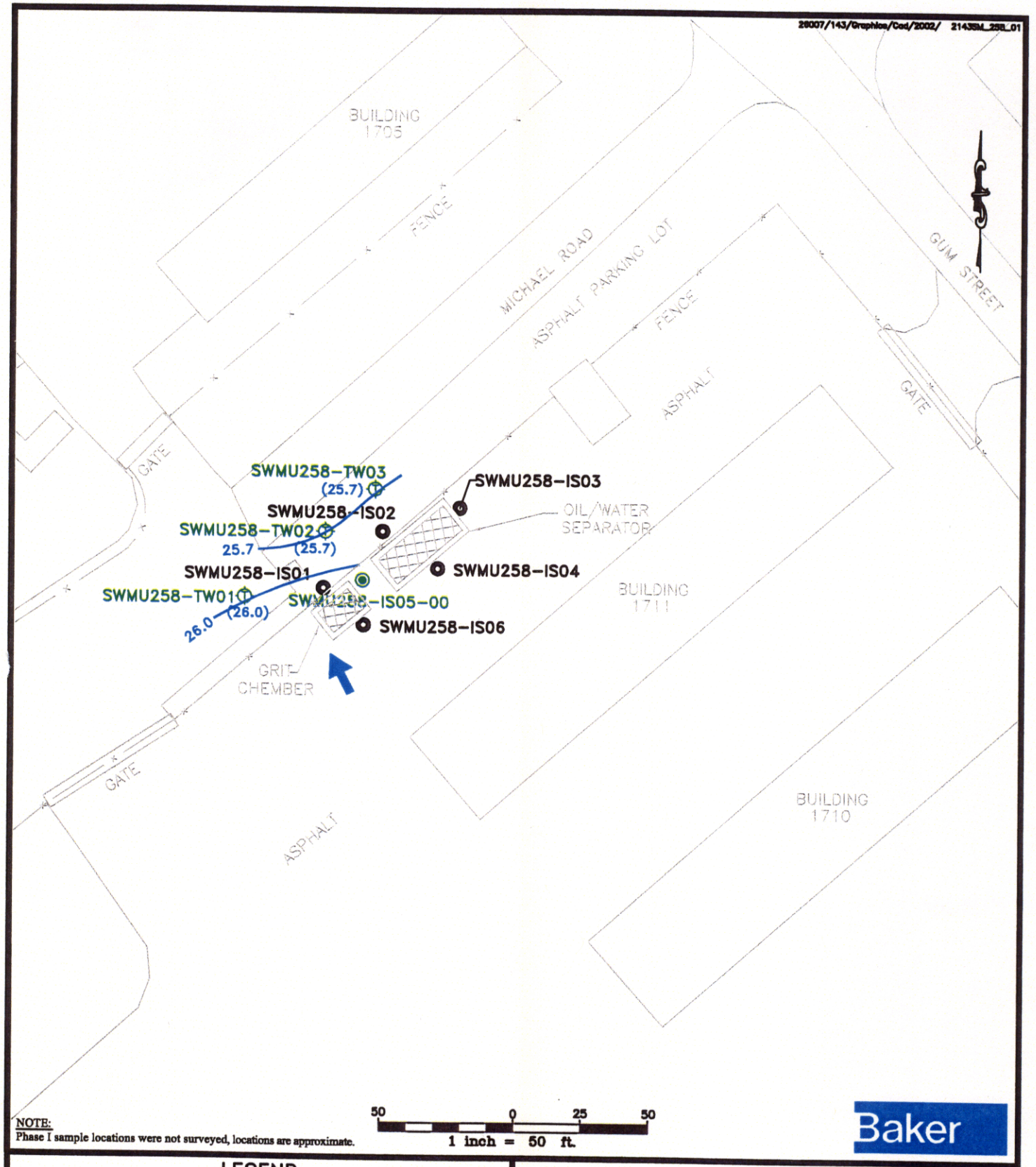
8/26/02
SWMU258_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 258
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 2/3 | 3.7 J - 12.2 | 1 | 1 |
| Barium | 145 | 2000 | 3/3 | 21.7 - 36.4 | 0 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 2.4 J - 14.3 | 1 | 0 |
| Lead | 3.6 | 15 | 1/3 | 7.7 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

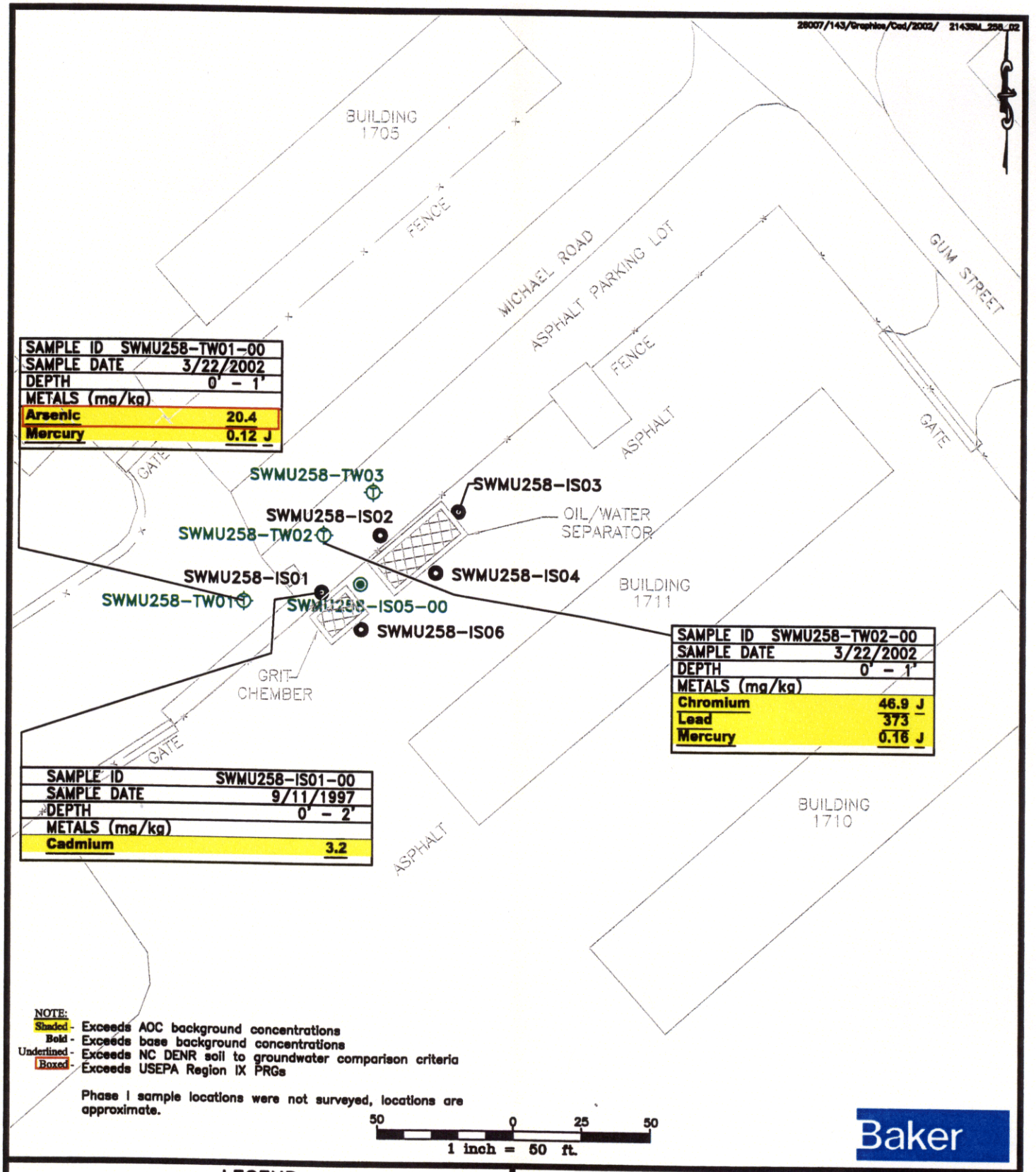
LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 26.0 - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 258
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB94

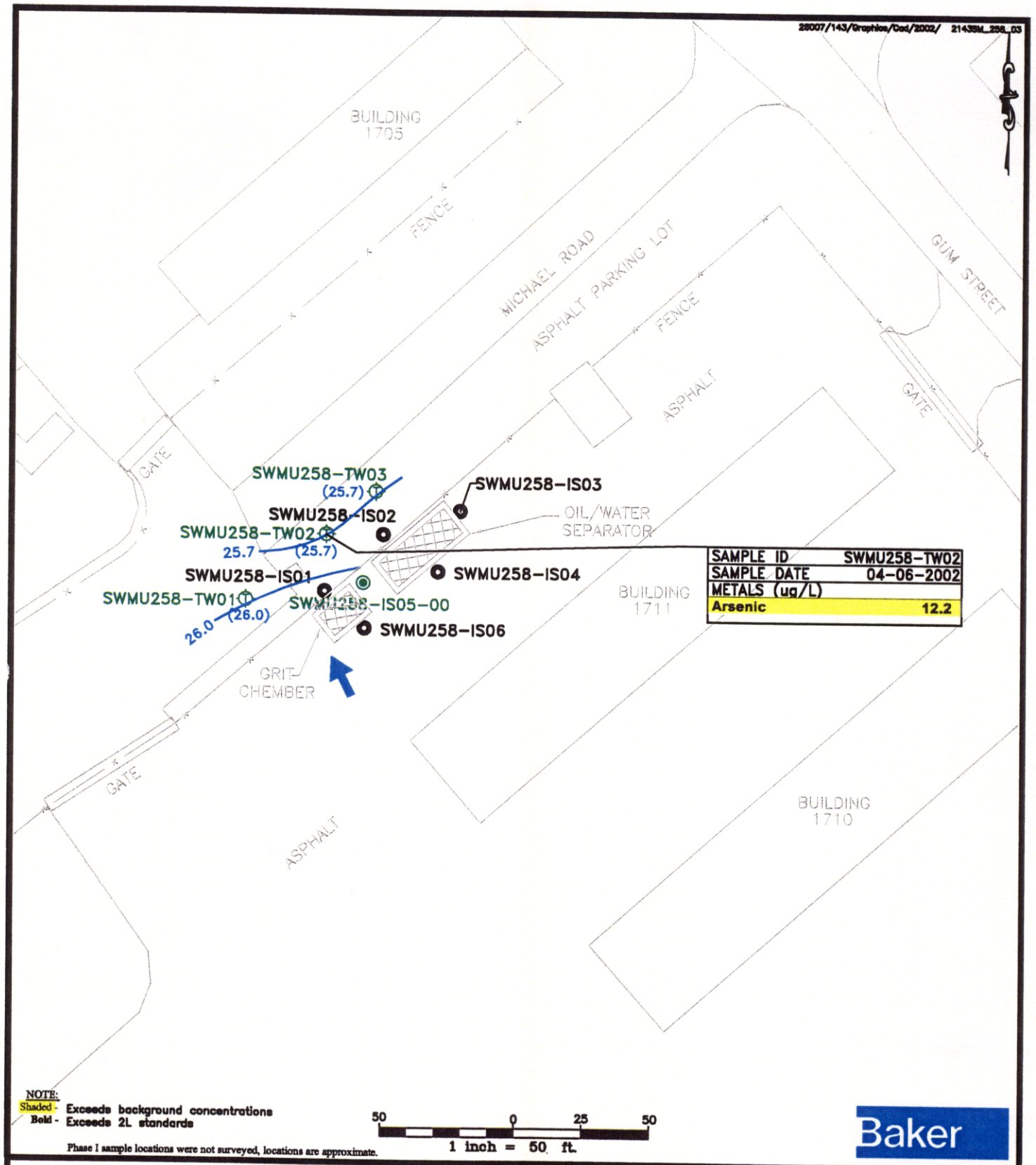



## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 258
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 26.0 - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 258
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.8 261 (Underground Storage Tank-1) and 297 (1780-Oil/Water Separator-2)

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.8.1 SWMU Description and History

SWMU 261 was a 550-gallon, steel USTs that has been in operation since 1970. SWMU 297 was a steel oil/water separator associated with SWMU 261. The years of operation for SWMU 297 are unknown. Both SWMUs contained oil, grease, and water debris and have since been removed from service. A nearby ditch that accepted discharge from SWMU 297 was identified during the site visit conducted by Baker in October 1996. The ditch drains to Cogdels Creek which is located approximately 300 feet south of the SWMU. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September, 1997. The purpose of the investigation was to determine if operation of the oil/water separators and associated UST has impacted surface and subsurface soils in the vicinity of the SWMUs. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the SWMUs (see Figure 1). In addition, a surface soil sample was collected from the nearby drainage ditch approximately 15 feet from the SWMUs. The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, cadmium, chromium, and lead exceeded the regulatory driven criteria and background/secondary criteria. Therefore, additional investigation at these two SWMUs was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMUs were located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified during Phase I should be re-evaluated against the industrial PRGs.

### 4.8.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 8 and 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMUs and determine if groundwater has been impacted as a result of a release(s) from the SWMUs. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and/or subsurface soil sampling at four temporary well borings
- Surface soil sampling at two locations along the drainage ditch
- Groundwater sampling at four temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix C.

The water table was measured in the wells at depths ranging from approximately 3.4 to 14.9 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 8.0 to 16.7 feet above mean MSL. It should be noted the groundwater elevation in well SWMU261-TW04 (16.7 feet above MSL) appeared to be anomalously high and was not included in interpolation of the groundwater contours. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southeast.

### 4.8.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix E.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals were detected in the soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. None of these metals exceeded the USEPA Region IX industrial PRGs. Arsenic and barium exceeded the AOC and/or Base background criteria in one or more surface soil samples; however, the concentrations were below the NC DENR soil to groundwater criteria and the USEPA Region IX industrial PRGs. Cadmium, chromium, lead, and mercury exceeded the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria in surface soil samples SWMU261-SS01 and SWMU261-SS03, which were collected from a drainage ditch. Mercury was also detected above NC DENR soil to groundwater screening criteria in three subsurface soil samples; however, the concentrations were below the AOC and Base background criteria and the USEPA Region IX industrial PRG. Selenium was only detected in subsurface soil. The concentration was below the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals were detected in the groundwater sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury and selenium. All of these metals exceeded the Base background screening criteria in samples from one or more of the wells. In addition, arsenic, barium, cadmium, chromium, lead and/or mercury exceeded the 2L standards in groundwater samples from wells SWMU261-TW01 and SWMU261-TW02. It should be noted that the turbidity was elevated in the groundwater samples from these wells and may have caused artificially high metals concentrations in the samples. The elevated turbidity may be attributable to the high percentage of silt encountered during drilling and installation of the temporary wells.

All of the metals detected in the groundwater were detected in soils at the SWMU.

### 4.8.4 Conclusions

Several metals were detected in soil and groundwater at concentrations exceeding the applicable screening criteria. Metals that exceeded both the AOC and Base background screening criteria and the NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs were as follows:

- Cadmium, chromium, lead and mercury

Metals that exceeded the Base background screening criteria and 2L standards in groundwater were as follows:

- Arsenic, barium, cadmium, chromium, lead and mercury

The elevated turbidity in the groundwater samples from the temporary wells may have caused artificially high concentrations in the samples.

Based on evaluation of the analytical results, additional investigation at SWMU261/297 is warranted to further investigate the presence of metals in soil and groundwater. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU261-TW01 | 3/25/02 | BAKER | 23.54 | 23.5 | 20 | 20 | 8 | 6 | 10 | 14.9 | 8.6 |
| SWMU261-TW02 | 3/25/02 | BAKER | 18.76 | 19.2 | 12 | 12 | 0.5 | 0 | 2 | 10.8 | 8.0 |
| SWMU261-TW03 | 3/25/02 | BAKER | 18.62 | 18.9 | 12 | 12 | 0.5 | 0 | 2 | 10.5 | 8.1 |
| SWMU261-TW04 | 3/25/02 | BAKER | 20.14 | 20.3 | 12 | 12 | 0.5 | 0 | 2 | 3.4 | 16.7 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU261

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU261-IS01-00 09-13-1997 0' - 2' | SWMU261-IS02-00 09-13-1997 0' - 2' | SWMU261-SS01-00 09-17-1997 0' - 2' | SWMU297-IS01-00 09-13-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.7 | 1.3 | 5.24 | 2.7 | 1.3 | ND | ND | **1.5** |
| Barium | 36 | 23 | 848 | 100000 | ND | ND | **140** | ND |
| Cadmium | 2.4 | 0.04 | 2.7 | 810 | ND | ND | **31.6** | **1.7** |
| Chromium | 27 | 12 | 27 | 450 | **15.7** | 10.9 | **65.8** | 8.5 |
| Lead | 25 | 26 | 270 | 750 | 5.4 | 4.1 | **604** | 22.9 |
| Mercury | 0.05 | 0.13 | 0.015 | 610 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU297-IS02-00 09-13-1997 0' - 2' | SWMU261-SS02-00 03-26-2002 0' - 1' | SWMU261-SS03-00 03-26-2002 0' - 1' | SWMU261-TW01-00 03-26-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.7 | 1.3 | 5.24 | 2.7 | 1.1 | ND | ND | **1.9** J |
| Barium | 36 | 23 | 848 | 100000 | ND | 22.5 J | 36.9 J | 19.9 J |
| Cadmium | 2.4 | 0.04 | 2.7 | 810 | ND | **1.3** J | 11.9 J | ND |
| Chromium | 27 | 12 | 27 | 450 | 6.8 | 9.6 J | 28.7 J | **16.9** J |
| Lead | 25 | 26 | 270 | 750 | 4.7 | 53.9 J | 587 J | ND |
| Mercury | 0.05 | 0.13 | 0.015 | 610 | ND | 0.05 J | 0.19 J | 0.03 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU261-TW02-00 03-26-2002 0' - 1' | | SWMU261-TW03-00 03-26-2002 0' - 1' | | SWMU261-TW04-00 03-26-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 2.7 | 1.3 | 5.24 | 2.7 | ND | | 0.89 | J | 0.39 | J |
| Barium | 36 | 23 | 848 | 100000 | 13 | J | 9.2 | J | 16.4 | J |
| Cadmium | 2.4 | 0.04 | 2.7 | 810 | ND | | ND | | ND | |
| Chromium | 27 | 12 | 27 | 450 | 5.5 | J | 5.6 | J | 6.9 | J |
| Lead | 25 | 26 | 270 | 750 | 12.3 | J | ND | | 17.2 | J |
| Mercury | 0.05 | 0.13 | 0.015 | 610 | 0.03 | J | 0.03 | J | 0.04 | J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 2.7 | 1.3 | 5.24 | 2.7 | 4/11 | 0.39 J - 1.9 J | 0 | 2 | 0 | 0 |
| Barium | 36 | 23 | 848 | 100000 | 7/11 | 9.2 J - 140 | 2 | 2 | 0 | 0 |
| Cadmium | 2.4 | 0.04 | 2.7 | 810 | 4/11 | 1.3 J - 31.6 | 2 | 4 | 2 | 0 |
| Chromium | 27 | 12 | 27 | 450 | 11/11 | 5.5 J - 65.8 | 2 | 4 | 2 | 0 |
| Lead | 25 | 26 | 270 | 750 | 9/11 | 4.1 - 604 | 3 | 3 | 2 | 0 |
| Mercury | 0.05 | 0.13 | 0.015 | 610 | 6/11 | 0.03 J - 0.19 J | 1 | 1 | 6 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
AOC comparison - AOC 7 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU261-IS01-06 09-13-1997 12' - 14' | SWMU261-IS02-06 09-13-1997 12' - 14' | SWMU297-IS01-06 09-13-1997 12' - 14' | SWMU297-IS02-06 09-13-1997 12' - 14' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 19 | 23 | 848 | 100000 | ND | ND | ND | ND |
| Chromium | 27 | 25 | 27 | 450 | 12.3 | 8.8 | 4.7 | 9.5 |
| Lead | 15 | 9.2 | 270 | 750 | 5.6 | 3.4 | 3 | 4.8 |
| Mercury | 0.08 | 0.13 | 0.015 | 610 | 0.047 | ND | 0.052 | 0.063 |
| Selenium | 0.67 | 0.63 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

9/11/02
SWMU261_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU261-TW01A-07 04-09-2002 13' - 15' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Barium | 19 | 23 | 848 | 100000 | 8.2 J |
| Chromium | 27 | 25 | 27 | 450 | 6.8 J |
| Lead | 15 | 9.2 | 270 | 750 | 3.5 J |
| Mercury | 0.08 | 0.13 | 0.015 | 610 | ND |
| Selenium | 0.67 | 0.63 | 12 | 10000 | 0.31 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

9/11/02
SWMU261_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 19 | 23 | 848 | 100000 | 1/5 | 8.2 J | 0 | 0 | 0 | 0 |
| Chromium | 27 | 25 | 27 | 450 | 5/5 | 6.8 J - 12.3 | 0 | 0 | 0 | 0 |
| Lead | 15 | 9.2 | 270 | 750 | 5/5 | 3.4 - 5.6 | 0 | 0 | 0 | 0 |
| Mercury | 0.08 | 0.13 | 0.015 | 610 | 3/5 | 0.047 | 0 | 0 | 3 | 0 |
| Selenium | 0.67 | 0.63 | 12 | 10000 | 1/5 | 0.31 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
AOC comparison - AOC 7 Subsurface Soil
Base comparison - Silt Subsurface Soil

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 261/297
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 19 | 23 | 848 | 100000 | 1/5 | 8.2 J | 0 | 0 | 0 | 0 |
| Chromium | 27 | 25 | 27 | 450 | 5/5 | 6.8 J - 12.3 | 0 | 0 | 0 | 0 |
| Lead | 15 | 9.2 | 270 | 750 | 5/5 | 3.4 - 5.6 | 0 | 0 | 0 | 0 |
| Mercury | 0.08 | 0.13 | 0.015 | 610 | 3/5 | 0.047 | 0 | 0 | 3 | 0 |
| Selenium | 0.67 | 0.63 | 12 | 10000 | 1/5 | 0.31 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 7 Subsurface Soil
Base comparison - Silt Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 261
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU261-TW01 04-09-2002 | | SWMU261-TW02 04-08-2002 | | SWMU261-TW03 04-08-2002 | | SWMU261-TW04 04-08-2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | | | |
| Arsenic | 12 | 10 | **67.1** | | **24.2** | | ND | | ND | |
| Barium | 145 | 2000 | **2360** | J | 532 | J | 32.9 | | 8.6 | J |
| Cadmium | 0.23 | 5 | **9.4** | J | 4.4 | J | ND | | ND | |
| Chromium | 5.8 | 50 | **1210** | | **313** | | 17.8 | | 1.4 | J |
| Lead | 3.6 | 15 | **1200** | J | **249** | J | 8.1 | | ND | |
| Mercury | 0.050 | 1.1 | **3.6** | | 1.1 | | ND | | ND | |
| Selenium | 2.8 | 50 | 23.7 | | 7.7 | | ND | | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

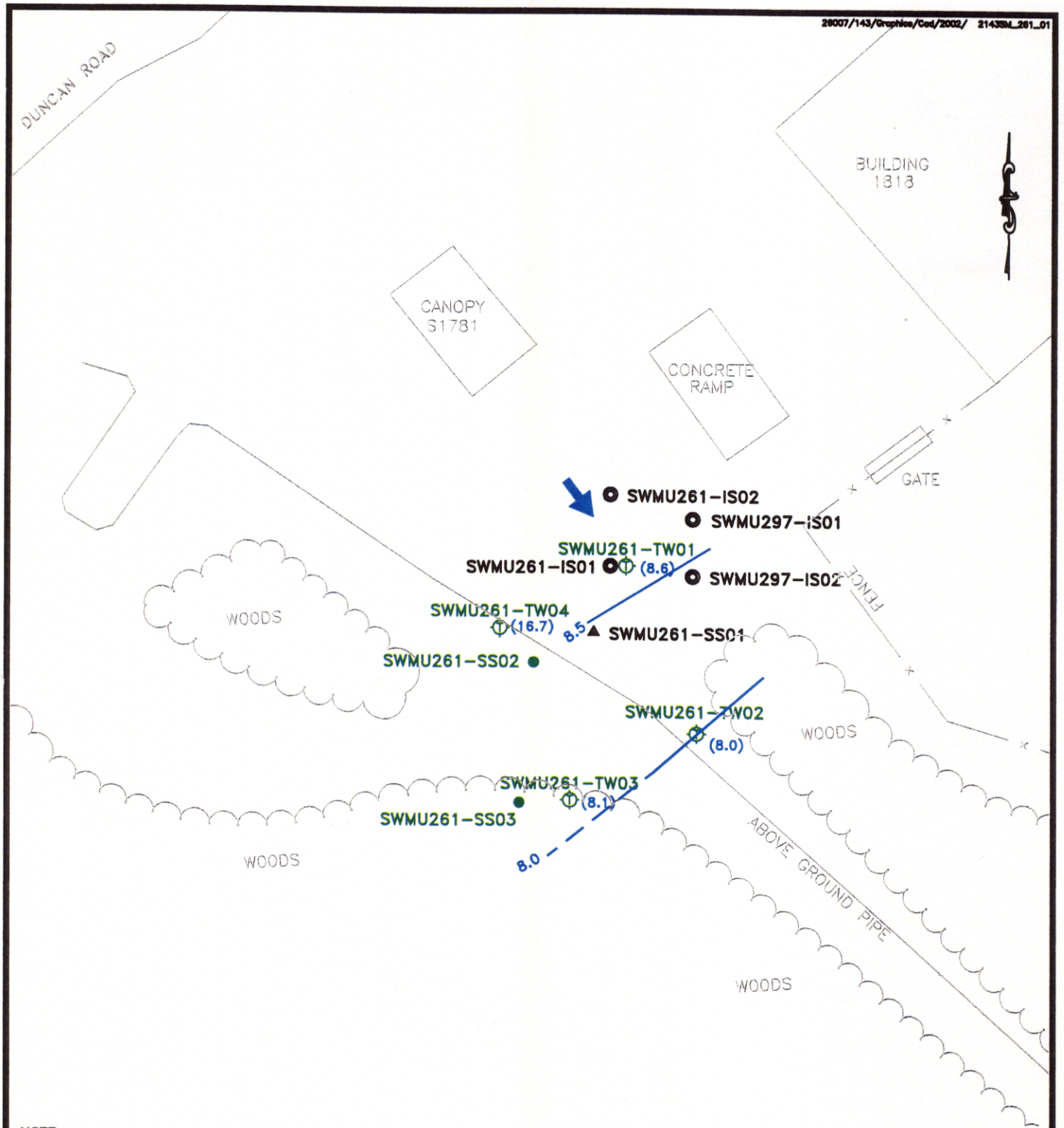
8/30/02
SWMU261_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 261
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 2/4 | 24.2 - 67.1 | 2 | 2 |
| Barium | 145 | 2000 | 4/4 | 8.6 J - 2360 J | 2 | 1 |
| Cadmium | 0.23 | 5 | 2/4 | 4.4 J - 9.4 J | 2 | 1 |
| Chromium | 5.8 | 50 | 4/4 | 1.4 J - 1210 | 3 | 2 |
| Lead | 3.6 | 15 | 3/4 | 8.1 - 1200 J | 3 | 2 |
| Mercury | 0.050 | 1.1 | 2/4 | 1.1 - 3.6 | 2 | 1 |
| Selenium | 2.8 | 50 | 2/4 | 7.7 - 23.7 | 2 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

25 0 12.5 25
1 inch = 25 ft.

Baker

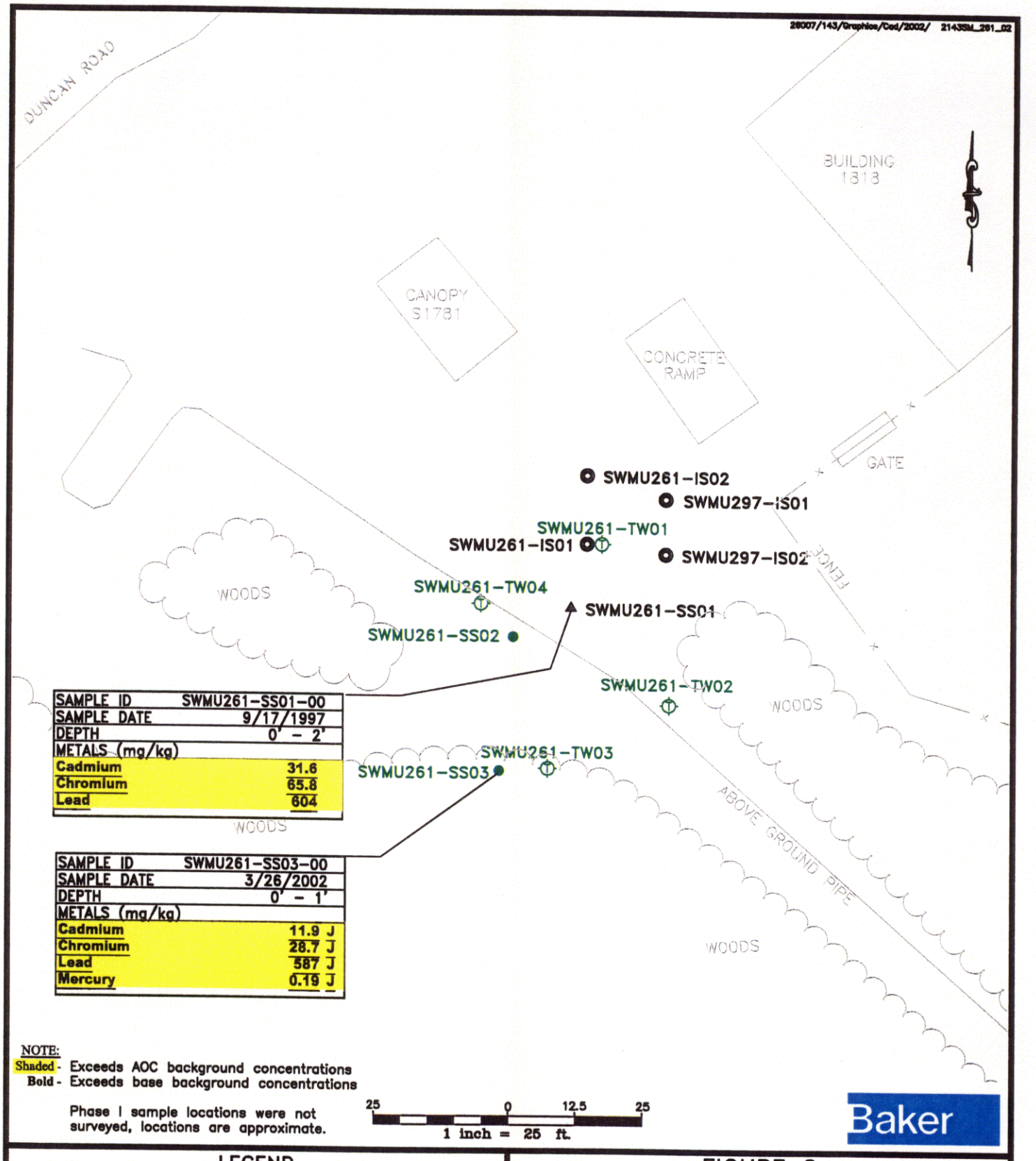
## LEGEND

- TEMPORARY WELL
- SURFACE SOIL SAMPLE
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL
- GROUNDWATER FLOW DIRECTION
- 8.0 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 261/297
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753 EB10Y




| SAMPLE ID | SWMU261-SS01-00 |
|---|---|
| SAMPLE DATE | 9/17/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| Cadmium | 31.6 |
| Chromium | 65.8 |
| Lead | 604 |

| SAMPLE ID | SWMU261-SS03-00 |
|---|---|
| SAMPLE DATE | 3/26/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| Cadmium | 11.9 J |
| Chromium | 28.7 J |
| Lead | 587 J |
| Mercury | 0.19 J |

NOTE:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations

Phase I sample locations were not surveyed, locations are approximate.

Baker

LEGEND
- TEMPORARY WELL
- SURFACE SOIL SAMPLE
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 261/297
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

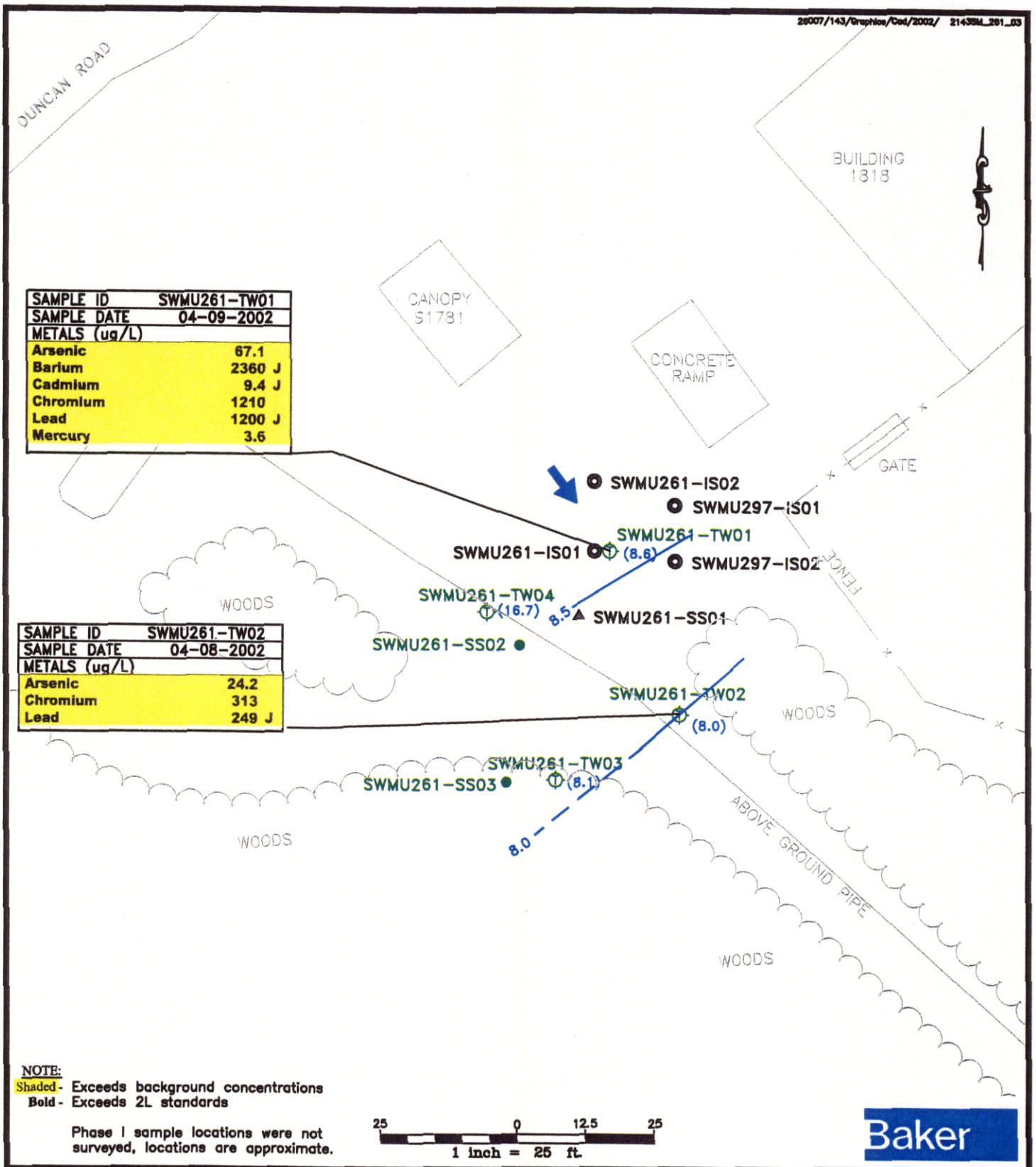



FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 261/297
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.9 SWMU 264 - 2611 Container

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.9.1 SWMU Description and History

SWMU 264 is a former container storage area located south of Building 2611 in the Paradise Point area between the New River and Seth Williams Boulevard. The New River is located approximately 300 feet southwest of the SWMU. The ground surface in the vicinity of the SWMU is covered with asphalt. The SWMU consisted of several drums of unknown material and stained pavement at the time of the original site visit conducted by EnSafe, Inc in 1993. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997 at which time the SWMU consisted of an open asphalt parking lot. No evidence of a release was identified on the pavement as described during EnSafe's visit. The purpose of the investigation was to determine if the materials in drums (present during EnSafe's visit) have impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface samples were collected from one soil boring advanced in the vicinity of the former drums (See Figure 1). An additional surface soil sample was collected from another area where EnSafe, Inc. had observed containers of unknown materials. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, pesticides and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, pentachlorophenol and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 264 was recommended in the form of a Phase II CSI.

### 4.9.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 through 26 and April 7, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix I.

The water table was measured in the wells at depths ranging from approximately 9.5 to 10.4 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 4.9 to 6.8 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south.

### 4.9.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical summaries collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Three SVOCs were detected in the sample set, as follows: bis(2-ethylhexyl)phthalate, pentachlorophenol, and pyrene. Pentachlorophenol exceeded the NC DENR soil to groundwater screening criteria, in surface soil sample SWMU264-SS01-00, which was collected during the Phase I CSI conducted in September 1997. None of the other SVOCs detected in the samples exceeded the established screening criteria.

Six metals were detected in the soil sample set, as follows: arsenic, barium, chromium, lead, mercury, and selenium. Arsenic exceeded the AOC and Base background criteria and the USEPA Region IX residential PRG. Barium and chromium exceeded the AOC and/or Base background criteria, however, the concentrations were below the NC DENR soil to groundwater criteria and the USEPA Region IX residential PRGs. Mercury was the only metal that exceeded the NC DENR soil to groundwater criteria, however, the concentrations were below the AOC and Base background criteria and USEPA Region IX residential PRG. None of the other metals detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Two SVOCs (2-methylnaphthalene and phenanthrene) were detected in the groundwater sample collected from well SWMU264-TW01. Neither detection exceeded the screening criteria.

Five metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, cadmium, chromium, and selenium. All of these metals except arsenic exceeded the Base background criteria; however, the concentrations were below the 2L standards.

All of the compounds detected in the groundwater (except for 2-methylnapthalene, phenanthrene and cadmium) were detected in soils at the SWMU.

### 4.9.4 Conclusions

Pentachlorophenol exceeded the NC DENR soil to groundwater criteria and arsenic exceeded both the AOC and Base background criteria, and USEPA Region IX residential PRG in soils. However, this compound was not detected in the groundwater sample collected from nearby monitoring well SWMU264-TW03 or in any of the Phase II soil sample locations. Therefore, it is assumed that this result was a single isolated, anomalous detection and does not warrant additional activities.

None of the compounds detected in groundwater exceeded both the Base background criteria and 2L standards.

Based on evaluation of the analytical results, the conclusions above and the fact no exposure is expected with detections being below asphalt, no further action at SWMU 264 is warranted.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU264-TW01 | 3/24/02 | BAKER | 16.33 | 16.6 | 16 | 16 | 4 | 2.2 | 6 | 9.85 | 6.5 |
| SWMU264-TW02 | 3/25/02 | BAKER | 17.19 | 17.5 | 16 | 16 | 4 | 2 | 6 | 10.41 | 6.8 |
| SWMU264-TW03 | 3/26/02 | BAKER | 14.36 | 14.55 | 14 | 14 | 2 | 0 | 4 | 9.49 | 4.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU264

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU264-IS01-00 09-10-1997 0' - 2' | | SWMU264-SS01-00 09-17-1997 0' - 2' | | SWMU264-TW01-00 03-24-2002 0' - 1' | | SWMU264-TW02-00 03-25-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 140 | J | 97 | J | 400 | | 86 | J |
| Pentachlorophenol | NE | NE | 104 (1) | 3000 | ND | | 870 | J | ND | | ND | |
| Pyrene | NE | NE | 286000 | 2300000 | ND | | 58 | J | ND | | ND | |
| **METALS (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 4.5 | 0.88 | 5.24 | 0.39 | **5.2** | | **1.3** | | **1.3** | J | **4.2** | J |
| Barium | 32 | 19 | 848 | 5400 | **28.7** | | **24.3** | | 8.1 | J | 15 | J |
| Chromium | 0.07 | 8.9 | 27 | 210 | **24.9** | | **9.8** | | 8.2 | J | **19.9** | J |
| Lead | 17 | 26 | 270 | 400 | 8.6 | | 9.5 | | 4.4 | J | 6.9 | J |
| Mercury | 0.11 | 0.12 | 0.015 | 23 | ND | | ND | | ND | | 0.02 | J |
| Selenium | 1.6 | 1.3 | 12 | 390 | ND | | ND | | 0.33 | J | 0.47 | J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4848 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU264-TW03-00 03-26-2002 0' - 1' | |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 290 | J |
| Pentachlorophenol | NE | NE | 104 (1) | 3000 | ND | |
| Pyrene | NE | NE | 286000 | 2300000 | ND | |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 4.5 | 0.88 | 5.24 | 0.39 | **1.7** | J |
| Barium | 32 | 19 | 848 | 5400 | 6.8 | J |
| Chromium | 0.07 | 8.9 | 27 | 210 | 8.6 | |
| Lead | 17 | 26 | 270 | 400 | 4.5 | |
| Mercury | 0.11 | 0.12 | 0.015 | 23 | 0.02 | J |
| Selenium | 1.6 | 1.3 | 12 | 390 | ND | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4848 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 5/5 | 86 J - 400 | NA | NA | 0 | 0 |
| Pentachlorophenol | NE | NE | 104 (1) | 3000 | 1/5 | 870 J | NA | NA | 1 | 0 |
| Pyrene | NE | NE | 286000 | 2300000 | 1/5 | 58 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 4.5 | 0.88 | 5.24 | 0.39 | 5/5 | 1.3 J - 5.2 | 1 | 5 | 0 | 5 |
| Barium | 32 | 19 | 848 | 5400 | 5/5 | 6.8 J - 28.7 | 0 | 2 | 0 | 0 |
| Chromium | 0.07 | 8.9 | 27 | 210 | 5/5 | 8.2 J - 24.9 | 5 | 3 | 0 | 0 |
| Lead | 17 | 26 | 270 | 400 | 5/5 | 4.4 J - 9.5 | 0 | 0 | 0 | 0 |
| Mercury | 0.11 | 0.12 | 0.015 | 23 | 2/5 | 0.02 J | 0 | 0 | 2 | 0 |
| Selenium | 1.6 | 1.3 | 12 | 390 | 2/5 | 0.33 J - 0.47 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4848 mg/kg.
AOC comparison - AOC 4 Surface Soil
Base comparison - Combined Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU264-IS01-02 09-10-1997 4' - 6' | SWMU264-TW01-04 03-24-2002 7' - 9' | SWMU264-TW02-04 03-25-2002 7' - 9' | SWMU264-TW03-03 03-26-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 85 J | ND | 100 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 6.3 | 1.6 | 5.24 | 0.39 | 2.7 | 3.3 J | 2.6 J | ND |
| Barium | 113 | 22 | 848 | 5400 | ND | 10.7 J | 3.9 J | ND |
| Chromium | 36 | 16 | 27 | 210 | **16.7** | **16.8** J | 5.9 J | 2.5 |
| Lead | 12 | 8.2 | 270 | 400 | 5.4 | 6.2 J | 3.4 J | ND |
| Selenium | 1.5 | 0.69 | 12 | 390 | ND | 0.46 J | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/1/2002
SWMU264_SOIL

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 2/4 | 85 J - 100 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 6.3 | 1.6 | 5.24 | 0.39 | 3/4 | 2.6 J - 3.3 J | 0 | 3 | 0 | 3 |
| Barium | 113 | 22 | 848 | 5400 | 2/4 | 3.9 J - 10.7 J | 0 | 0 | 0 | 0 |
| Chromium | 36 | 16 | 27 | 210 | 4/4 | 2.5 - 16.8 | 0 | 2 | 0 | 0 |
| Lead | 12 | 8.2 | 270 | 400 | 3/4 | 3.4 J - 6.2 J | 0 | 0 | 0 | 0 |
| Selenium | 1.5 | 0.69 | 12 | 390 | 1/4 | 0.46 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 4 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU264-TW01 04-07-2002 | | SWMU264-TW02 04-07-2002 | | SWMU264-TW03 04-07-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 2-Methylnaphthalene | NE | 28 | 1.1 | J | ND | | ND | |
| Phenanthrene | NE | 210 | 2 | J | ND | | ND | |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | ND | | ND | | 6.5 | J |
| Barium | 145 | 2000 | 32.4 | | 38.3 | | 193 | |
| Cadmium | 0.23 | 5 | ND | | ND | | 4.1 | J |
| Chromium | 5.8 | 50 | 0.94 | J | 0.75 | J | 8.7 | |
| Selenium | 2.8 | 50 | ND | | ND | | 4.9 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

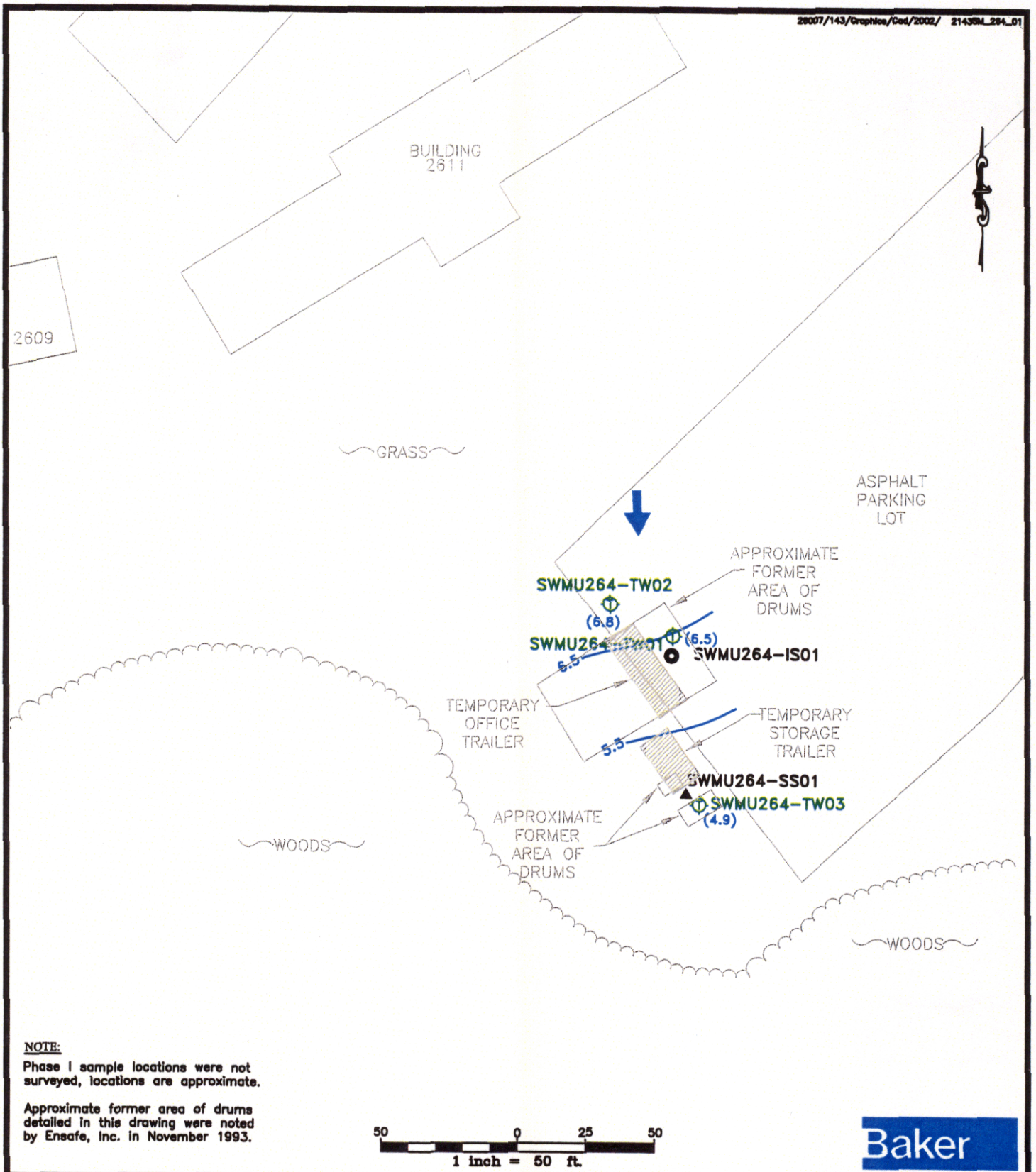
8/29/02
SWMU264_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 264
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 2-Methylnaphthalene | NE | 28 | 1/3 | 1.1 J | NA | 0 |
| Phenanthrene | NE | 210 | 1/3 | 2 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 1/3 | 6.5 J | 0 | 0 |
| Barium | 145 | 2000 | 3/3 | 32.4 - 193 | 1 | 0 |
| Cadmium | 0.23 | 5 | 1/3 | 4.1 J | 1 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 0.75 J - 8.7 | 1 | 0 |
| Selenium | 2.8 | 50 | 1/3 | 4.9 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.

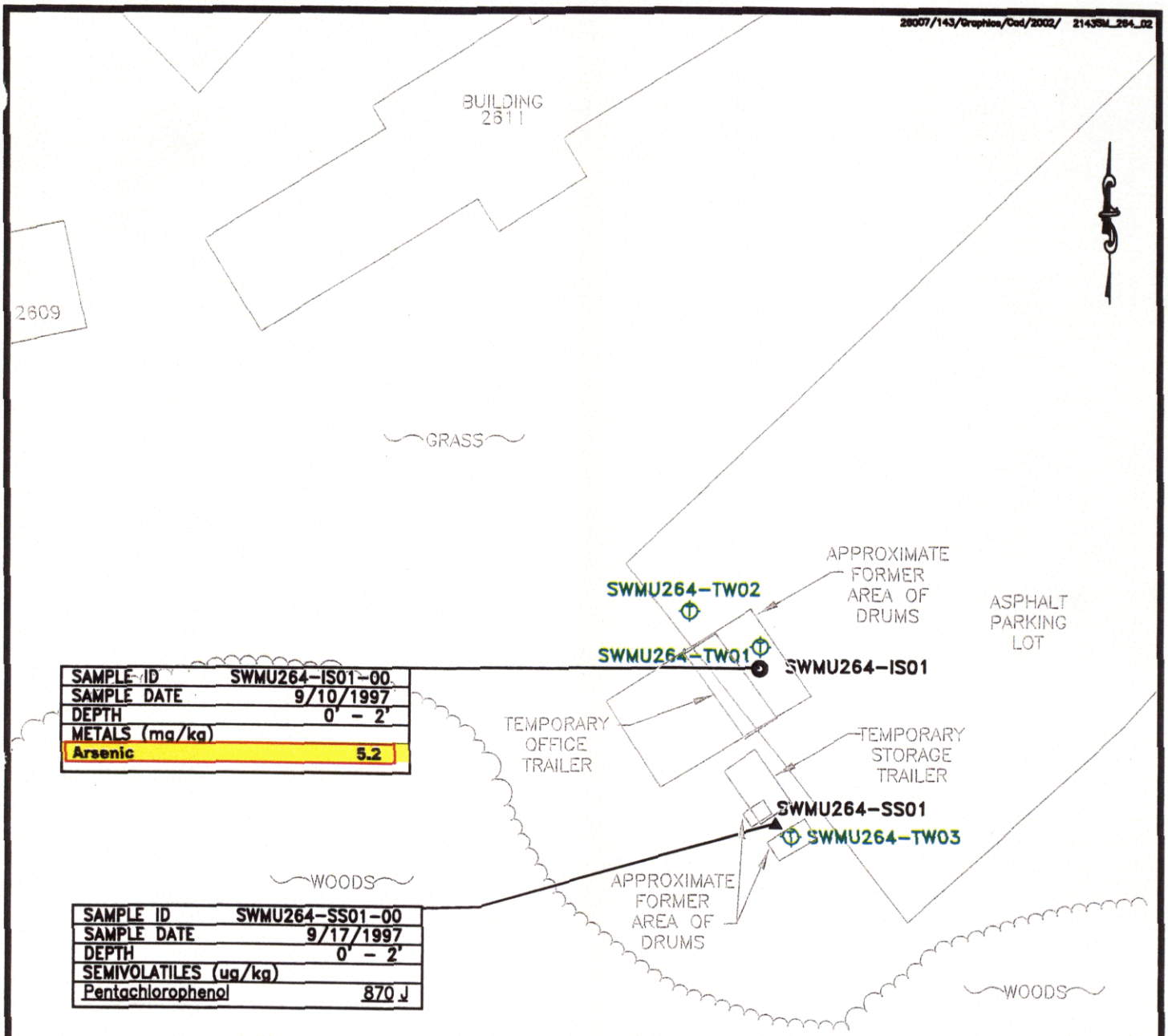



## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL
- GROUNDWATER FLOW DIRECTION
- 5.5 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 264
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU264-IS01-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Arsenic** | **5.2** |

| SAMPLE ID | SWMU264-SS01-00 |
|---|---|
| SAMPLE DATE | 9/17/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Pentachlorophenol | 870 J |

NOTE:
Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

Approximate former area of drums detailed in this drawing were noted by Ensafe, Inc. in November 1993.

50 0 25 50
1 inch = 50 ft.

Baker

LEGEND
- TEMPORARY WELL
- PHASE I SOIL BORING
- PHASE I SURFACE SOIL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 264
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.10 SWMU 265 - 2615 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.10.1 SWMU Description and History

SWMU 265 is located southeast of Paradise Point adjacent to Building 2613 along Seth Williams Boulevard. The New River is located approximately 600 feet southwest of the SWMU. The SWMU consists of a concrete oil/water separator that receives run off containing a mixture of rain water and/or No. 6 fuel oil from the loading ramp adjacent to the SWMU. The SWMU currently is in operation. The area surrounding the SWMU is grass covered. During the site visit conducted by Baker in October 1996, minor evidence of petroleum staining was observed on the loading ramp. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings that were advanced around the perimeter of the SWMU (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs and SVOCs. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 265 was recommended in the form of a Phase II CSI.

### 4.10.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and April 7, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 10.6 to 11 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 8.6 to 9.0 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southeast.

### 4.10.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Ten SVOCs (mostly PAHs) were detected in the soil sample set. Benzo(a)pyrene was detected at concentrations exceeding the NC DENR soil to groundwater screening criteria and the USEPA Region IX residential PRG in the surface and subsurface soil samples collected from boring SWMU265-IS01, which was advanced in September 1997 during the Phase I CSI. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Groundwater

The analytical results and a statistical summary for positive detections were compared to North Carolina 2L Standards and are presented on Tables 6 and 7.

One SVOC [bis(2-ethylhexyl)phthalate] was detected in the groundwater sample from well SWMU265-TW01. The concentration was below the 2L standard. No SVOCs were detected in samples from the remaining two wells.

Bis(2-ethylhexyl)phthalate was also detected at low concentrations in the soil samples collected at the SWMU. Benzo(a)pyrene, which was detected in soil samples from one of the borings at concentrations exceeding the screening criteria, was not detected in groundwater at the SWMU.

### 4.10.4 Conclusions

Benzo(a)pyrene was detected in soil samples from one of the borings at concentrations exceeding the NC DENR soil to groundwater screening criteria and/or the USEPA Region IX residential PRG. No SVOCs were detected in groundwater at concentrations exceeding North Carolina 2L standards.

Based on evaluation of the analytical results, no additional action is warranted at this SWMU. Benzo(a)pyrene was detected in soil samples collected during the Phase I CSI. Subsequent sampling conducted during the Phase II CSI did not detect this compound in soil or groundwater samples. The area of benzo(a)pyrene contamination appears to be defined as the immediate area surrounding boring SWMU265-IS01. This detection is considered a single isolated detection within the boundaries of the SWMU, and does not warrant additional investigative or remedial activities.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU265-TW01 | 3/24/02 | BAKER | 19.80 | 20.1 | 17 | 17 | 5 | 3 | 7 | 10.76 | 9.0 |
| SWMU265-TW02 | 3/24/02 | BAKER | 19.43 | 19.6 | 17 | 17 | 5 | 3 | 7 | 10.57 | 8.9 |
| SWMU265-TW03 | 3/24/02 | BAKER | 19.56 | 19.6 | 17 | 17 | 5 | 3 | 7 | 11 | 8.6 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU265

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU265-IS01-00 09-10-1997 0' - 2' | SWMU265-IS02-00 09-10-1997 0' - 2' | SWMU265-IS03-00 09-10-1997 0' - 2' | SWMU265-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)anthracene | 358 | 620 | 66 J | ND | ND | ND |
| Benzo(a)pyrene | 91 (1) | 62 | 120 J | ND | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 620 | 110 J | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | 83 J | ND | ND | ND |
| Benzo(k)fluoranthene | 11600 (1) | 6200 | 86 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 130 J | 170 J | 160 J | 110 J |
| Chrysene | 39800 | 62000 | 110 J | ND | ND | ND |
| Fluoranthene | 276000 | 2300000 | 33 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 620 | 69 J | ND | ND | ND |
| Pyrene | 286000 | 2300000 | 76 J | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.

J - Analyte detected. Report value is estimated.

ND - Analyte not detected.

NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU265-TW01-00 03-24-2002 0' - 1' | SWMU265-TW02-00 03-24-2002 0' - 1' | SWMU265-TW03-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| Benzo(a)anthracene | 358 | 620 | ND | ND | ND |
| Benzo(a)pyrene | 91 (1) | 62 | ND | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 620 | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | 11600 (1) | 6200 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 63 J | 150 J | 53 J |
| Chrysene | 39800 | 62000 | ND | ND | ND |
| Fluoranthene | 276000 | 2300000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 620 | ND | ND | ND |
| Pyrene | 286000 | 2300000 | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.

J - Analyte detected. Report value is estimated.

ND - Analyte not detected.

NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | 358 | 620 | 1/7 | 66 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 91 (1) | 62 | 1/7 | 120 J | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | 1160 (1) | 620 | 1/7 | 110 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 1/7 | 83 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | 11600 (1) | 6200 | 1/7 | 86 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 7/7 | 53 J - 170 J | NA | NA | 0 | 0 |
| Chrysene | 39800 | 62000 | 1/7 | 110 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 2300000 | 1/7 | 33 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 3260 | 620 | 1/7 | 69 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 2300000 | 1/7 | 76 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
However, site-specific critieria were not calculated because the TOC was 1000 mg/kg,
which is the same concentration used to calculate the default criteria.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU265-IS01-01 09-10-1997 2' - 4' | SWMU265-IS02-01 09-10-1997 2' - 4' | SWMU265-IS03-01 09-10-1997 2' - 4' | SWMU265-IS04-01 09-10-1997 2' - 4' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)anthracene | 358 | 620 | 56 J | ND | ND | ND |
| Benzo(a)pyrene | 91 | 62 | 86 J | ND | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 620 | 50 J | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | 50 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 160 J | 150 J | 150 J | 160 J |
| Chrysene | 39800 | 62000 | 100 J | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | ND | ND | ND |
| Fluoranthene | 276000 | 2300000 | 67 J | ND | ND | ND |
| Pyrene | 286000 | 2300000 | 130 J | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/11/02
SWMU265_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU265-TW01-05 03-24-2002 9' - 11' | SWMU265-TW02-05 03-24-2002 9' - 11' | SWMU265-TW03-05 03-24-2002 9' - 11' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| Benzo(a)anthracene | 358 | 620 | ND | ND | ND |
| Benzo(a)pyrene | 91 | 62 | ND | ND | ND |
| Benzo(b)fluoranthene | 1160 (1) | 620 | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 170 J | 56 J | 440 |
| Chrysene | 39800 | 62000 | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | ND | 31 J |
| Fluoranthene | 276000 | 2300000 | ND | ND | ND |
| Pyrene | 286000 | 2300000 | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | 358 | 620 | 1/7 | 56 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 91 | 62 | 1/7 | 86 J | NA | NA | 0 | 1 |
| Benzo(b)fluoranthene | 1160 (1) | 620 | 1/7 | 50 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 1/7 | 50 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 7/7 | 56 J - 440 | NA | NA | 0 | 0 |
| Chrysene | 39800 | 62000 | 1/7 | 100 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 1200000 | 1/7 | 31 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 2300000 | 1/7 | 67 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 2300000 | 1/7 | 130 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Background concentrations were collected for inorganics
Detected concentrations exceed NC DENR
generic soil-to-water criteria. However, site-specific
critieria were not calculated because the TOC was 1000 mg/kg,
which is the same concentration used to calculate the default criteria.

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | SWMU265-TW01 04-07-2002 | SWMU265-TW02 04-07-2002 | SWMU265-TW03 04-07-2002 |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | 0.77 J | ND | ND |

**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

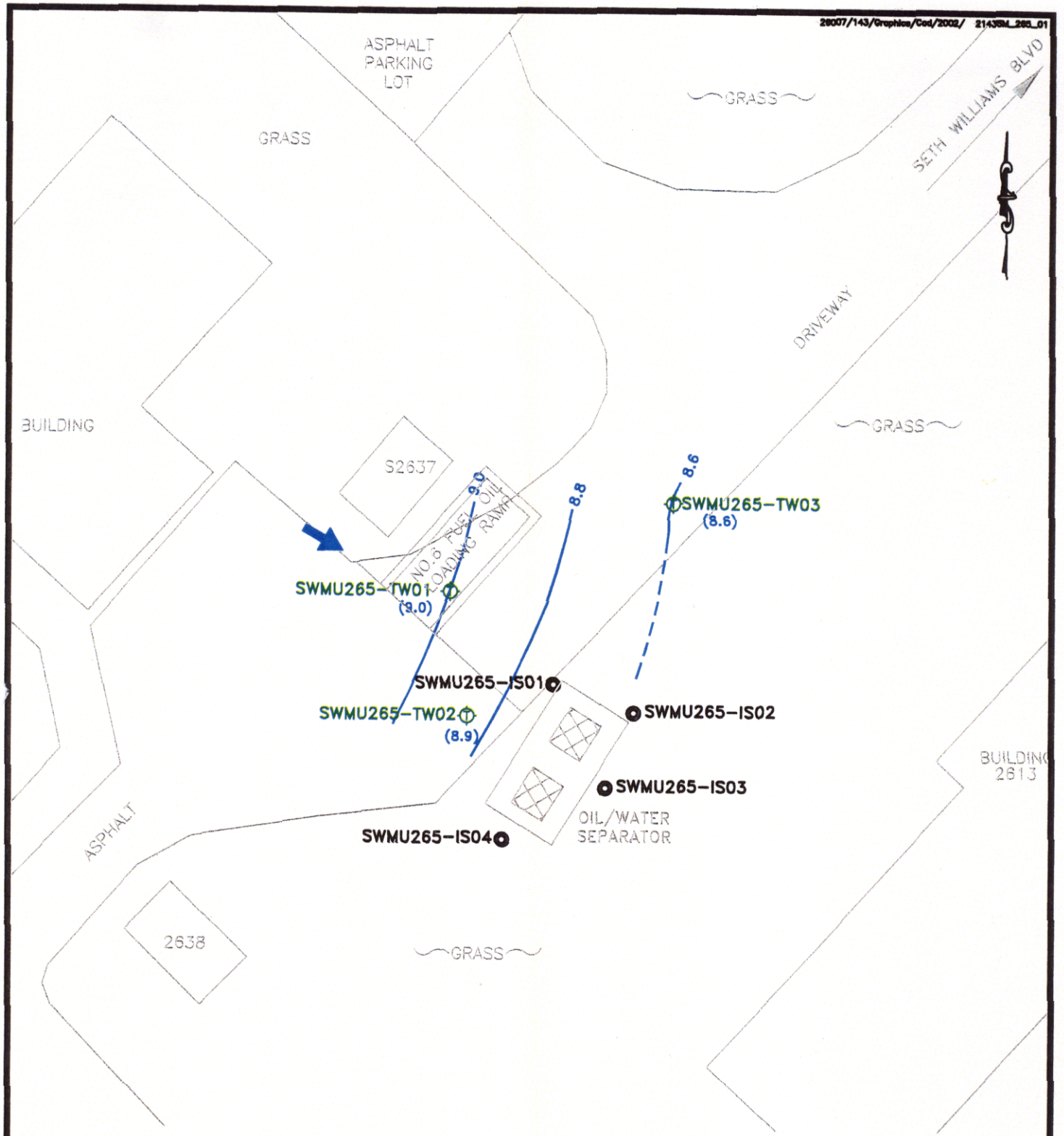
9/3/02
SWMU265_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 265
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | 1/3 | 0.77 J | NA | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

25 0 12.5 25
1 inch = 25 ft.

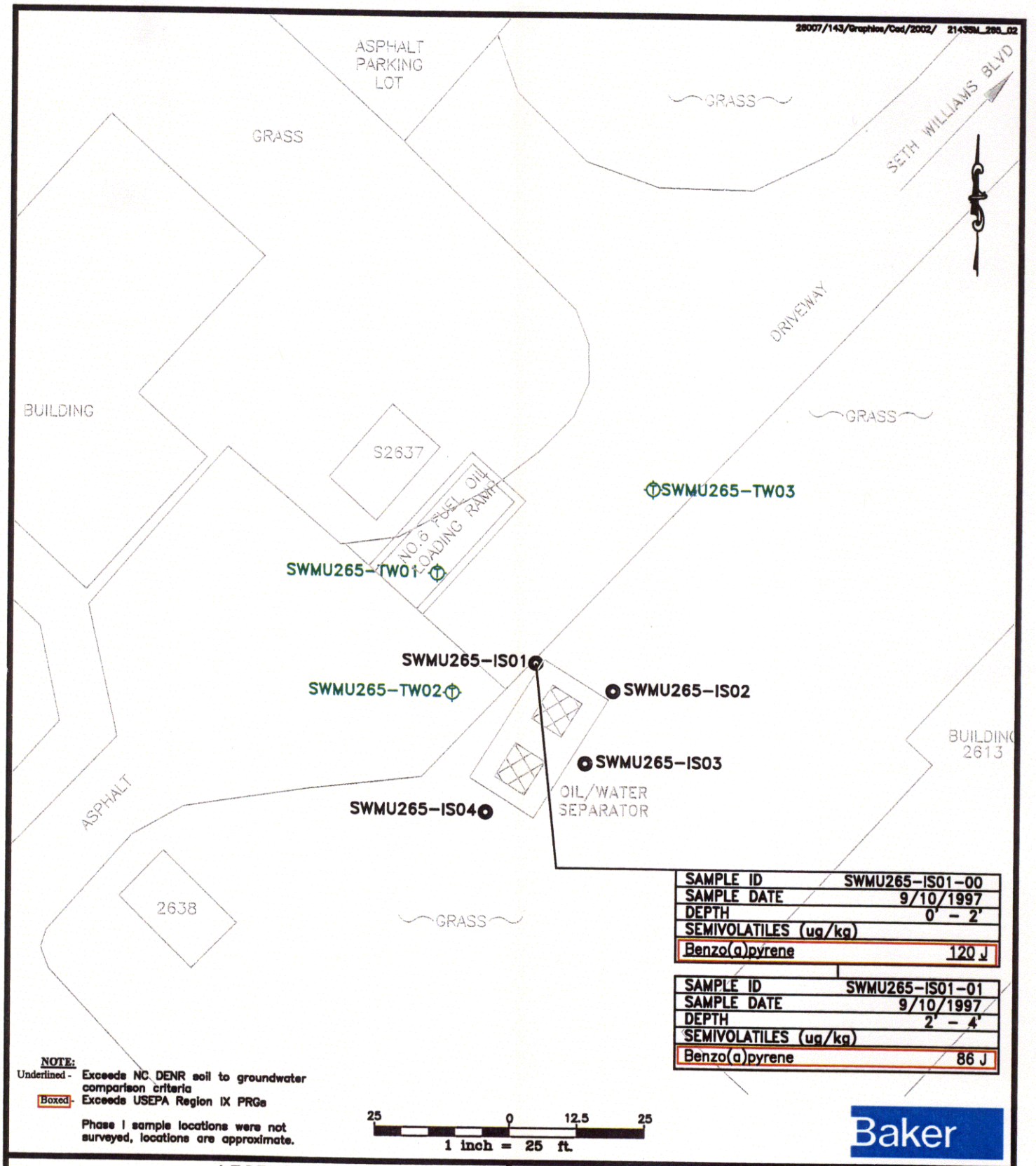
Baker

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 8.6 - - - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 265
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
# PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 265
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.11 SWMU 269 - Building 816 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.11.1 SWMU Description and History

SWMU 269 was an oil/water separator/vehicle wash rack located adjacent to Building 816, near the intersection of Main Service Road and Daly Road in Hadnot Point. The primary function of the SWMU was to collect water, soap, oil, grease, and dirt from the vehicle wash rack; separate the solids from the liquids; and then segregate the oil and grease from the remaining liquids. Since the site visit conducted by EnSafe, Inc., the oil/water separator and associated wash rack have been removed. A disturbed area of soil in the general area of the SWMU was identified during the October 1996 site visit conducted by Baker. Based on discussions with Base personnel, it was determined that the SWMU was located in the general area of the disturbed soil. A SWMU investigation plan is presented on Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if historic operations pertaining to the wash rack and oil/water separator have impacted surface and subsurface soils surrounding the SWMU. Surface and subsurface soil samples were collected at four soil borings that were advanced around the perimeter of the former SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 269 was recommended in the form of a Phase II CSI.

### 4.11.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 7, 2002 in general accordance with the Final Project Plans (Baker, 2002). As a result of the 2002 CSI at SWMU 269, additional investigation was warranted due to elevated concentrations of VOCs, SVOCs and metals detected in soil and/or groundwater. Additional samples were collected on June 18, June 24 and June 26, 2003 to complete the Phase II CSI.

The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI and 2002 Phase II sampling. Detailed procedures used to collect and analyze the samples are described in Section 3.0 of this report.

The field investigation at SWMU 269 included the following:

- Surface and subsurface soil sampling at eight temporary well borings
- Surface and subsurface soil sampling at four soil borings
- Groundwater sampling at eight temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 13.4 to 16.7 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 6.8 to 6.9 feet above MSL in 2002, and 9.0 to 9.1 feet above MSL in 2003. An interpretive groundwater contour map, utilizing data from 2003, is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow north.

It should be noted that after the fieldwork conducted in 2002 and prior to the fieldwork in 2003, new construction was completed north-northwest of the SWMU including a storm water retention pond. It is suspected that this retention pond has influenced groundwater flow in the area around the SWMU. The results from 2002 showed groundwater flowing to the southeast and results from 2003 showed groundwater flowing to the north. These results may have also been influenced by the extremely wet season in 2003. Further investigation into the groundwater at SWMU 269 may provide the necessary information to understand the impact of the retention pond and hydrogeological characteristics at the SWMU.

### 4.11.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories (2002) and analyzed for RCRA metals. In addition, two subsurface soil samples from borings SWMU269-TW01 and SWMU269-TW03 were analyzed for VOCs and SVOCs (in the March 2002 sampling) because elevated PID reading (up to 359 ppm) and petroleum odors were identified in the samples from these borings. Soil and groundwater samples collected during the additional sampling in 2003 were analyzed for VOCs, SVOCs and RCRA metals by Chemtech Laboratories. A summary of the laboratory analytical results is included in Appendix G.

<u>Soil</u>

For the purpose of this investigation, the analytical results for all phases of investigation were combined and are presented below. One sample of bis(2-Ethylhexyl)phthalate (SWMU 269-SB10-08) was reported at a concentration of 9,800,000 (ug/kg), which is likely due to laboratory contamination. The analytical results and statistical summaries for positive detections from the Phase I and Phase II sampling events were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Eighteen VOCs were detected in subsurface soil samples from one or more of the borings. Benzene, ethylbenzene, and xylenes (total) exceeded the NC DENR soil to groundwater screening criteria in the sample from boring SWMU 269-TW01. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

Fourteen SVOCs (mostly PAHs) were detected in subsurface soil samples from one or more of the borings. 2-Methylnaphthalene and naphthalene exceeded the NC DENR soil to groundwater

screening criteria in the sample from boring SWMU 269-TW01. 2-Methylnaphthalene was also detected above screening criteria in sample SWMU269-SB12-02. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

During the June 2003 sampling event, four subsurface samples were also analyzed for Diesel Range Organics (DRO) to determine if DRO was present due to previous detections of PAHs from the previous sampling events. DRO was detected in two of the four subsurface soil samples collected SWMU269-SB09-06 and SWMU 269-SB12-02 at concentrations of 1800 mg/kg and 1700 mg/kg, respectively.

All eight RCRA metals were detected in the surface and subsurface soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, silver and selenium. Arsenic exceeded both AOC and Base background criteria and the USEPA Region IX residential PRG in surface soil sample SWMU269-IS01-00, which was collected in September 1997 during the Phase I CSI. Arsenic also exceeded the Base background criteria and the USEPA Region IX residential PRG in one or more of the subsurface soil samples; however, concentrations were below the AOC background criteria and NC DENR soil to groundwater criteria. Barium, cadmium, chromium, lead and selenium were detected above the AOC and/or Base background screening criteria; however, the concentrations did not exceed the NC DENR soil to groundwater screening criteria or the USEPA Region IX residential PRGs. Mercury was the only metal that exceeded the NC DENR soil to groundwater criteria; however, the concentrations were below the AOC and Base background criteria and NC DENR soil to groundwater criteria. Therefore, the detection of mercury is most likely the result of background concentrations and not past activities at the SWMU. Silver exceeded the Base background criteria and the USEPA Region IX residential PRG in subsurface soil sample SWMU269-TW03-06. However, concentrations were below the AOC background criteria and NC DENR soil to groundwater criteria.

It should be noted that mobile laboratory samples were collected during the 2003 sampling event. Subsurface soil samples were collected and analyzed for VOCs from the four additional soil borings (see Table 8). These samples were collected to supplement the fixed-based laboratory results. None of the VOCs detected in subsurface soil samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX Tap Water PRGs (as a secondary comparison)

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Fourteen VOCs were detected in groundwater samples from one or more of the wells as shown on Table 6. Benzene, ethylbenzene, trichloroethene, vinyl chloride and cis-1,2-dichloroethene were detected above USEPA Region IX tap water PRGs and/or NC 2L standards.

Five SVOCs were detected in groundwater samples from one or more of the wells as shown in Table 6. 2-Methylnaphthalene was detected above the NC DENR 2L standard in the sample

collected from SWMU269-TW06. Naphthalene was detected above the NC DENR 2L standards and the USEPA Region IX tap water PRGs in two samples.

Six metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, lead, mercury, and selenium. Barium, and chromium exceeded the background screening criteria; however, the concentrations were below the 2L standards. Lead exceeded both the background screening criteria and the 2L standard in the sample from well SWMU269-TW02. Arsenic exceeded the USEPA Region IX tap water PRGs in two samples; however, the concentrations were below the Base background screening levels. The six metals detected in groundwater were also detected in soils at the SWMU.

The tap water screening numbers are very conservative and are presented to provide a secondary comparison; they represent numbers to be used for consumption of water. There is not a potable water source in this area.

It should be noted that mobile laboratory samples were collected during the 2003 sampling event. Groundwater grab samples were collected from the five new temporary wells and also from the four additional soil borings. All samples were analyzed for VOCs. Groundwater results from the five temporary wells correlated very well with the fixed-based laboratory results. Mobile laboratory results are presented in Table 8.

The mobile laboratory resultsfor the groundwater sample collected from SWMU269-GW11 are illustrated on Figure 3. The sample contained detections of benzene, cis-1,2-dichloroethene, 1,1-dichloroethene and trichloroethene that exceeded applicable screening criteria.

### 4.11.4 Conclusions

Several VOCs, SVOCs, and metals were detected in soil and/or groundwater at concentrations exceeding applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs in soil were as follows:

- VOCs - benzene, ethylbenzene and xylenes (total)
- SVOCs - 2-methylnaphthalene and naphthalene
- Metals - arsenic

Compounds that exceeded NC DENR 2L groundwater protection standards and/or USEPA Region IX tap water PRGs in groundwater were as follows:

- VOCs - benzene, ethylbenzene, cis-1,2-dichloroethene, 1,1-dichloroethene, trichloroethene and vinyl chloride
- SVOCs - 2-methylnaphthalene and naphthalene
- Metals – lead

Based on evaluation of the analytical results, additional investigation at SWMU 269 is warranted. The recommended additional investigation activities are presented in Section 5.0.

TA 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU269-TW01 | 3/25/2002 | BAKER | 23.60 | 23.4 | 20 | 20 | 8 | 6 | 10 | 16.68 | 6.9 |
| SWMU269-TW02 | 3/25/2002 | BAKER | 23.05 | 23.0 | 20 | 20 | 8 | 6 | 10 | 16.16 | 6.9 |
| SWMU269-TW03 | 3/25/2002 | BAKER | 22.45 | 22.6 | 19 | 19 | 7 | 5 | 9 | 15.64 | 6.8 |
| SWMU269-TW04 | 6/17/2003 | BAKER | 24.80 | N/A | 22 | 22 | 10 | 9 | 12-22 | 15.73 | 9.07 |
| SWMU269-TW05 | 6/17/2003 | BAKER | 27.64 | N/A | 24 | 24 | 12 | 11 | 14-24 | 18.65 | 8.99 |
| SWMU269-TW06 | 6/17/2003 | BAKER | 25.87 | N/A | 24 | 24 | NR | NR | NR | 16.88 | 8.99 |
| SWMU269-TW07 | 6/17/2003 | BAKER | 25.74 | N/A | 22 | 22 | 10 | 9 | 12-22 | 16.67 | 9.07 |
| SWMU269-TW08 | 6/17/2003 | BAKER | 24.12 | N/A | 22 | 22 | 10 | 9.4 | 12-22 | 15.04 | 9.08 |

Notes:
NR = Not recorded
msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOILS - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria<br>AOC 9 | **Base Background Criteria**<br>**Surface-F. Sand** | North Carolina<br>Soil to Groundwater<br>Stds | USEPA Region IX<br>PRGs<br>Residential Soils | SWMU269-IS01-00<br>09-13-1997<br>0' - 2' | SWMU269-IS02-00<br>09-13-1997<br>0' - 2' | SWMU269-IS03-00<br>09-13-1997<br>0' - 2' | SWMU269-IS04-00<br>09-13-1997<br>0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.14 | 0.671 | 5.24 | 0.39 | 3.1 | ND | ND | ND |
| Barium | 30.88 | 16.8 | 848 | 5400 | ND | ND | ND | ND |
| Cadmium | 0.85 | 0.0549 | 2.72 | 37 | ND | ND | ND | ND |
| Chromium | 9.45 | 15.2 | 27.2 | 210 | 6.9 | 10.1 | 5.5 | 7.5 |
| Lead | 40.04 | 20.9 | 270 | 400 | 6.2 | 10.6 | 9.4 | 9 |
| Mercury | 0.12 | 0.1 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | NE | 0.463 | 12.2 | 390 | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background criteria
Bold - Exceeds Base Background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Surface Soil
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not Established

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOILS - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria<br>AOC 9 | **Base Background Criteria**<br>**Surface-F. Sand** | North Carolina<br>Soil to Groundwater<br>Stds | USEPA Region IX<br>PRGs<br>Residential Soils | SWMU269-TW01-00<br>03-25-2002<br>0' - 1' | SWMU269-TW02-00<br>03-25-2002<br>0' - 1' | SWMU269-TW03-00<br>03-25-2002<br>0' - 1' | SWMU269-TW04-00<br>06-17-2003<br>0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.14 | 0.671 | 5.24 | 0.39 | ND | ND | ND | **0.97** J |
| Barium | 30.88 | 16.8 | 848 | 5400 | 76.9 J | 9.8 J | 8.5 J | 15 J |
| Cadmium | 0.85 | 0.0549 | 2.72 | 37 | ND | ND | ND | **0.55** J |
| Chromium | 9.45 | 15.2 | 27.2 | 210 | 4.7 J | 4.5 J | 4.9 J | 4.3 |
| Lead | 40.04 | 20.9 | 270 | 400 | 4.5 J | 3.8 J | 13.5 J | 13.3 J |
| Mercury | 0.12 | 0.1 | 0.0154 | 23 | ND | 0.04 J | 0.02 | ND |
| Selenium | NE | 0.463 | 12.2 | 390 | ND | 0.27 J | 0.24 J | ND |

Notes:
Shaded - Exceeds AOC background criteria
Bold - Exceeds Base Background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Surface Soil
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not Established

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOILS - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Surface-F. Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-TW05-00<br>06-17-2003<br>0' - 1' | SWMU269-TW06-00<br>06-18-2003<br>0' - 1' | SWMU269-TW07-00<br>06-18-2003<br>0' - 1' | SWMU269-TW08-00<br>06-18-2003<br>0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.14 | 0.671 | 5.24 | 0.39 | **0.95** J | **0.77** J | ND | ND |
| Barium | 30.88 | 16.8 | 848 | 5400 | 8.3 J | 9.7 J | 7.4 J | 7.5 J |
| Cadmium | 0.85 | 0.0549 | 2.72 | 37 | ND | **0.1** J | **0.15** J | **0.15** J |
| Chromium | 9.45 | 15.2 | 27.2 | 210 | 3.1 | 4.6 | 2.5 | 2.8 |
| Lead | 40.04 | 20.9 | 270 | 400 | 4 J | 7.3 J | 5.9 J | 9.9 J |
| Mercury | 0.12 | 0.1 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | NE | 0.463 | 12.2 | 390 | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background criteria
Bold - Exceeds Base Background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Surface Soil
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not Established

**TABLE 3**

**STATISTICAL SUMMARY**
**SURFACE SOILS - SWMU 269**
**RCRA INVESTIGATION - CTO-0143**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Lab Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria<br>AOC 9 | **Base Background Criter<br>Surface-F. Sand** | North Carolina<br>Soil to Groundwater<br>Stds | USEPA Region IX<br>PRGs<br>Residential Soils | Frequency<br>of Detection | Range of<br>Positive Detects | Background Criteria<br>AOC 9 | **Base Background Criteria<br>Surface-F. Sand** | North Carolina<br>Soil to Groundwater<br>Stds | USEPA Region IX<br>PRGs<br>Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.14 | 0.671 | 5.24 | 0.39 | 4/12 | 0.77 J - 3.1 | 1 | 4 | 0 | 4 |
| Barium | 30.88 | 16.8 | 848 | 5400 | 8/12 | 7.4 J - 76.9 J | 1 | 1 | 0 | 0 |
| Cadmium | 0.85 | 0.0549 | 2.72 | 37 | 4/12 | 0.1 J - 0.55 J | 0 | 4 | 0 | 0 |
| Chromium | 9.45 | 15.2 | 27.2 | 210 | 12/12 | 2.5 - 10.1 | 1 | 0 | 0 | 0 |
| Lead | 40.04 | 20.9 | 270 | 400 | 12/12 | 3.8 J - 13.5 J | 0 | 0 | 0 | 0 |
| Mercury | 0.12 | 0.1 | 0.0154 | 23 | 2/12 | 0.02 - 0.04 J | 0 | 0 | 2 | 0 |
| Selenium | NE | 0.463 | 12.2 | 390 | 2/12 | 0.24 J - 0.27 J | 0 | 0 | 0 | 0 |

Notes:

J - Analyte detected. Report value is estimated.

AOC comparison - AOC 9 Surface Soil

Base Comparison - Fine Sand Data Set for Surface Soil

NE - Not Established

TA[illegible] 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 9 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-IS01-06 | SWMU269-IS02-06 | SWMU269-IS03-06 | SWMU269-IS04-06 |
|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 09-13-1997 | 09-13-1997 | 09-13-1997 | 09-13-1997 |
| Depth Range | | | | | 12' - 14' | 12' - 14' | 12' - 14' | 12' - 14' |
| **Volatiles (ug/kg) (1)** | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | NA | NA | NA | NA |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | 1.5 | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | ND | 4.8 | 15 | 7.1 |
| 2-Butanone | NE | NE | 692 | 7300000 | NA | NA | NA | NA |
| Acetone | NE | NE | 2810 | 1600000 | NA | NA | NA | NA |
| Benzene | NE | NE | 6.37 (2) | 600 | ND | ND | ND | ND |
| Carbon Disulfide | NE | NE | 4940 | 360000 | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | NA | NA | NA | NA |
| Cyclohexane | NE | NE | NE | 140000 | NA | NA | NA | NA |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | ND | ND | ND | ND |
| Isopropylbenzene | NE | NE | 1680 | 570000 | NA | NA | NA | NA |
| m/p-Xylenes | NE | NE | 4960 | 270000 | NA | NA | NA | NA |
| Methylcyclohexane | NE | NE | NE | 2600000 | NA | NA | NA | NA |
| o-Xylene | NE | NE | 4960 | 270000 | NA | NA | NA | NA |
| Toluene | NE | NE | 7270 | 520000 | ND | ND | ND | ND |
| Trichloroethene | NE | NE | 18.3 | 53 | NA | NA | NA | NA |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | ND | ND | ND | ND |
| **Semivolatiles (ug/kg)** | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | NA | NA | NA | NA |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | ND | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 100 J | 140 J | 450 J | 83 J |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | ND | ND | ND | ND |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | ND | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 885 (2) | 56000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | 370 |

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-IS01-06<br>09-13-1997<br>12' - 14' | SWMU269-IS02-06<br>09-13-1997<br>12' - 14' | SWMU269-IS03-06<br>09-13-1997<br>12' - 14' | SWMU269-IS04-06<br>09-13-1997<br>12' - 14' |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | 2.5 | 2.1 | 1.4 | ND |
| Barium | 19.42 | 22.58 | 848 | 5400 | ND | ND | ND | ND |
| Cadmium | NE | NE | 2.72 | 32 | ND | ND | ND | ND |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | 14.2 | 9 | 8.6 | 5.9 |
| Lead | 10.91 | 9.19 | 270 | 400 | 5.8 | 4.4 | 8.6 | 3.1 |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | ND | ND | ND | ND |
| Silver | NE | NE | 0.223 | 390 | ND | ND | ND | ND |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | |
| DRO | NE | NE | NE | NE | NA | NA | NA | NA |

Notes:
Shaded -Exceeds AOC Background
Bold - Exceeds Base Background Concentrations
Underline - Exceeds North Carolina soil to Groundwater stds
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Silt Data Set for Subsurface Soil
(1) Phase I volatiles(1997) were only analyzed for SW8020 (BTEX)
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 1601 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 1601 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-TW01-06<br>03-25-2002<br>11' - 13' | | SWMU269-TW02-06<br>03-25-2002<br>11' - 13' | SWMU269-TW03-06<br>03-25-2002<br>11' - 13' | | SWMU269-SB09-06<br>06-23-2003<br>11-13 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Volatiles (ug/kg) (1)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | ND | | NA | ND | | ND |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | ND | | NA | ND | | ND |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | | NA | ND | | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | ND | | NA | ND | | ND |
| 2-Butanone | NE | NE | 692 | 7300000 | ND | | NA | ND | | ND |
| Acetone | NE | NE | 2810 | 1600000 | ND | | NA | ND | | ND |
| Benzene | NE | NE | 6.37 (2) | 600 | 150 | J | NA | ND | | ND |
| Carbon Disulfide | NE | NE | 4940 | 360000 | ND | | NA | ND | | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 120 | J | NA | ND | | ND |
| Cyclohexane | NE | NE | NE | 140000 | 390 | J | NA | ND | | ND |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | 2300 | | NA | ND | | ND |
| Isopropylbenzene | NE | NE | 1680 | 570000 | 1600 | | NA | ND | | ND |
| m/p-Xylenes | NE | NE | 4960 | 270000 | NA | | NA | NA | | ND |
| Methylcyclohexane | NE | NE | NE | 2600000 | 1400 | | NA | ND | | ND |
| o-Xylene | NE | NE | 4960 | 270000 | NA | | NA | NA | | ND |
| Toluene | NE | NE | 7270 | 520000 | 960 | | NA | ND | | ND |
| Trichloroethene | NE | NE | 18.3 | 53 | ND | | NA | ND | | ND |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | 42000 | | NA | ND | | NA |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | 2800 | | NA | ND | | ND |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | 28000 | | NA | ND | | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | | NA | ND | | ND |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | 36 | J | NA | ND | | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 2200 | | NA | 140 | J | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | | NA | ND | | ND |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | 860 | | NA | ND | | ND |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | ND | | NA | ND | | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | | NA | ND | | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | 63 | J | NA | 25 | J | ND |
| Fluorene | NE | NE | 44300 | 2700000 | 850 | | NA | ND | | ND |
| Naphthalene | NE | NE | 885 (2) | 56000 | 5400 | | NA | ND | | ND |
| Phenanthrene | NE | NE | 59600 | NE | 1500 | | NA | ND | | ND |
| Pyrene | NE | NE | 286000 | 2300000 | 160 | J | NA | ND | | ND |

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-TW01-06<br>03-25-2002<br>11' - 13' | SWMU269-TW02-06<br>03-25-2002<br>11' - 13' | SWMU269-TW03-06<br>03-25-2002<br>11' - 13' | SWMU269-SB09-06<br>06-23-2003<br>11-13 |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | **4.3** | 0.43 J | 2.5 | ND |
| Barium | 19.42 | 22.58 | 848 | 5400 | 13.5 | 22.7 J | ND | 9.8 J |
| Cadmium | NE | NE | 2.72 | 32 | ND | ND | ND | ND |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | 15.7 | 8.2 J | 8.9 | ND |
| Lead | 10.91 | 9.19 | 270 | 400 | 6.4 | 4.7 J | 3.7 | 1.3 |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | ND | 0.05 J | ND | ND |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | 0.59 J | 0.31 J | **0.82** J | ND |
| Silver | NE | NE | 0.223 | 390 | ND | ND | ND | 0.26 J |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | |
| DRO | NE | NE | NE | NE | NA | NA | NA | 1800 |

Notes:
Shaded -Exceeds AOC Background
Bold - Exceeds Base Background Concentrations
Underline - Exceeds North Carolina soil to Groundwater stds
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Silt Data Set for Subsurface Soil
(1) Phase I volatiles(1997) were only analyzed for SW8020 (BTEX)
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 1601 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 1601 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-SB10-02<br>06-23-2003<br>3-5 | SWMU269-SB10-06<br>06-23-2003<br>11-13 | SWMU269-SB10-08<br>06-23-2003<br>15-17 | SWMU269-SB11-02<br>06-23-2003<br>3-5 |
|---|---|---|---|---|---|---|---|---|
| **Volatiles (ug/kg) (1)** | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | ND | ND | NA | ND |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | ND | ND | NA | ND |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | ND | NA | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | ND | ND | NA | ND |
| 2-Butanone | NE | NE | 692 | 7300000 | ND | ND | NA | ND |
| Acetone | NE | NE | 2810 | 1600000 | 9.9 J | 27 | NA | 40 |
| Benzene | NE | NE | 6.37 (2) | 600 | ND | ND | NA | ND |
| Carbon Disulfide | NE | NE | 4940 | 360000 | ND | ND | NA | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | ND | ND | NA | ND |
| Cyclohexane | NE | NE | NE | 140000 | ND | ND | NA | ND |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | ND | ND | NA | ND |
| Isopropylbenzene | NE | NE | 1680 | 570000 | ND | ND | NA | ND |
| m/p-Xylenes | NE | NE | 4960 | 270000 | ND | ND | NA | ND |
| Methylcyclohexane | NE | NE | NE | 2600000 | ND | ND | NA | ND |
| o-Xylene | NE | NE | 4960 | 270000 | ND | ND | NA | ND |
| Toluene | NE | NE | 7270 | 520000 | ND | 7.5 J | NA | ND |
| Trichloroethene | NE | NE | 18.3 | 53 | ND | ND | NA | ND |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | NA | NA | NA | NA |
| **Semivolatiles (ug/kg)** | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | ND | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 920 | 95 J | 9800000 | 2300 |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | 630 | ND |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | ND | ND | ND | ND |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | ND | ND | 110 J | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | 940 | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | 130 J | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 885 (2) | 56000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | ND |

TA 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-SB10-02<br>06-23-2003<br>3-5 | SWMU269-SB10-06<br>06-23-2003<br>11-13 | SWMU269-SB10-08<br>06-23-2003<br>15-17 | SWMU269-SB11-02<br>06-23-2003<br>3-5 |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | ND | ND | 1.5 J | 0.81 J |
| Barium | 19.42 | 22.58 | 848 | 5400 | 9 J | 13.2 J | 14 J | 20.7 J |
| Cadmium | NE | NE | 2.72 | 32 | ND | ND | ND | ND |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | ND | ND | ND | ND |
| Lead | 10.91 | 9.19 | 270 | 400 | 3.1 | 2 | 1.8 | 3.2 |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | ND | ND | ND | 0.78 J |
| Silver | NE | NE | 0.223 | 390 | ND | ND | ND | ND |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | |
| DRO | NE | NE | NE | NE | NA | NA | ND | ND |

Notes:
Shaded -Exceeds AOC Background
Bold - Exceeds Base Background Concentrations
Underline - Exceeds North Carolina soil to Groundwater stds
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Silt Data Set for Subsurface Soil
(1) Phase I volatiles(1997) were only analyzed for SW8020 (BTEX)
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 1601 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 1601 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 9 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-SB11-08 | SWMU269-SB12-02 | SWMU269-TW04-07 | SWMU269-TW05-08 |
|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 06-23-2003 | 06-23-2003 | 06-17-2003 | 06-17-2003 |
| Depth Range | | | | | 15-17 | 3-5 | 13-15 | 15-17 |
| **Volatiles (ug/kg) (1)** | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | NA | ND | ND | ND |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | NA | ND | ND | ND |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | NA | ND | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | NA | ND | ND | ND |
| 2-Butanone | NE | NE | 692 | 7300000 | NA | 7.9 J | 7.2 J | ND |
| Acetone | NE | NE | 2810 | 1600000 | NA | 47 | 89 | 30 |
| Benzene | NE | NE | 6.37 (2) | 600 | NA | ND | ND | ND |
| Carbon Disulfide | NE | NE | 4940 | 360000 | NA | ND | ND | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | NA | ND | ND | ND |
| Cyclohexane | NE | NE | NE | 140000 | NA | ND | ND | ND |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | NA | 2.5 J | ND | ND |
| Isopropylbenzene | NE | NE | 1680 | 570000 | NA | 1.5 J | ND | ND |
| m/p-Xylenes | NE | NE | 4960 | 270000 | NA | 17 | ND | ND |
| Methylcyclohexane | NE | NE | NE | 2600000 | NA | ND | ND | ND |
| o-Xylene | NE | NE | 4960 | 270000 | NA | 9.8 J | ND | ND |
| Toluene | NE | NE | 7270 | 520000 | NA | ND | ND | ND |
| Trichloroethene | NE | NE | 18.3 | 53 | NA | ND | ND | ND |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | NA | NA | NA | NA |
| **Semivolatiles (ug/kg)** | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | ND U | 260 J | ND |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | ND | ND U | 2600 | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND U | 130 J | ND |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | ND | ND U | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 430 | 38 J | 160 J | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND U | ND | ND |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | ND | ND U | ND | ND |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | ND | ND U | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | 46 J | ND U | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND U | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND U | ND | ND |
| Naphthalene | NE | NE | 885 (2) | 56000 | ND | ND U | 350 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND U | 580 J | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND U | ND | ND |

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-SB11-08<br>06-23-2003<br>15-17 | SWMU269-SB12-02<br>06-23-2003<br>3-5 | SWMU269-TW04-07<br>06-17-2003<br>13-15 | SWMU269-TW05-08<br>06-17-2003<br>15-17 |
|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | 2.6 | ND | 1 J | ND |
| Barium | 19.42 | 22.58 | 848 | 5400 | 17.1 J | 4.6 J | 11.2 J | 7.9 J |
| Cadmium | NE | NE | 2.72 | 32 | ND | 0.11 J | ND | ND |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | ND | ND | 3.9 | 5.9 |
| Lead | 10.91 | 9.19 | 270 | 400 | 2.7 | 14.9 | 4.2 J | 5 J |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | ND | ND | ND | ND |
| Silver | NE | NE | 0.223 | 390 | ND | ND | ND | ND |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | |
| DRO | NE | NE | NE | NE | NA | 1700 | NA | NA |

Notes:
Shaded -Exceeds AOC Background
Bold - Exceeds Base Background Concentrations
Underline - Exceeds North Carolina soil to Groundwater stds
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Silt Data Set for Subsurface Soil
(1) Phase I volatiles(1997) were only analyzed for SW8020 (BTEX)
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 1601 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 1601 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

TAB 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-TW06-08<br>06-18-2003<br>15-17 | SWMU269-TW07-08<br>06-18-2003<br>15-17 | SWMU269-TW08-07<br>06-18-2003<br>13-15 |
|---|---|---|---|---|---|---|---|
| **Volatiles (ug/kg) (1)** | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | 11 J | ND | ND |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | 4.8 J | ND | ND |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | ND | ND | ND |
| 2-Butanone | NE | NE | 692 | 7300000 | ND | ND | ND |
| Acetone | NE | NE | 2810 | 1600000 | 40 | ND | ND |
| Benzene | NE | NE | 6.37 (2) | 600 | 3.4 J | ND | ND |
| Carbon Disulfide | NE | NE | 4940 | 360000 | 4 J | ND | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 3 J | ND | ND |
| Cyclohexane | NE | NE | NE | 140000 | ND | ND | ND |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | 12 J | ND | ND |
| Isopropylbenzene | NE | NE | 1680 | 570000 | 4 J | ND | ND |
| m/p-Xylenes | NE | NE | 4960 | 270000 | 43 | ND | ND |
| Methylcyclohexane | NE | NE | NE | 2600000 | 12 | ND | ND |
| o-Xylene | NE | NE | 4960 | 270000 | 26 | ND | ND |
| Toluene | NE | NE | 7270 | 520000 | 58 | ND | ND |
| Trichloroethene | NE | NE | 18.3 | 53 | 1.2 J | ND | ND |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | NA | NA | NA |
| **Semivolatiles (ug/kg)** | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | ND | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | ND | ND | ND |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND |
| Naphthalene | NE | NE | 885 (2) | 56000 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND |

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS -SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria<br>AOC 9 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU269-TW06-08<br>06-18-2003<br>15-17 | SWMU269-TW07-08<br>06-18-2003<br>15-17 | SWMU269-TW08-07<br>06-18-2003<br>13-15 |
|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | ND | ND | 1.7 J |
| Barium | 19.42 | 22.58 | 848 | 5400 | 4.3 J | 4.8 J | 4.4 J |
| Cadmium | NE | NE | 2.72 | 32 | ND | ND | ND |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | 1.9 J | 3 | 3.8 |
| Lead | 10.91 | 9.19 | 270 | 400 | 2.2 J | 2.4 J | 3 J |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | ND | ND | ND |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | ND | ND | ND |
| Silver | NE | NE | 0.223 | 390 | ND | ND | ND |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | |
| DRO | NE | NE | NE | NE | NA | NA | NA |

Notes:
Shaded -Exceeds AOC Background
Bold - Exceeds Base Background Concentrations
Underline - Exceeds North Carolina soil to Groundwater stds
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Silt Data Set for Subsurface Soil
(1) Phase I volatiles(1997) were only analyzed for SW8020 (BTEX)
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 1601 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 1601 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**TABLE 5**

**STATISTICAL SUMMARY**
**SUBSURFACE SOIL - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 9 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detects | Number of Exceedances: Background Criteria AOC 9 | Number of Exceedances: Base Background Criteria Subsurface-Silt | Number of Exceedances: North Carolina Soil to Groundwater Stds | Number of Exceedances: USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Volatiles (ug/kg)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1200000 | 1/12 | 11 J - 11 J | NA | NA | 0 | 0 |
| 1,1-Dichloroethane | NE | NE | 3820 | 510000 | 1/12 | 4.8 J - 4.8 J | NA | NA | 0 | 0 |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | 1/16 | 1.5 - 1.5 | NA | NA | 0 | 0 |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 3400 | 3/16 | 4.8 - 15 | NA | NA | 0 | 0 |
| 2-Butanone | NE | NE | 692 | 7300000 | 2/12 | 7.2 J - 7.9 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 1600000 | 7/12 | 9.9 J - 89 | NA | NA | 0 | 0 |
| Benzene | NE | NE | 6.37 (2) | 600 | 2/16 | 3.4 J - 150 J | NA | NA | 1 | 0 |
| Carbon Disulfide | NE | NE | 4940 | 360000 | 1/12 | 4 J - 4 J | NA | NA | 0 | 0 |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 2/12 | 3 J - 120 J | NA | NA | 0 | 0 |
| Cyclohexane | NE | NE | NE | 140000 | 1/12 | 390 J - 390 J | NA | NA | NA | 0 |
| Ethyl Benzene | NE | NE | 312 (2) | 8900 | 3/16 | 2.5 J - 2300 | NA | NA | 1 | 0 |
| Isopropylbenzene | NE | NE | 1680 | 570000 | 3/12 | 1.5 J - 1600 | NA | NA | 0 | 0 |
| m/p-Xylenes | NE | NE | 4960 | 270000 | 2/10 | 17 - 43 | NA | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | NE | 2600000 | 2/12 | 12 - 1400 | NA | NA | NA | 0 |
| o-Xylene | NE | NE | 4960 | 270000 | 2/10 | 9.8 J - 26 | NA | NA | 0 | 0 |
| Toluene | NE | NE | 7270 | 520000 | 3/16 | 7.5 J - 960 | NA | NA | 0 | 0 |
| Trichloroethene | NE | NE | 18.3 | 53 | 1/12 | 1.2 J - 1.2 J | NA | NA | 0 | 0 |
| Xylenes (Total) | NE | NE | 6540 (2) | 270000 | 1/6 | 42000 - 42000 | NA | NA | 1 | 0 |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | 2/14 | 260 J - 2800 | NA | NA | 0 | 0 |
| 2-Methylnaphthalene | NE | NE | 2120 (3) | NE | 2/18 | 2600 - 28000 | NA | NA | 2 | NA |
| Acenaphthene | NE | NE | 8160 | 3700000 | 1/18 | 130 J - 130 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 92.8 | 62 | 1/18 | 36 J - 36 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 13/18 | 38 J - 9800000 DL | NA | NA | 1 | 1 |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 1/18 | 630 - 630 | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 7400 (3) | 290000 | 1/18 | 860 - 860 | NA | NA | 0 | 0 |
| Diethyl phthalate | NE | NE | 28200 | 49000000 | 1/18 | 110 J - 110 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | 2/18 | 46 J - 940 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | 3/18 | 25 J - 130 J | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 2700000 | 1/18 | 850 - 850 | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 885 (2) | 56000 | 2/18 | 350 J - 5400 | NA | NA | 1 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 2/18 | 580 J - 1500 | NA | NA | 0 | NA |
| Pyrene | NE | NE | 286000 | 2300000 | 1/18 | 160 J - 160 J | NA | NA | 0 | 0 |

**TABLE 5**

**STATISTICAL SUMMARY**
**SUBSURFACE SOIL - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 9 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detects | Background Criteria AOC 9 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 9.01 | 3.01 | 5.24 | 0.39 | 11/19 | 0.43 J - 4.3 | 0 | 1 | 0 | 11 |
| Barium | 19.42 | 22.58 | 848 | 5400 | 14/19 | 4.3 J - 22.7 J | 2 | 1 | 0 | 0 |
| Cadmium | NE | NE | 2.72 | 32 | 1/19 | 0.11 J - 0.11 J | NA | NA | 0 | 0 |
| Chromium | 16.44 | 25.0 | 27.2 | 210 | 12/19 | 1.9 J - 15.7 | 0 | 0 | 0 | 0 |
| Lead | 10.91 | 9.19 | 270 | 400 | 19/19 | 1.3 - 14.9 | 1 | 1 | 0 | 0 |
| Mercury | 0.05 | 0.129 | 0.0154 | 23 | 1/19 | 0.05 J - 0.05 J | 0 | 0 | 1 | 0 |
| Selenium | 1.5 | 0.625 | 12.2 | 390 | 4/19 | 0.31 J - 0.82 J | 0 | 2 | 0 | 0 |
| Silver | NE | NE | 0.223 | 390 | 1/19 | 0.26 J - 0.26 J | NA | NA | 1 | 0 |
| **Petroleum Hydrocarbons** | | | | | | | | | | |
| DRO | NE | NE | NE | NE | 2/4 | 1700 - 1800 | NA | NA | NA | NA |

Notes:

J - Analyte detected. Report value is estimated.

NA- Not Analyzed

NE - Not established

AOC comparison - AOC 9 Subsurface Soil

Base comparison - Silt Data Set for Subsurface Soil

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date | Base Background Criteria<br>Groundwater Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water | SWMU269-GW01<br>04-07-2002 | SWMU269-GW02<br>04-07-2002 | SWMU269-GW03<br>04-07-2002 | SWMU269-TW04<br>06-25-2003 | SWMU269-TW05<br>06-25-2003 | SWMU269-TW06<br>06-25-2003 |
|---|---|---|---|---|---|---|---|---|---|
| **Volatiles (ug/L)** | | | | | | | | | |
| 1,1,1-Trichloroethane | NE | 200 | 3200 | NA | NA | NA | ND | 4.1 J | 3.9 J |
| 1,1-Dichloroethane | NE | 700 | 810 | NA | NA | NA | 2.9 J | 81 | 90 |
| 1,1-Dichloroethene | NE | 7 | 340 | NA | NA | NA | ND | 3.7 J | 6.3 J |
| Benzene | NE | 1 | 0.34 | NA | NA | NA | ND | **8.5** J | **50** |
| cis-1,2-Dichloroethene | NE | 70 | 61 | NA | NA | NA | 4.4 J | 35 | **180** |
| Cyclohexane | NE | NE | 35000 | NA | NA | NA | ND | ND | 1.6 J |
| Ethyl Benzene | NE | 29 | 2.9 | NA | NA | NA | ND | 6.3 J | 4.7 J |
| Isopropylbenzene | NE | 70 | 660 | NA | NA | NA | ND | 3.5 J | 6 J |
| m/p-Xylenes | NE | 530 | 210 | NA | NA | NA | ND | 5.6 J | 11 J |
| Methylcyclohexane | NE | NE | 5200 | NA | NA | NA | ND | ND | 2 J |
| o-Xylene | NE | 530 | 210 | NA | NA | NA | ND | 2.2 J | 13 |
| trans-1,2-Dichloroethene | NE | 70 | 120 | NA | NA | NA | ND | ND | 1.3 J |
| Trichloroethene | NE | 2.8 | 0.028 | NA | NA | NA | ND | **3.2** J | **14** |
| Vinyl Chloride | NE | 0.015 | 0.02 | NA | NA | NA | ND | **1.8** J | **3.6** J |
| **Semivolatiles (ug/L)** | | | | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | NA | NA | NA | ND | 2.2 J | 4 J |
| 2-Methylnaphthalene | NE | 14 | NE | NA | NA | NA | 3.7 J | 13 | **35** |
| Carbazole | NE | NE | 3.4 | NA | NA | NA | ND | 1.4 J | ND |
| Naphthalene | NE | 21 | 6.2 | NA | NA | NA | 1.9 J | **64** | **26** |
| Phenanthrene | NE | 210 | NE | NA | NA | NA | ND | ND | 1.1 J |
| **Metals (ug/L)** | | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | ND | 2.6 J | ND | 3.2 J | ND | ND |
| Barium | 37.31 | 2000 | 2600 | 31.4 | 97.3 | 73.5 | 95.5 J | 58.5 J | 34.4 J |
| Chromium | 5.76 | 50 | NE | ND | 25.2 | 2.5 J | ND | ND | ND |
| Lead | 3.61 | 15 | NE | ND | 17.5 | 4 J | ND | ND | ND |
| Mercury | NE | 1.1 | 11 | ND | 0.13 J | ND | ND | ND | ND |
| Selenium | NE | 50 | 180 | 5.8 | ND | ND | 5.3 J | 4 J | 3.6 J |

Notes:
Shaded -Exceeds Base background concentrations
Bold - Exceeds NC 2L Groundwater Protection Standards
Underline - Exceeds USEPA Region IX PRGs
J - Analyte detected. Reported value is estimated.
NE - Not established
NA - Not analyzed
ND - Not Detected

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date | Base Background Criteria<br>Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water | SWMU269-TW07<br>06-25-2003 | SWMU269-TW08<br>06-26-2003 |
|---|---|---|---|---|---|
| **Volatiles (ug/L)** | | | | | |
| 1,1,1-Trichloroethane | NE | 200 | 3200 | ND | ND |
| 1,1-Dichloroethane | NE | 700 | 810 | ND | ND |
| 1,1-Dichloroethene | NE | 7 | 340 | ND | ND |
| Benzene | NE | 1 | 0.34 | ND | ND |
| cis-1,2-Dichloroethene | NE | 70 | 61 | ND | ND |
| Cyclohexane | NE | NE | 35000 | ND | ND |
| Ethyl Benzene | NE | 29 | 2.9 | ND | ND |
| Isopropylbenzene | NE | 70 | 660 | ND | ND |
| m/p-Xylenes | NE | 530 | 210 | ND | ND |
| Methylcyclohexane | NE | NE | 5200 | ND | ND |
| o-Xylene | NE | 530 | 210 | ND | ND |
| trans-1,2-Dichloroethene | NE | 70 | 120 | ND | ND |
| Trichloroethene | NE | 2.8 | 0.028 | ND | ND |
| Vinyl Chloride | NE | 0.015 | 0.02 | ND | ND |
| **Semivolatiles (ug/L)** | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | ND | ND |
| 2-Methylnaphthalene | NE | 14 | NE | ND | ND |
| Carbazole | NE | NE | 3.4 | ND | ND |
| Naphthalene | NE | 21 | 6.2 | ND | ND |
| Phenanthrene | NE | 210 | NE | ND | ND |
| **Metals (ug/L)** | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | ND | ND |
| Barium | 37.31 | 2000 | 2600 | 77.2 J | 38.8 J |
| Chromium | 5.76 | 50 | NE | ND | ND |
| Lead | 3.61 | 15 | NE | ND | ND |
| Mercury | NE | 1.1 | 11 | ND | ND |
| Selenium | NE | 50 | 180 | ND | ND |

Notes:
Shaded -Exceeds Base background concentrations
Bold - Exceeds NC 2L Groundwater Protection Standards
Underline - Exceeds USEPA Region IX PRGs
J - Analyte detected. Reported value is estimated.
NE - Not established
NA - Not analyzed
ND - Not Detected

**TABLE 7**

**STATISTICAL SUMMARY**
**GROUNDWATER - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water | Frequency of Detection | Range of Positive Detects | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water |
|---|---|---|---|---|---|---|---|---|
| **Volatiles (ug/L)** | | | | | | | | |
| 1,1,1-Trichloroethane | NE | 200 | 3200 | 2/5 | 3.9 J - 4.1 J | NA | 0 | 0 |
| 1,1-Dichloroethane | NE | 700 | 810 | 3/5 | 2.9 J - 90 | NA | 0 | 0 |
| 1,1-Dichloroethene | NE | 7 | 340 | 2/5 | 3.7 J - 6.3 J | NA | 0 | 0 |
| Benzene | NE | 1 | 0.34 | 2/5 | 8.5 J - 50 | NA | 2 | 2 |
| cis-1,2-Dichloroethene | NE | 70 | 61 | 3/5 | 4.4 J - 180 | NA | 1 | 1 |
| Cyclohexane | NE | NE | 35000 | 1/5 | 1.6 J - 1.6 J | NA | NA | 0 |
| Ethyl Benzene | NE | 29 | 2.9 | 2/5 | 4.7 J - 6.3 J | NA | 0 | 2 |
| Isopropylbenzene | NE | 70 | 660 | 2/5 | 3.5 J - 6 J | NA | 0 | 0 |
| m/p-Xylenes | NE | 530 | 210 | 2/5 | 5.6 J - 11 J | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | 5200 | 1/5 | 2 J - 2 J | NA | NA | 0 |
| o-Xylene | NE | 530 | 210 | 2/5 | 2.2 J - 13 | NA | 0 | 0 |
| trans-1,2-Dichloroethene | NE | 70 | 120 | 1/5 | 1.3 J - 1.3 J | NA | 0 | 0 |
| Trichloroethene | NE | 2.8 | 0.028 | 2/5 | 3.2 J - 14 | NA | 2 | 2 |
| Vinyl Chloride | NE | 0.015 | 0.02 | 2/5 | 1.8 J - 3.6 J | NA | 2 | 2 |
| **Semivolatiles (ug/L)** | | | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | 2/5 | 2.2 J - 4 J | NA | 0 | 0 |
| 2-Methylnaphthalene | NE | 14 | NE | 3/5 | 3.7 J - 35 | NA | 1 | NA |
| Carbazole | NE | NE | 3.4 | 1/5 | 1.4 J - 1.4 J | NA | NA | 0 |
| Naphthalene | NE | 21 | 6.2 | 3/5 | 1.9 J - 64 | NA | 2 | 2 |
| Phenanthrene | NE | 210 | NE | 1/5 | 1.1 J - 1.1 J | NA | 0 | NA |
| **Metals (ug/L)** | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 2/8 | 2.6 J - 3.2 J | 0 | 0 | 0 |
| Barium | 37.31 | 2000 | 2600 | 8/8 | 31.4 - 97.5 | 6 | 0 | 0 |
| Chromium | 5.76 | 50 | NE | 2/8 | 2.5 J - 25.2 | 1 | 0 | NA |
| Lead | 3.61 | 15 | NE | 2/8 | 4 J - 17.5 | 2 | 1 | NA |
| Mercury | NE | 1.1 | 11 | 1/8 | 0.13 J - 0.13 J | NA | 0 | 0 |
| Selenium | NE | 50 | 180 | 4/8 | 3.6 J - 5.8 | NA | 0 | 0 |

Notes:
J - Analyte detected. Reported value is estimated.
NE - Not established
NA - Not Applicable

**TABLE 8**

**MOBILE LABORA[illegible] DATA SUMMARY**
**GROUNDWATER AND SOIL - SWMU 269**
**SWMU CONFIRMATORY SAMPLING (CTO-143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

---WATER SAMPLES---
CONCENTRATIONS IN UG/L

| SAMPLE NAME | 1,1-DCE | METHYLENE CHLORIDE | TRANS-1,2-DCE | 1,1-DCA | CIS-1,2-DCE | 1,1,1-TCA | TCE | PCE | BENZENE | TOLUENE | ETHYL BENZENE | M&P XYLENE | O-XYLENE | **TPH C5-C12 | FILE NAME | DATE SAMPLED | DATE ANALYZED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU269-GW07 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 8 | 2 | 37 | DX5A/B1.18A | 6/22/2003 | 6/22/2003 |
| SWMU269-GW04 | ND | ND | ND | 3 | 6 | ND | ND | ND | ND | ND | ND | 2 | 3 | 832 | DX5A/B1.19A | 6/22/2003 | 6/22/2003 |
| SWMU269-GW05 | 3 | ND | ND | 69 | 40 | 3 | 3 | 0.6 | 5 | ND | 4 | 2 | 1 | 401 | DX5A/B1.20A | 6/22/2003 | 6/22/2003 |
| SWMU269-GW08 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1124 | DX5A/B1.21A | 6/22/2003 | 6/22/2003 |
| SWMU269-GW06 | 6 | ND | ND | 66 | 181 | 3 | 11 | ND | 37 | ND | 6 | 8 | 13 | 37 | DX5A/B1.22A | 6/22/2003 | 6/22/2003 |
| SWMU269-GW09 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 10 | DX5A/B1.57A | 6/23/2003 | 6/23/2003 |
| SWMU269-GW10 | 3 | ND | ND | 17 | 3 | ND | 2 | ND | ND | ND | ND | ND | ND | 60 | DX5A/B1.63A | 6/23/2003 | 6/24/2003 |
| SWMU269-GW11 | 9 | ND | ND | 86 | 181 | 1 | 8 | 0.5 | 29 | ND | ND | ND | ND | 99 | DX5A/B1.71A | 6/23/2003 | 6/24/2003 |
| SWMU269-GW12 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 8 | DX5A/B1.76A | 6/23/2003 | 6/24/2003 |
| MDL | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | 1 | 1 | 1 | 1 | 5 | | | |

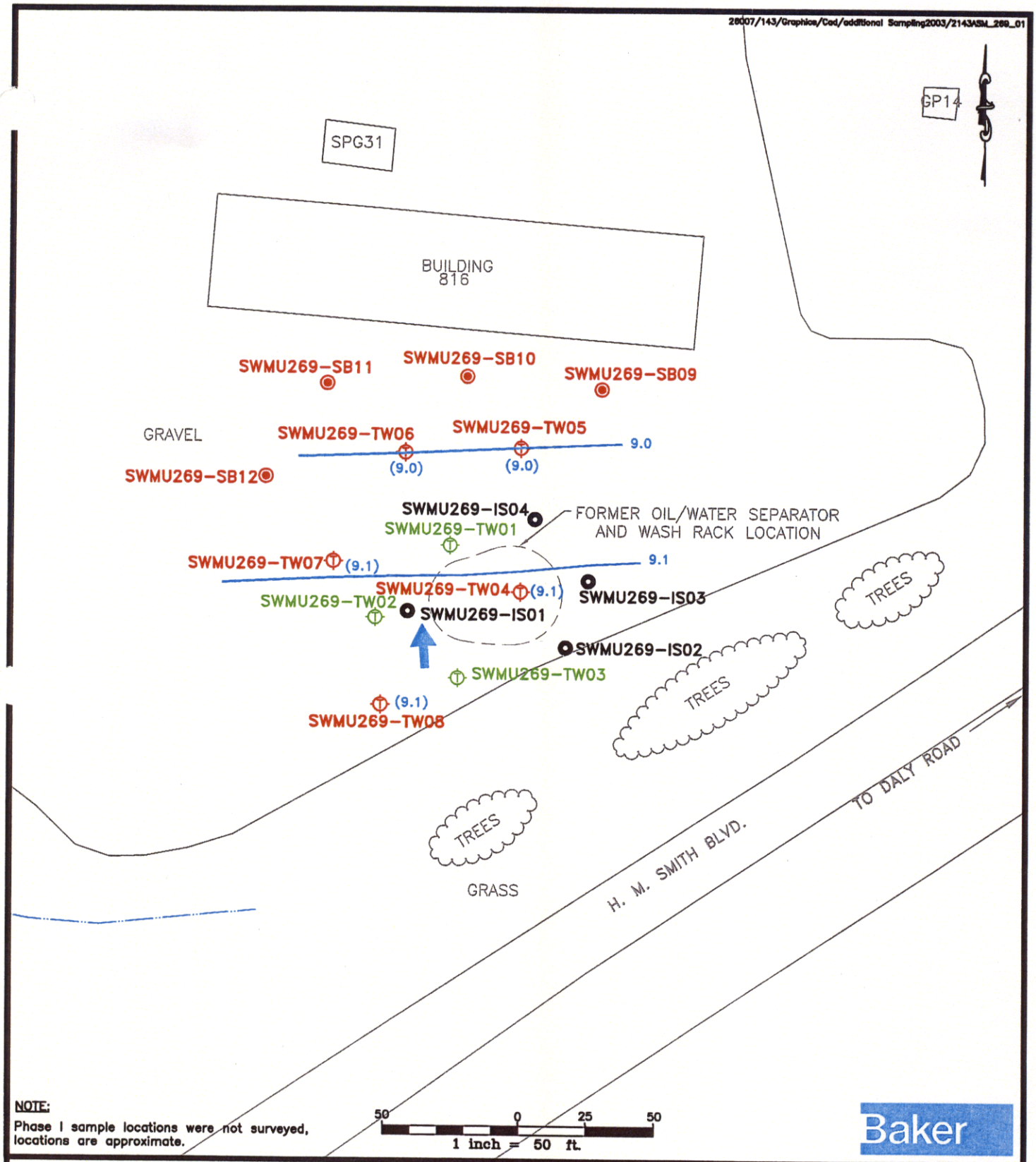
---SOIL SAMPLES---
CONCENTRATIONS IN UG/KG

| SAMPLE NAME | 1,1-DCE | METHYLENE CHLORIDE | TRANS-1,2-DCE | 1,1-DCA | CIS-1,2-DCE | 1,1,1-TCA | TCE | PCE | BENZENE | TOLUENE | ETHYL BENZENE | M&P XYLENE | O-XYLENE | **TPH C5-C12 | FILE NAME | DATE SAMPLED | DATE ANALYZED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU269-SB09-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 38 | DX5A/B1.53A | 6/23/2003 | 6/23/2003 |
| SWMU269-SB09-04 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 14 | DX5A/B1.54A | 6/23/2003 | 6/23/2003 |
| SWMU269-SB09-06 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 23 | DX5A/B1.55A | 6/23/2003 | 6/23/2003 |
| SWMU269-SB09-08 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 37 | DX5A/B1.56A | 6/23/2003 | 6/23/2003 |
| SWMU269-SB10-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 30 | DX5A/B1.58A | 6/23/2003 | 6/23/2003 |
| SWMU269-SB10-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 256 | DX5A/B1.59A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB10-06 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 20 | DX5A/B1.60A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB10-06B | ND | ND | ND | ND | ND | ND | ND | ND | ND | 25 | ND | ND | ND | 32 | DX5A/B1.61A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB10-08 | 4 | ND | ND | ND | ND | ND | ND | ND | ND | 12 | ND | ND | ND | 32 | DX5A/B1.62A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB11-01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 10 | DX5A/B1.66A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB11-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 14 | DX5A/B1.67A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB11-05 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND ND | | DX5A/B1.68A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB11-06 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 19 | DX5A/B1.69A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB11-08 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 12 | DX5A/B1.70A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB12-02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 10 | 7 | 37 | DX5A/B1.72A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB12-04 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 13 | DX5A/B1.73A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB12-06 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 49 | DX5A/B1.75A | 6/23/2003 | 6/24/2003 |
| SWMU269-SB12-07 | ND | ND | ND | ND | 3 | ND | ND | ND | 2 | ND | 25 | 255 | 123 | 2340 | DX5A/B1.74A | 6/23/2003 | 6/24/2003 |
| MDL | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 10 | | | |

MDL-denotes lower 'Method Detection Limit'

ND-denotes 'Not Detected' at or above the lower method detection limit

** Includes the total of all identified and unidentified compounds in the C5-C12 hydrocarbon range calculated by using the sensitivity of decane

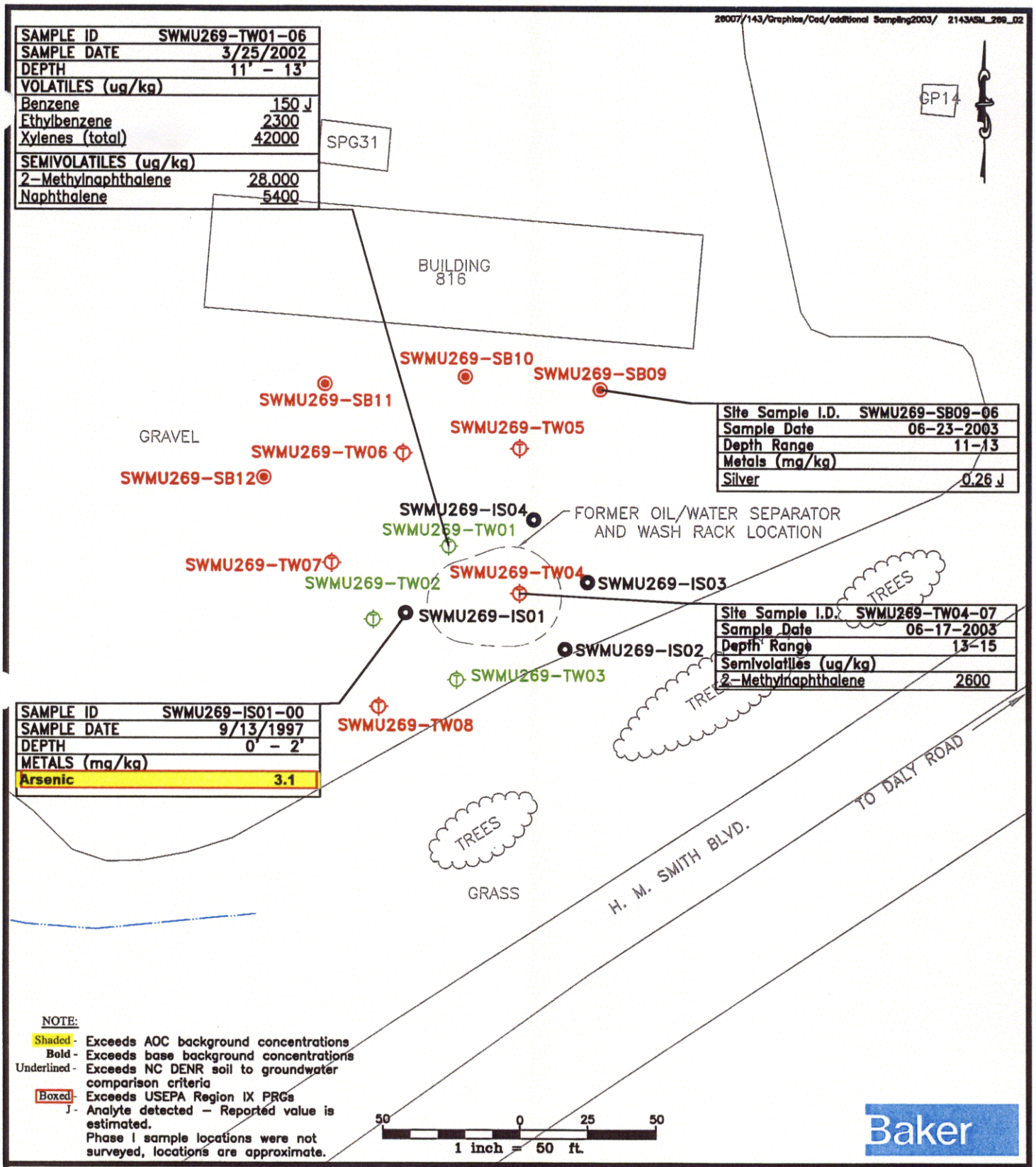



## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 9.0 – GROUNDWATER CONTOUR (JUNE 2003)

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 269
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

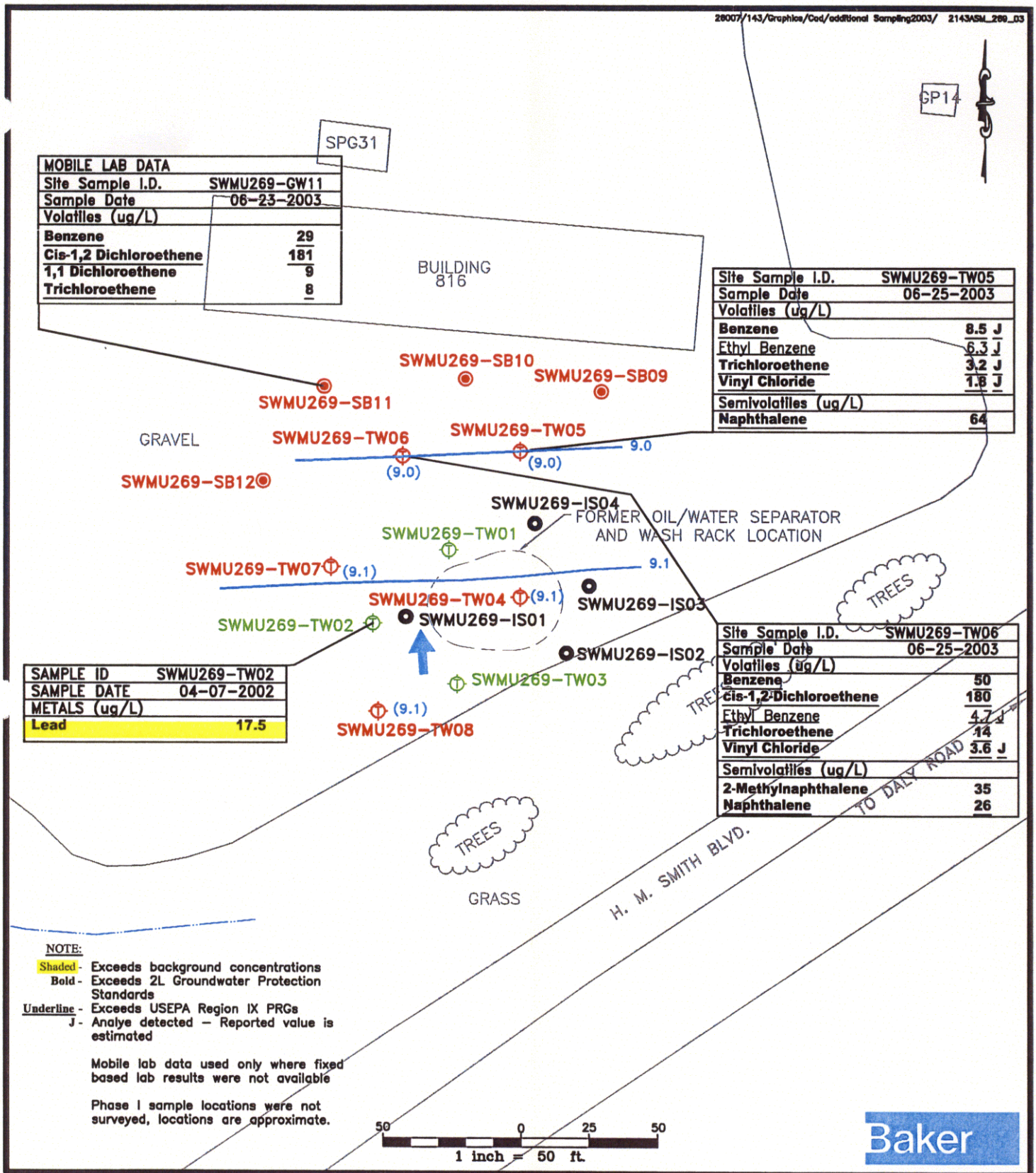



## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 269
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| MOBILE LAB DATA | |
|---|---|
| Site Sample I.D. | SWMU269-GW11 |
| Sample Date | 06-23-2003 |
| Volatiles (ug/L) | |
| **Benzene** | 29 |
| **Cis-1,2 Dichloroethene** | 181 |
| **1,1 Dichloroethene** | 9 |
| **Trichloroethene** | 8 |

| Site Sample I.D. | SWMU269-TW05 |
|---|---|
| Sample Date | 06-25-2003 |
| Volatiles (ug/L) | |
| **Benzene** | 8.5 J |
| Ethyl Benzene | 6.3 J |
| **Trichloroethene** | 3.2 J |
| **Vinyl Chloride** | 1.8 J |
| Semivolatiles (ug/L) | |
| **Naphthalene** | 64 |

| SAMPLE ID | SWMU269-TW02 |
|---|---|
| SAMPLE DATE | 04-07-2002 |
| METALS (ug/L) | |
| **Lead** | 17.5 |

| Site Sample I.D. | SWMU269-TW06 |
|---|---|
| Sample Date | 06-25-2003 |
| Volatiles (ug/L) | |
| **Benzene** | 50 |
| **cis-1,2 Dichloroethene** | 180 |
| Ethyl Benzene | 4.7 J |
| **Trichloroethene** | 14 |
| **Vinyl Chloride** | 3.6 J |
| Semivolatiles (ug/L) | |
| **2-Methylnaphthalene** | 35 |
| **Naphthalene** | 26 |

NOTE:

Shaded - Exceeds background concentrations

Bold - Exceeds 2L Groundwater Protection Standards

Underline - Exceeds USEPA Region IX PRGs

J - Analye detected – Reported value is estimated

Mobile lab data used only where fixed based lab results were not available

Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 9.1 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
## SWMU 269
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.12 SWMU 272 - AS137 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.12.1 SWMU Description and History

SWMU 272 is a concrete oil/water separator associated with the Campbell Street Fuel Farm. The SWMU is located along Campbell Street at the Marine Corps Air Station. The ground surface surrounding the SWMU is covered with grass. Large quantity ASTs (in excess of 10,000 gallons) are located north of the oil/water separator. Underground pipelines to the oil/water separator transport stormwater from the concrete paved areas within the fuel farm. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if the operation of the oil/water separator has impacted surface and/or subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the oil/water separator (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, some SVOCs and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 272 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.12.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 20 and 21, and April 2 and 3, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two temporary well borings and three soil borings
- Groundwater sampling at two temporary wells and one existing well

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 2.2 to 5.5 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 13.9 to 14.6 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow west.

### 4.12.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

A total of 28 SVOCs were detected in soil sample set. Most of the SVOCs were detected in the surface and subsurface soil sample from boring SWMU272-TW01. None of the SVOCs detected in the surface soil samples exceeded the applicable screening criteria. Benzo(a)pyrene exceeded the USEPA Region IX industrial PRG in subsurface soil sample SWMU272-TW01-03 and 2-chlorophenol, 4-chloro-3-methylphenol and pentachlorophenol exceeded the NC DENR soil to groundwater screening criteria in subsurface soil sample SWMU272-IS04-02. None of the other SVOCs detected in the subsurface soil samples exceeded the established screening criteria.

Seven metals were detected in the sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury and selenium. Barium, cadmium, lead and selenium were detected at concentrations that exceeded the background criteria, but did not exceed the NC DENR soil to groundwater criteria or the USEPA Region IX industrial PRGs. Chromium was detected at concentrations exceeding Base background and the NC DENR soil to groundwater screening criteria. However, the concentrations were below the AOC background criteria and NC DENR soil to groundwater screening criteria. Arsenic and mercury were detected at concentrations exceeding the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRG in one or more of the samples.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

One SVOC (Phenanthrene) and three metals (barium, chromium and lead) were detected in the sample set. However, none of these detections exceeded the applicable screening criteria. The compounds detected in the groundwater samples were also detected in soil samples collected at the SWMU.

### 4.12.4 Conclusions

Some SVOCs and metals were detected in soil at concentrations exceeding the applicable screening criteria. SVOCs and metals that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- SVOCs - Benzo(a)pyrene, 2-chlorophenol, 4-chloro-3-methylphenol and pentachlorophenol
- Metals - arsenic and mercury

None of the compounds detected in groundwater exceeded the applicable screening criteria.

Based on evaluation of the results, no further action is warranted at SWMU 272 because metals detected in surface and subsurface soils were at concentrations slightly above screening criteria. Phenols are not associated with the fuel farm or oil/water separator operations. The COPCs are not indicative of SWMU failure or release and the SWMU is not accessible, therefore, it likely received only its intended waste.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU272-TW01 | 3/21/02 | BAKER | 17.03 | 17.3 | 15 | 15 | 3 | 1 | 5 | 2.39 | 14.6 |
| SWMU272-TW03 | 3/21/02 | BAKER | 16.86 | 17.1 | 16 | 16 | 3 | 1 | 5 | 2.24 | 14.6 |
| UST143-MW09 | 11/19/92 | BAKER | 19.44 | 17.87 | 14 | 14 | 2 | 1 | 4 | 5.52 | 13.92 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU272

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-IS01-00 09-08-1997 0' - 2' | SWMU272-IS02-00 09-08-1997 0' - 2' | SWMU272-IS03-00 09-08-1997 0' - 2' | SWMU272-IS04-00 09-08-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 7030 (2) | 41000000 (1) | ND | 570 | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | 74 J | ND |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | ND | 48 J | ND |
| Benzo(b)fluoranthene | NE | NE | 6370 (2) | 2900 | ND | ND | 53 J | ND |
| Benzo(k)fluoranthene | NE | NE | 63700 (2) | 29000 | ND | ND | 45 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | 40 J | 39 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 68 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | 120 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 130 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 1.3 | ND | 2.4 | **1.4** |
| Barium | 33 | 23 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.04 | 0.043 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 19 | 12 | 27 | 450 | 5.5 | 5.4 | 11.4 | 7.8 |
| Lead | 23 | 26 | 270 | 750 | 3.8 | 3.1 | 14.4 | 10.9 |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | ND | ND | 0.11 | 0.044 |
| Selenium | 1.2 | 2.9 | 12 | 10000 | ND | ND | 0.63 | 0.67 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-SB01-00 03-20-2002 0' - 1' | | SWMU272-SB02-00 03-20-2002 0' - 1' | | SWMU272-SB03-00 03-20-2002 0' - 1' | | SWMU272-TW01-00 03-21-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 7030 (2) | 41000000 (1) | ND | | ND | | ND | | ND | |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | | ND | | ND | | ND | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | | ND | | ND | | 73 | J |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | | ND | | ND | | 60 | J |
| Benzo(b)fluoranthene | NE | NE | 6370 (2) | 2900 | ND | | ND | | ND | | 60 | J |
| Benzo(k)fluoranthene | NE | NE | 63700 (2) | 29000 | ND | | ND | | ND | | 70 | J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | | ND | | ND | | 56 | J |
| Chrysene | NE | NE | 39800 | 290000 | ND | | ND | | ND | | 75 | J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 91 | J | ND | | ND | | ND | |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | | ND | | ND | | 110 | J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | | ND | | ND | | 59 | J |
| Phenanthrene | NE | NE | 59600 | NE | ND | | ND | | ND | | 29 | J |
| Pyrene | NE | NE | 286000 | 54000000 | ND | | ND | | ND | | 95 | J |
| **METALS (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 3.2 | | 2.7 | | ND | | 2.2 | |
| Barium | 33 | 23 | 848 | 100000 | 21.7 | | **26.5** | | ND | | 19.3 | |
| Cadmium | 0.04 | 0.043 | 2.7 | 810 | 0.05 | J | 0.06 | J | 0.06 | J | ND | |
| Chromium | 19 | 12 | 27 | 450 | **16** | | **13.3** | | 7.4 | | **12.8** | J |
| Lead | 23 | 26 | 270 | 750 | 12.4 | | 12.4 | | 1.1 | | 24.5 | |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 0.04 | J | 0.06 | | ND | | 0.22 | |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 0.9 | | 0.85 | | ND | | 0.69 | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-TW03-00 03-21-2002 0' - 1' | |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 2-Methylnaphthalene | NE | NE | 7030 (2) | 41000000 (1) | ND | |
| Benzaldehyde | NE | NE | NE | 88000000 | 31 | J |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | |
| Benzo(a)pyrene | NE | NE | 91 | 290 | ND | |
| Benzo(b)fluoranthene | NE | NE | 6370 (2) | 2900 | ND | |
| Benzo(k)fluoranthene | NE | NE | 63700 (2) | 29000 | ND | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 1100 | |
| Chrysene | NE | NE | 39800 | 290000 | ND | |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | |
| Phenanthrene | NE | NE | 59600 | NE | ND | |
| Pyrene | NE | NE | 286000 | 54000000 | ND | |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | **1.5** | |
| Barium | 33 | 23 | 848 | 100000 | 10.6 | |
| Cadmium | 0.04 | 0.043 | 2.7 | 810 | ND | |
| Chromium | 19 | 12 | 27 | 450 | 6.8 | J |
| Lead | 23 | 26 | 270 | 750 | 6.3 | |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | ND | |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 0.55 | J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 7030 (2) | 41000000 (1) | 1/9 | 570 | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 88000000 | 1/5 | 31 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 2/9 | 73 J - 74 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 91 | 290 | 2/9 | 48 J - 60 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 6370 (2) | 2900 | 2/9 | 53 J - 60 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 63700 (2) | 29000 | 2/9 | 45 J - 70 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 4/9 | 39 J - 1100 | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/9 | 68 J - 75 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/9 | 91 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 2/9 | 110 J - 120 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/9 | 59 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/9 | 29 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/9 | 95 J - 130 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 7/9 | 1.3 - 3.2 | 4 | 6 | 0 | 1 |
| Barium | 33 | 23 | 848 | 100000 | 4/9 | 10.6 - 26.5 | 0 | 1 | 0 | 0 |
| Cadmium | 0.04 | 0.043 | 2.7 | 810 | 3/9 | 0.05 J - 0.06 J | 3 | 3 | 0 | 0 |
| Chromium | 19 | 12 | 27 | 450 | 9/9 | 5.4 - 16 | 0 | 3 | 0 | 0 |
| Lead | 23 | 26 | 270 | 750 | 9/9 | 1.1 - 24.5 | 1 | 0 | 0 | 0 |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 5/9 | 0.04 J - 0.22 | 2 | 1 | 5 | 0 |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 6/9 | 0.55 J - 0.9 | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4
DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-IS01-02 09-08-1997 4' - 6' | SWMU272-IS02-02 09-08-1997 4' - 6' | SWMU272-IS03-02 09-08-1997 4' - 6' | SWMU272-IS04-02 09-08-1997 4' - 6' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2,4-Dinitrotoluene | NE | NE | NE | 1800000 | ND | ND | ND | 51 J |
| 2-Chlorophenol | NE | NE | 5 (2) | 240000 | ND | ND | ND | 58 J |
| 2-Methylnaphthalene | NE | NE | 7030 (4) | 41000000 (1) | ND | 5300 J | 1900 | ND |
| 4-Chloro-3-methylphenol | NE | NE | 7.05 (2) (3) | 240000 (3) | ND | ND | ND | 90 J |
| 4-Nitrophenol | NE | NE | NE | 7000000 | ND | ND | ND | 370 J |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | 58 J |
| Acetophenone | NE | NE | NE | 1600 | NA | NA | NA | NA |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 1990 (2) | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 502 (2) | 290 | ND | ND | 98 J | ND |
| Benzo(b)fluoranthene | NE | NE | 6370 (4) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 63700 (4) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 39 J | 51 J | 130 J | 170 J |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 25200 (4) | 5100000 | ND | 160 J | 66 J | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 2840 (2) | 190000 | ND | 2100 J | 360 J | ND |
| Pentachlorophenol | NE | NE | 118 (2) | 11000 | ND | ND | ND | 440 J |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Phenol | NE | NE | 1750 | 100000000 | ND | ND | ND | 63 J |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | 94 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | ND | 3.4 | 7 | 13.4 |
| Barium | 47 | 29 | 848 | 100000 | ND | ND | 30.3 | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 38 | 27 | 27 | 450 | 4.5 | 18.2 | 25.5 | 25 |
| Lead | 15 | 14 | 270 | 750 | 2.4 | 11.6 | 15.1 | 10.2 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 0.86 | 1.7 | 12 | 10000 | ND | 0.69 | 0.91 | 1 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5508 mg/kg.
(3) - Criteria for surrogate, 2-chlorophenol, are used for comparison
(4) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 4
DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-SB01-03 03-20-2002 5' - 7' | SWMU272-SB02-03 03-20-2002 5' - 7' | SWMU272-SB03-02 03-20-2002 3' - 5' | SWMU272-TW01-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2,4-Dinitrotoluene | NE | NE | NE | 1800000 | ND | ND | ND | ND |
| 2-Chlorophenol | NE | NE | 5 (2) | 240000 | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 7030 (4) | 41000000 (1) | ND | ND | ND | ND |
| 4-Chloro-3-methylphenol | NE | NE | 7.05 (2) (3) | 240000 (3) | ND | ND | ND | ND |
| 4-Nitrophenol | NE | NE | NE | 7000000 | ND | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | ND | ND | 740 J | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | 140 J |
| Benzo(a)anthracene | NE | NE | 1990 (2) | 2900 | ND | ND | ND | 640 |
| Benzo(a)pyrene | NE | NE | 502 (2) | 290 | ND | ND | ND | 390 J |
| Benzo(b)fluoranthene | NE | NE | 6370 (4) | 2900 | ND | ND | ND | 460 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | 130 J |
| Benzo(k)fluoranthene | NE | NE | 63700 (4) | 29000 | ND | ND | ND | 410 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | 110 J |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | 70 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 940 J | 670 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 130 J | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | 69 J |
| Dibenzofuran | NE | NE | 25200 (4) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | 1300 |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | 240 J | 43 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | 280 J |
| Naphthalene | NE | NE | 2840 (2) | 190000 | ND | ND | ND | ND |
| Pentachlorophenol | NE | NE | 118 (2) | 11000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | 650 |
| Phenol | NE | NE | 1750 | 100000000 | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | 1100 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 0.59 J | 0.44 J | 1.3 | 2.4 |
| Barium | 47 | 29 | 848 | 100000 | 19.5 | 16.5 | ND | **30.1** |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | 0.1 J | 0.12 J | ND |
| Chromium | 38 | 27 | 27 | 450 | 14.1 | 17 | 8.2 | 20.6 J |
| Lead | 15 | 14 | 270 | 750 | 12 | 10.8 | 2 | 27.2 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 0.04 J | 0.06 | ND | 0.29 |
| Selenium | 0.86 | 1.7 | 12 | 10000 | 0.77 | 0.74 | ND | 1.5 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5508 mg/kg.
(3) - Criteria for surrogate, 2-chlorophenol, are used for comparison
(4) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 4
DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU272-TW03-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| 2,4-Dinitrotoluene | NE | NE | NE | 1800000 | ND |
| 2-Chlorophenol | NE | NE | 5 (2) | 240000 | ND |
| 2-Methylnaphthalene | NE | NE | 7030 (4) | 41000000 (1) | ND |
| 4-Chloro-3-methylphenol | NE | NE | 7.05 (2) (3) | 240000 (3) | ND |
| 4-Nitrophenol | NE | NE | NE | 7000000 | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND |
| Acetophenone | NE | NE | NE | 1600 | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND |
| Benzo(a)anthracene | NE | NE | 1990 (2) | 2900 | ND |
| Benzo(a)pyrene | NE | NE | 502 (2) | 290 | ND |
| Benzo(b)fluoranthene | NE | NE | 6370 (4) | 2900 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND |
| Benzo(k)fluoranthene | NE | NE | 63700 (4) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND |
| Carbazole | NE | NE | NE | 120000 | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND |
| Dibenzofuran | NE | NE | 25200 (4) | 5100000 | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND |
| Naphthalene | NE | NE | 2840 (2) | 190000 | ND |
| Pentachlorophenol | NE | NE | 118 (2) | 11000 | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND |
| Phenol | NE | NE | 1750 | 100000000 | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND |
| **METALS (mg/kg)** | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 5.8 |
| Barium | 47 | 29 | 848 | 100000 | 28.6 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND |
| Chromium | 38 | 27 | 27 | 450 | **30.6** J |
| Lead | 15 | 14 | 270 | 750 | 15.7 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | ND |
| Selenium | 0.86 | 1.7 | 12 | 10000 | 1.3 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5508 mg/kg.
(3) - Criteria for surrogate, 2-chlorophenol, are used for comparison
(4) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 5
STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2,4-Dinitrotoluene | NE | NE | NE | 1800000 | 1/9 | 51 J | NA | NA | 0 | 0 |
| 2-Chlorophenol | NE | NE | 5 (2) | 240000 | 1/9 | 58 J | NA | NA | 1 | 0 |
| 2-Methylnaphthalene | NE | NE | 7030 (4) | 41000000 (1) | 2/9 | 1900 - 5300 J | NA | NA | 0 | 0 |
| 4-Chloro-3-methylphenol | NE | NE | 7.05 (2) (3) | 240000 | 1/9 | 90 J | NA | NA | 1 | 0 |
| 4-Nitrophenol | NE | NE | NE | 7000000 | 1/9 | 370 J | NA | NA | 0 | 0 |
| Acenaphthene | NE | NE | 8160 | 38000000 | 1/9 | 58 J | NA | NA | 0 | 0 |
| Acetophenone | NE | NE | NE | 1600 | 1/5 | 740 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 100000000 | 1/9 | 140 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 1990 (2) | 2900 | 1/9 | 640 | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 502 (2) | 290 | 2/9 | 98 J - 390 J | NA | NA | 0 | 1 |
| Benzo(b)fluoranthene | NE | NE | 6370 (4) | 2900 | 1/9 | 460 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/9 | 130 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 63700 (4) | 29000 | 1/9 | 410 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 5/9 | 39 J - 170 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/9 | 70 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/9 | 670 - 940 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/9 | 130 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/9 | 69 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 25200 (4) | 5100000 | 2/9 | 66 J - 160 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/9 | 1300 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 2/9 | 43 J - 240 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/9 | 280 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 2840 (2) | 190000 | 2/9 | 360 J - 2100 J | NA | NA | 0 | 0 |
| Pentachlorophenol | NE | NE | 118 (2) | 11000 | 1/9 | 440 J | NA | NA | 1 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/9 | 650 | NA | NA | 0 | 0 |
| Phenol | NE | NE | 1750 | 100000000 | 1/9 | 63 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/9 | 94 J - 1100 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 8/9 | 0.44 J - 13.4 | 0 | 1 | 3 | 4 |
| Barium | 47 | 29 | 848 | 100000 | 5/9 | 16.5 - 30.3 | 0 | 2 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 2/9 | 0.1 J - 0.12 J | 2 | 2 | 0 | 0 |
| Chromium | 38 | 27 | 27 | 450 | 9/9 | 4.5 - 30.6 J | 0 | 1 | 1 | 0 |
| Lead | 15 | 14 | 270 | 750 | 9/9 | 2 - 27.2 | 3 | 3 | 0 | 0 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 3/9 | 0.04 J - 0.29 | 1 | 1 | 3 | 0 |
| Selenium | 0.86 | 1.7 | 12 | 10000 | 7/9 | 0.69 - 1.5 | 4 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
(3) - Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5508 mg/kg. Criteria for surrogate, 2-chlorophenol, are used for comparison
(4) - Site-specific criteria calculated with interim 2L and TOC of 5508mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Clay Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU272-TW01 04-03-2002 | SWMU272-TW03 04-02-2002 | SWMU272-MW09 04-03-2002 |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| Phenanthrene | NE | 210 | 0.8 J | 1 J | ND |
| **METALS (ug/L)** | | | | | |
| Barium | 145 | 2000 | 25.6 J | 87.1 J | 62.8 J |
| Chromium | 5.8 | 50 | 1.7 J | ND | 0.68 J |
| Lead | 3.6 | 15 | 2 J | ND | ND |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

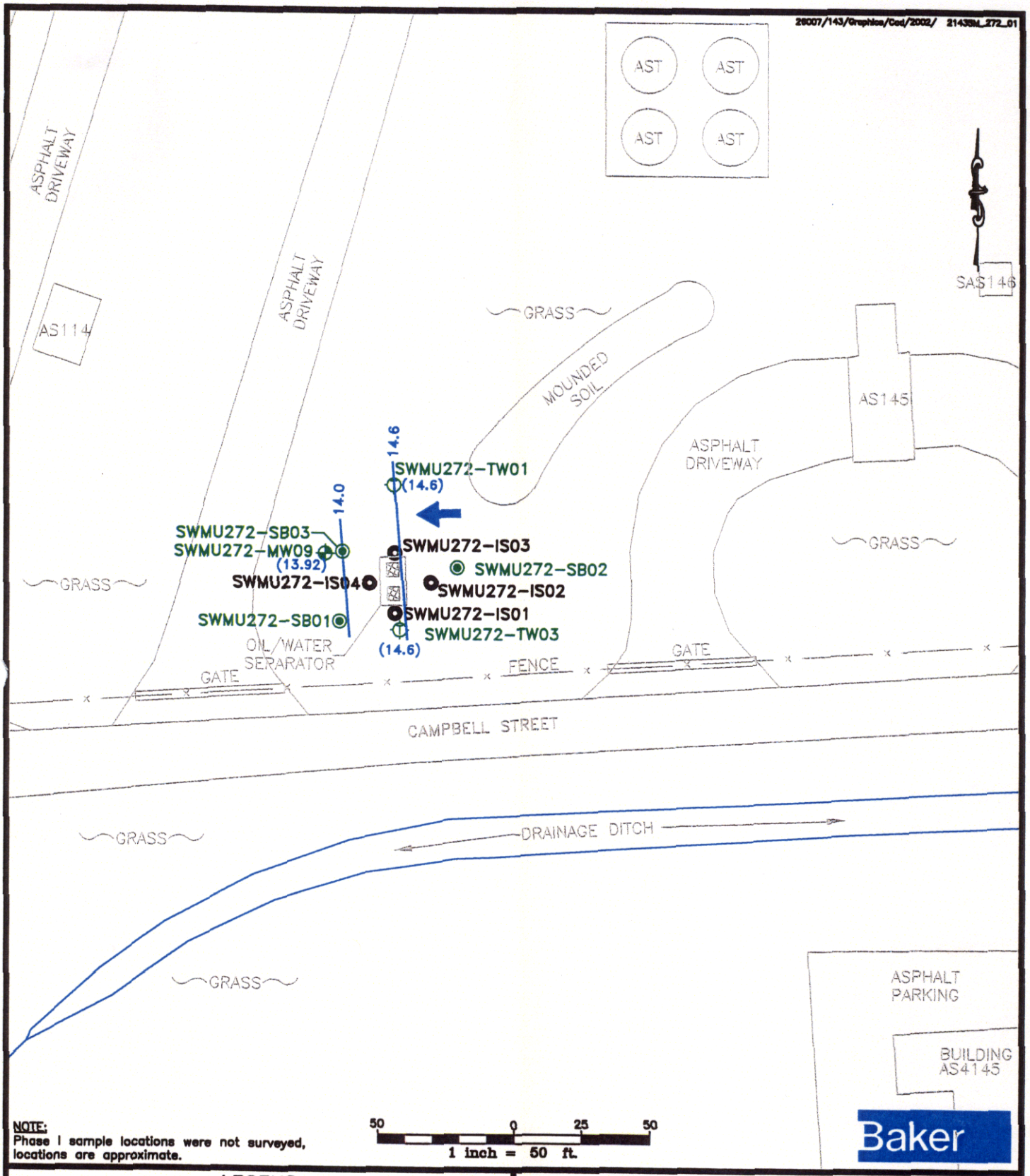
8/30/02
SWMU272_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 272
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| Phenanthrene | NE | 210 | 2/3 | 0.8 J - 1 J | NA | 0 |
| **METALS (ug/L)** | | | 0/0 | | | |
| Barium | 145 | 2000 | 3/3 | 25.6 J - 87.1 J | 0 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 0.68 J - 1.7 J | 0 | 0 |
| Lead | 3.6 | 15 | 1/3 | 2 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

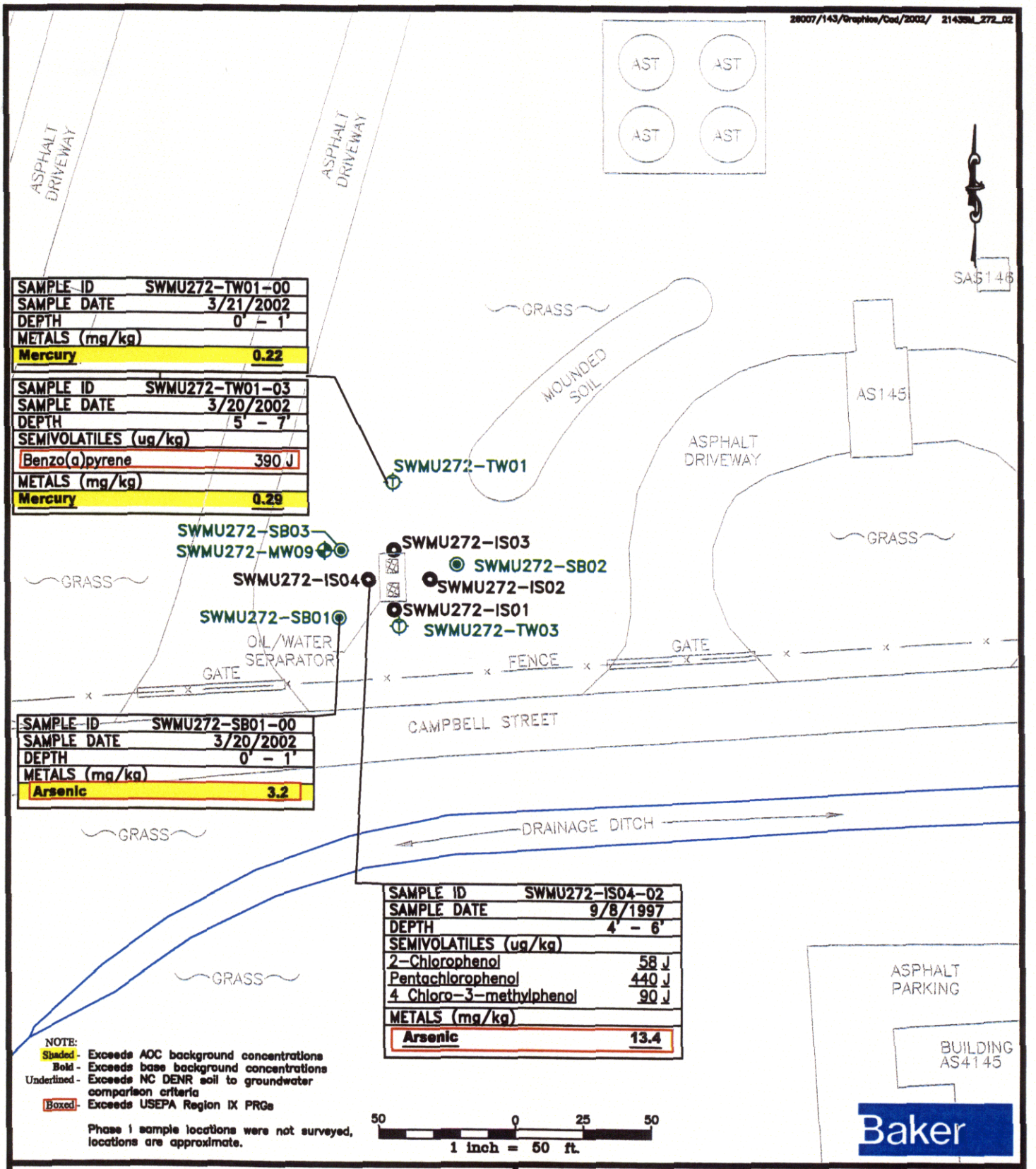
## LEGEND

- TEMPORARY WELL
- SOIL BORING
- MONITORING WELL SAMPLE
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 14.6 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 272
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

D27528214U




| SAMPLE ID | SWMU272-TW01-00 |
|---|---|
| SAMPLE DATE | 3/21/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Mercury** | **0.22** |

| SAMPLE ID | SWMU272-TW01-03 |
|---|---|
| SAMPLE DATE | 3/20/2002 |
| DEPTH | 5' - 7' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 390 J |
| METALS (mg/kg) | |
| **Mercury** | **0.29** |

| SAMPLE ID | SWMU272-SB01-00 |
|---|---|
| SAMPLE DATE | 3/20/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Arsenic** | **3.2** |

| SAMPLE ID | SWMU272-IS04-02 |
|---|---|
| SAMPLE DATE | 9/8/1997 |
| DEPTH | 4' - 6' |
| SEMIVOLATILES (ug/kg) | |
| 2-Chlorophenol | 58 J |
| Pentachlorophenol | 440 J |
| 4 Chloro-3-methylphenol | 90 J |
| METALS (mg/kg) | |
| **Arsenic** | **13.4** |

NOTE:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- TEMPORARY WELL
- SOIL BORING
- MONITORING WELL SAMPLE
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 272
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.13 SWMU 279 - FC200 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.13.1 SWMU Description and History

SWMU 279 consists of a former oil/water separator that was located north of Main Service Road behind Building FC-200 in the Hadnot Point Industrial Area. The oil/water separator was installed in 1973 and has since been removed. The ground surface in the vicinity of the SWMU is not paved or vegetated. Due to the lack of vegetation in the vicinity of the SWMU, soil is washed away during large storm events often prompting re-grading activities. No visual signs of contamination were noted in the vicinity of the SWMU. It was noted during the October 1996 site visit conducted by Baker that a large area around the SWMU had undergone sever erosion due to recent storms. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if historical use of the oil/water separator and wash rack has impacted surface and subsurface soils in the vicinity of the SWMU. During the investigation, it was noted that the area surrounding the SWMU had recently been re-graded. Surface and subsurface soil samples were collected from three soil borings advanced around the perimeter of the SWMU (See Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and the USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene exceeded the regulatory driven criteria. Therefore, additional investigation was recommended for this SWMU in the form of a Phase II CSI.

### 4.13.2 Phase II Confirmatory Sampling Investigation Activities

The Phase II investigation was conducted on March 26 and April 4 and 5, 2002 in general accordance with the Final Project Plans (Baker, 2000). The purpose of this investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 7.9 to 8.2 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 11.9 to 12.0 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southwest.

### 4.13.3 Investigation Finding

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 though 5 and were compared to the following screening criteria:

- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Four SVOCS were detected in the soil samples, as follows; benzo(a)pyrene, bis(2-Ethylhexyl)phthalate, di-n-octylphthalate and pyrene. Benzo(a)pyrene exceeded the USEPA Region IX residential PRG in subsurface sample SWMU279-IS03-03, which was collected during the Phase I investigation. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Groundwater

There were no SVOCs detected in the three groundwater samples that were collected from the temporary wells.

### 4.13.4 Conclusions

One SVOC [benzo(a)pyrene] was detected in one of the subsurface soil samples at a concentration exceeding the USEPA Region IX residential PRG.

There were no SVOCs that exceeded the Base background screening criteria or 2L standards in groundwater.

Based on the analytical results, benzo(a)pyrene appears to be an isolated, anomalous detection in subsurface soil and is not indicative of SWMU failure or release. Therefore, no additional actions are warranted at SWMU 279.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU279-TW01 | 3/25/02 | BAKER | 19.94 | 20.1 | 15 | 15 | 3 | 1.5 | 5 | 7.91 | 12.0 |
| SWMU279-TW02 | 3/25/02 | BAKER | 20.06 | 20.2 | 15 | 15 | 3 | 1.5 | 5 | 8.09 | 12.0 |
| SWMU279-TW03 | 3/25/02 | BAKER | 20.12 | 20.3 | 15 | 15 | 3 | 1.5 | 5 | 8.17 | 11.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU279

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 279
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU279-IS01-00 09-12-1997 0' - 2' | SWMU279-IS02-00 09-12-1997 0' - 2' | SWMU279-IS03-00 09-12-1997 0' - 2' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 85 J | 120 J | 140 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 279
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 3/3 | 85 J - 140 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 279
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU279-IS01-03 09-12-1997 6' - 8' | SWMU279-IS02-03 09-12-1997 6' - 8' | SWMU279-IS03-03 09-12-1997 6' - 8' | SWMU279-TW01-04 03-26-2002 7' - 9' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)pyrene | 212 (1) | 62 | ND | ND | 93 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 91 J | 220 J | 120 J | 1200 |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | ND | ND | 16 J |
| Pyrene | 286000 | 2300000 | ND | 44 J | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 2326 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

9/11/02
SWMU279_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 279
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU279-TW02-04 03-26-2002 7' - 9' | SWMU279-TW03-04 03-26-2002 7' - 9' |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | |
| Benzo(a)pyrene | 212 (1) | 62 | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 190 J | 94 J |
| Di-n-octyl phthalate | 10000000 | 1200000 | 360 J | ND |
| Pyrene | 286000 | 2300000 | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 2326 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.

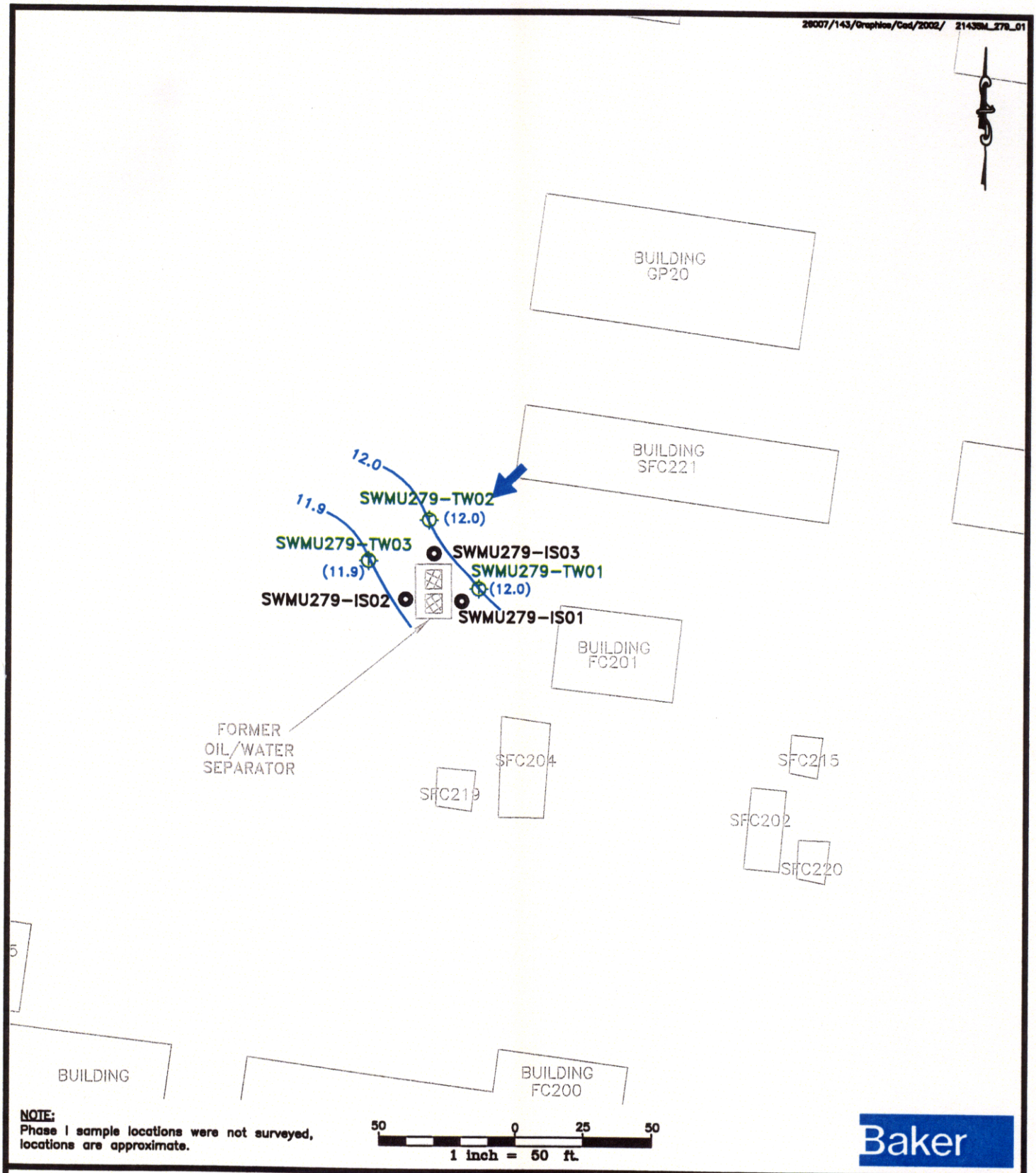
9/11/02
SWMU279_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 279
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)pyrene | 212 (1) | 62 | 1/6 | 93 J | NA | NA | 1 | 1 |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 6/6 | 91 J - 1200 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 1200000 | 2/6 | 16 J - 360 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 2300000 | 1/6 | 44 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 2326 mg/kg.




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

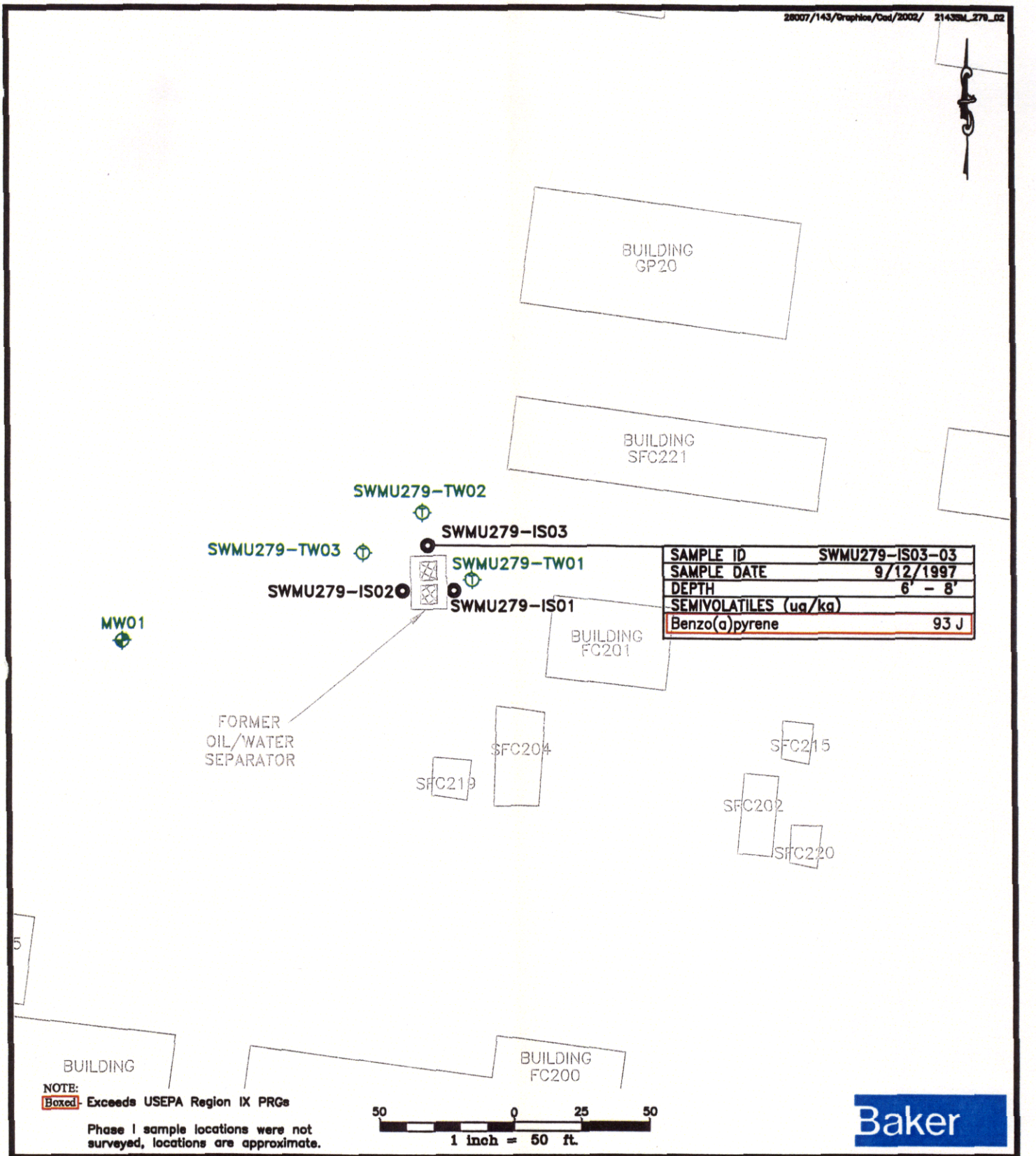
## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 12.0 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 279
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB15Y




## LEGEND

- TEMPORARY WELL
- MONITORING WELL LOCATION
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 279
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.14 285 (S947 Oil/Water Separator)

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.14.1 SWMU Description and History

SWMU 285 is an active oil/water separator location north of Building S-960 (covered storage area). Water is transported to this unit from the concrete and asphalt paved areas and the oil/water skimmings from two ASTs (located east of the separator) by underground pipelines. A SWMU investigation plan is presented on Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings that were advanced in the vicinity of SWMU 285. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, methylene chloride and several SVOCs, exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 285 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that COPCs identified in the Phase I data should be re-evaluated against the industrial PRGs.

### 4.14.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 26 and 27 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 5.2 to 6.9 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 23.7 to 24.7 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow east/southeast.

### 4.14.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs and SVOCs. A summary of the laboratory analytical results is provided in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Five VOCs were detected in the sample set, as follows: acetone, methylene chloride, tetrachloroethene, 1,3-dichlorobenzene and 1,4-dichlorobenzene. None of the VOCs detected in the samples exceeded the applicable screening criteria.

Seventeen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in surface soil sample SWMU285-IS03-00. Benzo(a)anthracene, benzo(a)pyrene and dibenz(a,h)anthracene were detected in this sample at concentrations that exceeded the NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- North Carolina 2L standards

No VOCs were detected in the groundwater samples. One SVOC [bis(2-Ethylhexyl)phthalate] was detected in the groundwater sample from well SWMU43-TW01. The concentration was below the 2L standard. No SVOCs were detected in the samples from the remaining two wells.

### 4.14.4 Conclusions

Benzo(a)anthracene, benzo(a)pyrene and dibenz(a,h)anthracene were detected in surface soil at concentrations exceeding the regulatory driven criteria. It is important to note that these three compounds were detected during Phase I and could not be confirmed during the Phase II activities. No VOCs or SVOCs exceeded the regulatory driven criteria in groundwater.

Based on evaluation of the analytical results, detections of benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene in surface soil above the regulatory driven criteria appear to be isolated and are not indicative of release from a below grade oil/water separator. Therefore, no additional actions are warranted at SWMU 285.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU285-TW01 | 3/26/02 | BAKER | 29.87 | 30.0 | 12 | 12 | 1 | 0 | 2 | 5.19 | 24.7 |
| SWMU285-TW02 | 4/3/02 | BAKER | 30.64 | 30.9 | 12 | 12 | 1.3 | 0 | 1.9 | 6.9 | 23.7 |
| SWMU285-TW03 | 3/26/02 | BAKER | 31.02 | 30.9 | 14 | 14 | 2 | 0 | 4 | 6.8 | 24.2 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU285

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU285-IS01-00 09-13-1997 0' - 2' | SWMU285-IS02-00 09-13-1997 0' - 2' | SWMU285-IS03-00 09-13-1997 0' - 2' | SWMU285-IS04-00 09-13-1997 0' - 2' |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | |
| Acetone | 2810 | 6200000 | 9.7 J | 23 J | 580 J | 140 J |
| Methylene chloride | 27 (1) | 21000 | 4.6 J | 3.3 J | 25 J | 9.1 J |
| Tetrachloroethene | 7.42 | 19000 | ND | ND | ND | ND |
| 1,2-Dichlorobenzene | 23700 | 52000 | ND | ND | 1.7 | ND |
| 1,4-Dichlorobenzene | 1240 | 8100 | ND | ND | ND | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Acenaphthylene | 11400 | NE | ND | ND | 74 J | ND |
| Anthracene | 995000 | 100000000 | ND | ND | 140 J | ND |
| Benzaldehyde | NE | 6100000 | NA | NA | NA | NA |
| Benzo(a)anthracene | 2080 (1) | 2900 | 42 J | ND | 2600 | 27 J |
| Benzo(a)pyrene | 553 (1) | 290 | 58 J | 38 J | 2700 | ND |
| Benzo(b)fluoranthene | 7010 (2) | 2900 | 65 J | ND | 2300 | ND |
| Benzo(ghi)perylene | 6720000 | NE | 48 J | ND | 1100 | ND |
| Benzo(k)fluoranthene | 70100 (2) | 29000 | 57 J | ND | 2500 | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 92 J | 110 J | 88 J | 140 J |
| Carbazole | NE | 120000 | ND | ND | 100 J | ND |
| Chrysene | 39800 | 290000 | 66 J | ND | 2500 | 43 J |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | 1020 (1) | 290 | ND | ND | 660 | ND |
| Fluoranthene | 276000 | 30000000 | 73 J | ND | 3100 | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 40 J | ND | 1200 | ND |
| Phenanthrene | 59600 | NE | 38 J | ND | 140 J | 36 J |
| Pyrene | 286000 | 54000000 | 67 J | ND | 3100 | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6067 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 6067mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU285-TW01-00 03-26-2002 0' - 1' | SWMU285-TW02-00 03-27-2002 0' - 1' | SWMU285-TW03-00 03-26-2002 0' - 1' |
|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | |
| Acetone | 2810 | 6200000 | ND | ND | ND |
| Methylene chloride | 27 (1) | 21000 | ND | ND | ND |
| Tetrachloroethene | 7.42 | 19000 | ND | ND | ND |
| 1,2-Dichlorobenzene | 23700 | 52000 | ND | ND | ND |
| 1,4-Dichlorobenzene | 1240 | 8100 | ND | ND | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | |
| Acenaphthylene | 11400 | NE | ND | ND | ND |
| Anthracene | 995000 | 100000000 | ND | ND | ND |
| Benzaldehyde | NE | 6100000 | 75 J | ND | 310 J |
| Benzo(a)anthracene | 2080 (1) | 2900 | ND | ND | ND |
| Benzo(a)pyrene | 553 (1) | 290 | ND | ND | ND |
| Benzo(b)fluoranthene | 7010 (2) | 2900 | ND | ND | ND |
| Benzo(ghi)perylene | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | 70100 (2) | 29000 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 1500 J | 97 J | 92 J |
| Carbazole | NE | 120000 | ND | ND | ND |
| Chrysene | 39800 | 290000 | ND | ND | ND |
| Di-n-octyl phthalate | 10000000 | 10000000 | 83 J | ND | 40 J |
| Dibenz(a,h)anthracene | 1020 (1) | 290 | ND | ND | ND |
| Fluoranthene | 276000 | 30000000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | ND | ND | ND |
| Phenanthrene | 59600 | NE | ND | ND | ND |
| Pyrene | 286000 | 54000000 | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6067 mg/kg.

(2) - Site-specific criteria calculated with interim 2L and TOC of 6067mg/kg.

J - Analyte detected. Report value is estimated.

NA - Not analyzed. Not on the Phase I Target Compound List

ND - Analyte not detected.

NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | |
| Acetone | 2810 | 6200000 | 4/7 | 23 J - 680 J | 0 | 0 |
| Methylene chloride | 27 (1) | 21000 | 4/7 | 3.3 J - 25 J | 0 | 0 |
| Tetrachloroethene | 7.42 | 19000 | 1/7 | 4.3 J | 0 | 0 |
| 1,2-Dichlorobenzene | 23700 | 52000 | 1/7 | 1.7 | 0 | 0 |
| 1,4-Dichlorobenzene | 1240 | 8100 | 1/7 | 1.7 | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Acenaphthylene | 11400 | NE | 1/7 | 74 J | 0 | 0 |
| Anthracene | 995000 | 100000000 | 1/7 | 140 J | 0 | 0 |
| Benzaldehyde | NE | 6100000 | 2/3 | 75 J - 310 J | 0 | 0 |
| Benzo(a)anthracene | 2080 (1) | 2900 | 3/7 | 27 J - 2600 | 1 | 0 |
| Benzo(a)pyrene | 553 (1) | 290 | 3/7 | 38 J - 2700 | 1 | 1 |
| Benzo(b)fluoranthene | 7010 (2) | 2900 | 2/7 | 65 J - 2300 | 0 | 0 |
| Benzo(ghi)perylene | 6720000 | NE | 2/7 | 48 J - 1100 | 0 | 0 |
| Benzo(k)fluoranthene | 70100 (2) | 29000 | 2/7 | 57 J - 2500 | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 7/7 | 88 J - 1500 J | 0 | 0 |
| Carbazole | NE | 120000 | 1/7 | 100 J | 0 | 0 |
| Chrysene | 39800 | 290000 | 3/7 | 43 J - 2500 | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 2/7 | 40 J - 83 J | 0 | 0 |
| Dibenz(a,h)anthracene | 1020 (1) | 290 | 1/7 | 660 | 0 | 1 |
| Fluoranthene | 276000 | 30000000 | 2/7 | 73 J - 3100 | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | 3260 | 2900 | 2/7 | 40 J - 1200 | 0 | 0 |
| Phenanthrene | 59600 | NE | 3/7 | 36 J - 140 J | 0 | 0 |
| Pyrene | 286000 | 54000000 | 2/7 | 67 J - 3100 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6067 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 6067mg/kg.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU285-IS01-03 09-12-1997 6' - 8' | SWMU285-IS02-03 09-13-1997 6' - 8' | SWMU285-IS03-03 09-13-1997 6' - 8' | SWMU285-IS04-03 09-13-1997 6' - 8' | SWMU285-TW01-02 03-26-2002 3' - 5' |
|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | |
| Acetone | 2810 | 6200000 | 44 J | 22 J | 57 J | 21 J | NA |
| Methylene chloride | 22 | 21000 | ND | 3 J | 3 J | 3 J | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 120 J | 86 J | 130 J | 250 J | 320 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NA - Not analyzed
ND - Analyte not detected.

9/11/02
SWMU285_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU285-TW02-02 03-03-2002 3' - 5' | SWMU285-TW03-03 03-26-2002 5' - 7' |
|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | |
| Acetone | 2810 | 6200000 | ND | NA |
| Methylene chloride | 22 | 21000 | 14 | NA |
| **SEMIVOLATILES (ug/kg)** | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | ND | 160 J |

Underlined - Exceeds NC DENR so
Boxed - Exceeds USEPA Regi
J - Analyte detected. Rep
NA - Not analyzed
ND - Analyte not detected.

9/11/02
SWMU285_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Acetone | 2810 | 6200000 | 4/5 | 21 J - 57 J | NA | NA | 0 | 0 |
| Methylene chloride | 22 | 21000 | 4/5 | 3 J - 14 | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 6/7 | 86 J - 320 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | SWMU285-TW01 04-05-2002 | SWMU285-TW02 04-05-2002 | SWMU285-TW03 04-05-2002 |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | 0.8 J | ND | ND |

J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

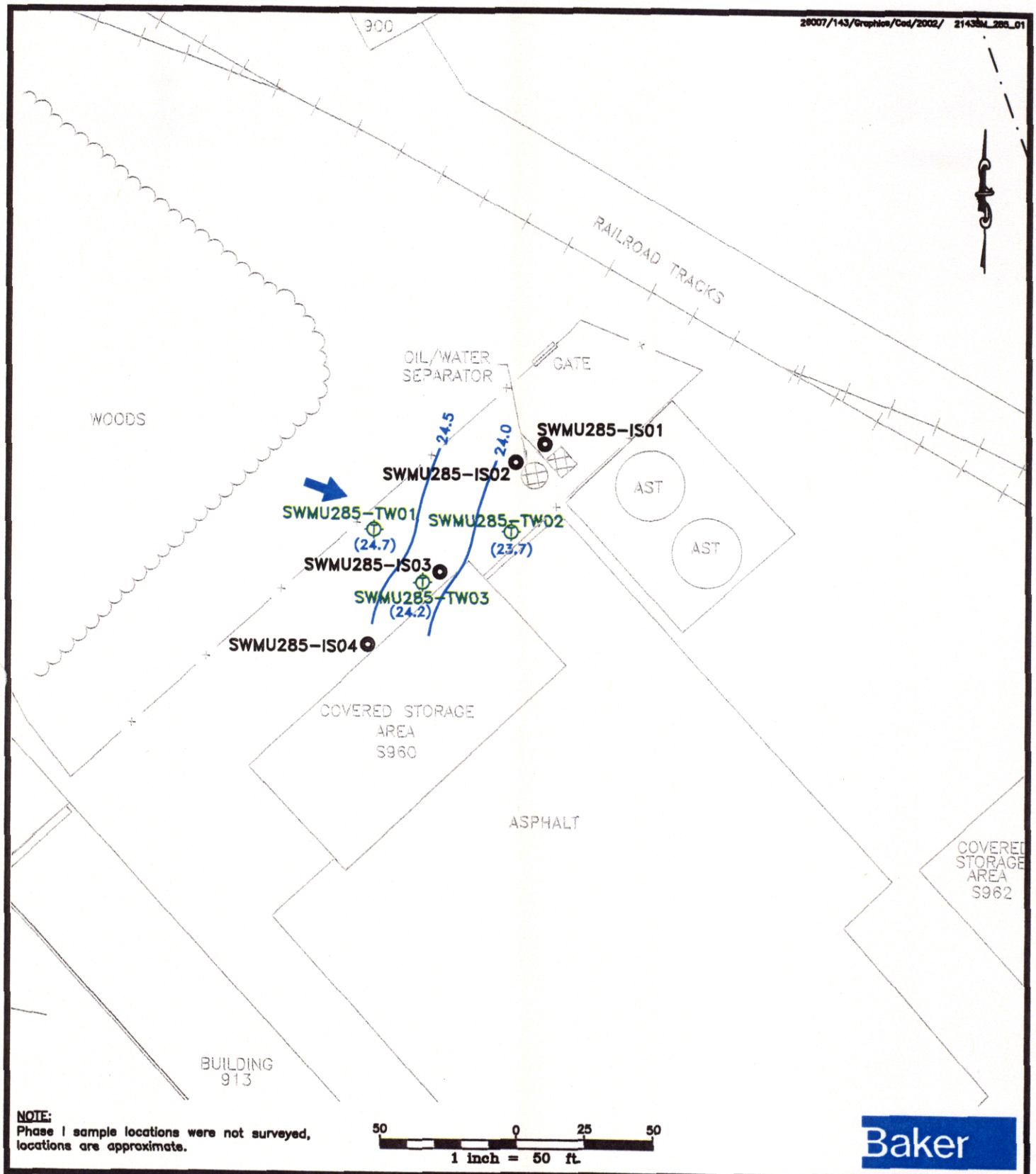
9/3/02
SWMU285_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 285
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| bis(2-Ethylhexyl)phthalate | 3 | 1/3 | 0.8 J | NA | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.



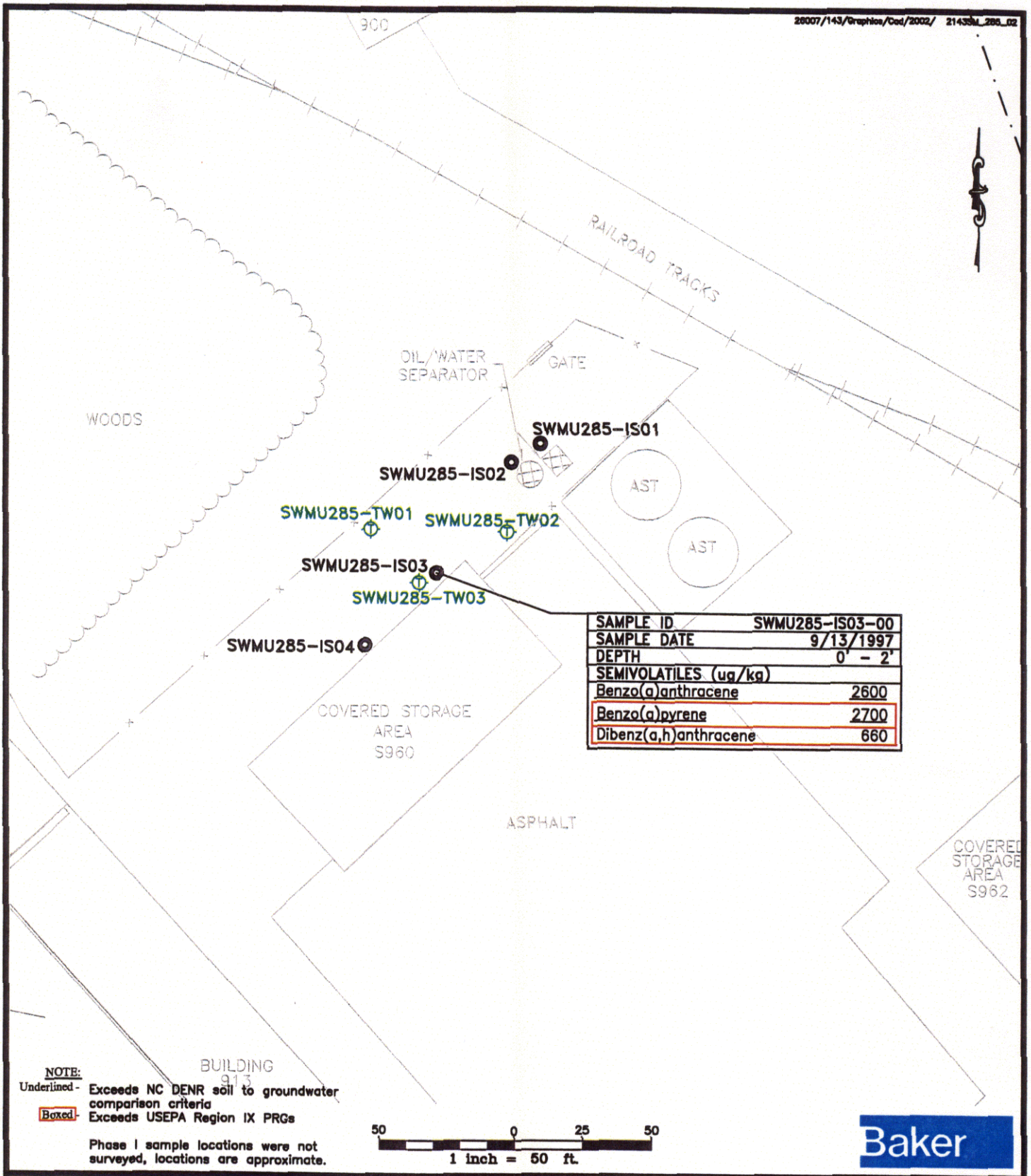

**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 24.5 – GROUNDWATER CONTOUR
- FENCE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 285
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 24.5 – GROUNDWATER CONTOUR
- FENCE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
# PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 285
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.15 SWMU 291 - 034 Ditch

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.15.1 SWMU Description and History

SWMU 291 is located on Dogwood Street behind Building 1450 in the Hadnot Point Industrial Area. Cogdel's Creek is located approximately 425 feet south of the SWMU. The SWMU is a stormwater drainage ditch which historically received runoff from Building 1450 and the associated oil/water separator. During the Phase I CSI, it was noted that a portion of the original ditch had been backfilled during recent construction activities. The new construction at the site had resulted in the removal and re-distribution of soils surrounding the SWMU. The area surrounding the SWMU is covered with grass and trees. A SWMU investigation plan is presented as Figure 1.

The Phase 1 investigation was conducted in September 1997. The purpose of the investigation was to determine if soils in the vicinity of the SWMU and surface water/sediment in the drainage ditch have been impacted by runoff from Building 1450 and the associated oil/water separator. Soil samples were collected from two soil borings that were advanced between the parking lot and Building 1450. In addition, one surface water sample and two sediment samples were collected from the portion of the drainage ditch that had not been backfilled by construction activities.

The samples were submitted to Quanterra Laboratories and analyzed for VOCs, pesticides, PCBs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. The analytical results for surface water and sediment samples were compared to NC DENR surface water and sediment screening criteria. Based on evaluation of the analytical results chromium concentrations in soil exceeded the regulatory driven criteria and established background/secondary screening criteria. In addition, VOCs, SVOCs, pesticides and/or metals exceeded the regulatory driven criteria and in surface water and sediment. Therefore, additional investigation at SWMU 291 was recommended in the form of a Phase II CSI. Corrective measures were conducted at the SWMU by IT Corporation in 2001 and included the removal of contaminated sediment from the drainage ditch. As a result, the Phase II CSI was focused in the vicinity of soil boring SWMU291-IS01.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.15.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and April 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 10.3 to 15.0 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 10.3 to 10.4 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southeast.

### 4.15.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results are included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Five metals were detected in the surface soil sample set, as follows: barium, cadmium, chromium, lead, and mercury. There were three detections of mercury that exceed the NC DENR soil to groundwater comparison criteria, however, these concentrations were not above the AOC or Base screening criteria.

Seven metals were detected in the subsurface soil samples, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Most of the metals exceeded the background criteria in one or more of the samples. Arsenic and chromium were detected above the AOC and Base background criteria and NC DENR soil to groundwater criteria or USEPA Region IX PRGs. Mercury was detected above the NC DENR soil to groundwater criteria but the concentrations were below the AOC and Base background screening criteria and USEPA Region IX industrial PRGs. None of the other detected metals exceeded the NC DENR soil to groundwater criteria of USEPA Region IX PRGs.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, cadmium, chromium, lead, selenium and silver. Cadmium, lead, and selenium exceeded the Base background screening criteria, in sample SWMU291-GW03; however, the concentrations were below the 2L standards. Also in sample SWMU291-GW03, arsenic exceeded the Base background criteria and 2L standard. None of the other metals detected in the samples exceeded the established screening criteria.

All of the metals detected in groundwater (except for silver) were also detected in soil samples at the SWMU. Although arsenic was detected above the screening criteria in the groundwater sample from TW03, it was not detected in the soil samples from this same well.

### 4.15.4 Conclusions

A few metals were detected in soil and/or groundwater at concentrations exceeding applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria, NC DENR soil to groundwater screening criteria, and/or USEPA Region IX industrial PRGs in soil are as follows:

- Metals - arsenic and chromium

Compounds that exceeded the Base background screening criteria and 2L standards in groundwater are as follows:

- Metals - arsenic

Based on evaluation of the results, no further action is warranted at SWMU 291 because distribution of COPCs appears to be isolated, anomalous detects reported during Phase I in 1997. The SWMU was a former drainage ditch and surface soil contamination could be expected if there was a release from the SWMU. Furthermore, the SWMU emptied into a ponded area which was remediated under Interim Measures conducted in January, 2001. Therefore, the suspected source of contamination has been removed.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU291-TW01 | 3/24/02 | BAKER | 25.40 | 25.4 | 20 | 20 | 8 | 6 | 10 | 15 | 10.4 |
| SWMU291-TW02 | 3/24/02 | BAKER | 23.40 | 23.7 | 15 | 15 | 2.9 | 1.5 | 5 | 13 | 10.4 |
| SWMU291-TW03 | 3/24/02 | BAKER | 20.58 | 20.6 | 12 | 12 | 0.5 | 0 | 2 | 10.25 | 10.3 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU291

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU291-IS01-00 09-13-1997 0' - 2' | SWMU291-IS02-00 09-13-1997 0' - 2' | SWMU291-TW01-00 03-24-2002 0' - 1' | SWMU291-TW02-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 36 | 17 | 848 | 100000 | **23.8** | ND | 7.5 | 11.5 |
| Cadmium | 2.4 | 0.05 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 27 | 15 | 27 | 450 | 7.1 | 6.4 | 4.9 | 5.2 |
| Lead | 25 | 21 | 270 | 750 | 17.6 | 13.7 | 3.6 | 3.6 |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | ND | ND | 0.023 J | 0.023 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU291-TW03-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Barium | 36 | 17 | 848 | 100000 | 14.9 |
| Cadmium | 2.4 | 0.05 | 2.7 | 810 | **0.055** J |
| Chromium | 27 | 15 | 27 | 450 | 6.4 |
| Lead | 25 | 21 | 270 | 750 | 14.7 |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | 0.049 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 36 | 17 | 848 | 100000 | 4/5 | 7.5 - 23.8 | 0 | 1 | 0 | 0 |
| Cadmium | 2.4 | 0.05 | 2.7 | 810 | 1/5 | 0.055 J | 0 | 1 | 0 | 0 |
| Chromium | 27 | 15 | 27 | 450 | 5/5 | 4.9 - 7.1 | 0 | 0 | 0 | 0 |
| Lead | 25 | 21 | 270 | 750 | 5/5 | 3.6 - 17.6 | 0 | 0 | 0 | 0 |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | 3/5 | 0.023 J - 0.049 J | 0 | 0 | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 7 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU291-IS01-04 09-13-1997 8' - 10' | SWMU291-IS02-04 09-13-1997 8' - 10' | SWMU291-TW01-04 03-24-2002 7' - 9' | SWMU291-TW02-04 03-24-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 2.7 | 11.3 | **2.7** | ND | ND |
| Barium | 19 | 22 | 848 | 100000 | 37.3 | ND | 13.4 | 19.8 |
| Cadmium | 0.87 | 0.01 | 2.7 | 810 | ND | ND | ND | **0.058** J |
| Chromium | 27 | 16 | 27 | 450 | 43.3 | 11.2 | 5.8 | 8.2 |
| Lead | 15 | 8.2 | 270 | 750 | **11.3** | 4.7 | 7.1 | **15.6** |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | ND | ND | 0.032 J | 0.048 J |
| Selenium | 0.67 | 0.69 | 12 | 10000 | 0.95 | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU291_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU291-TW03-04 03-24-2002 7' - 9' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 2.7 | ND |
| Barium | 19 | 22 | 848 | 100000 | 12.7 |
| Cadmium | 0.87 | 0.01 | 2.7 | 810 | ND |
| Chromium | 27 | 16 | 27 | 450 | 4.8 |
| Lead | 15 | 8.2 | 270 | 750 | 8 J |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | 0.041 J |
| Selenium | 0.67 | 0.69 | 12 | 10000 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU291_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 2.7 | 2/5 | 2.7 - 11.3 | 1 | 2 | 1 | 1 |
| Barium | 19 | 22 | 848 | 100000 | 4/5 | 12.7 - 37.3 | 2 | 1 | 0 | 0 |
| Cadmium | 0.87 | 0.01 | 2.7 | 810 | 1/5 | 0.058 J | 0 | 1 | 0 | 0 |
| Chromium | 27 | 16 | 27 | 450 | 5/5 | 4.8 - 43.3 | 1 | 1 | 1 | 0 |
| Lead | 15 | 8.2 | 270 | 750 | 5/5 | 4.7 - 16.3 J | 1 | 2 | 0 | 0 |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | 3/5 | 0.032 J - 0.048 J | 0 | 0 | 3 | 0 |
| Selenium | 0.67 | 0.69 | 12 | 10000 | 1/5 | 0.95 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 7 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU291-TW01 04-09-2002 | | SWMU291-TW02 04-09-2002 | | SWMU291-TW03 04-09-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | ND | | ND | | 23.6 | |
| Barium | 145 | 2000 | 42.5 | | 97.8 | J | 137 | J |
| Cadmium | 0.23 | 5 | ND | | ND | | 0.64 | J |
| Chromium | 5.8 | 50 | ND | | 1 | J | 1.9 | J |
| Lead | 3.6 | 15 | ND | | 2.1 | J | 3.9 | J |
| Selenium | 2.8 | 50 | 2.3 | J | 2.7 | J | 4.4 | J |
| Silver | 0.74 | 18 | ND | | ND | | 0.5 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

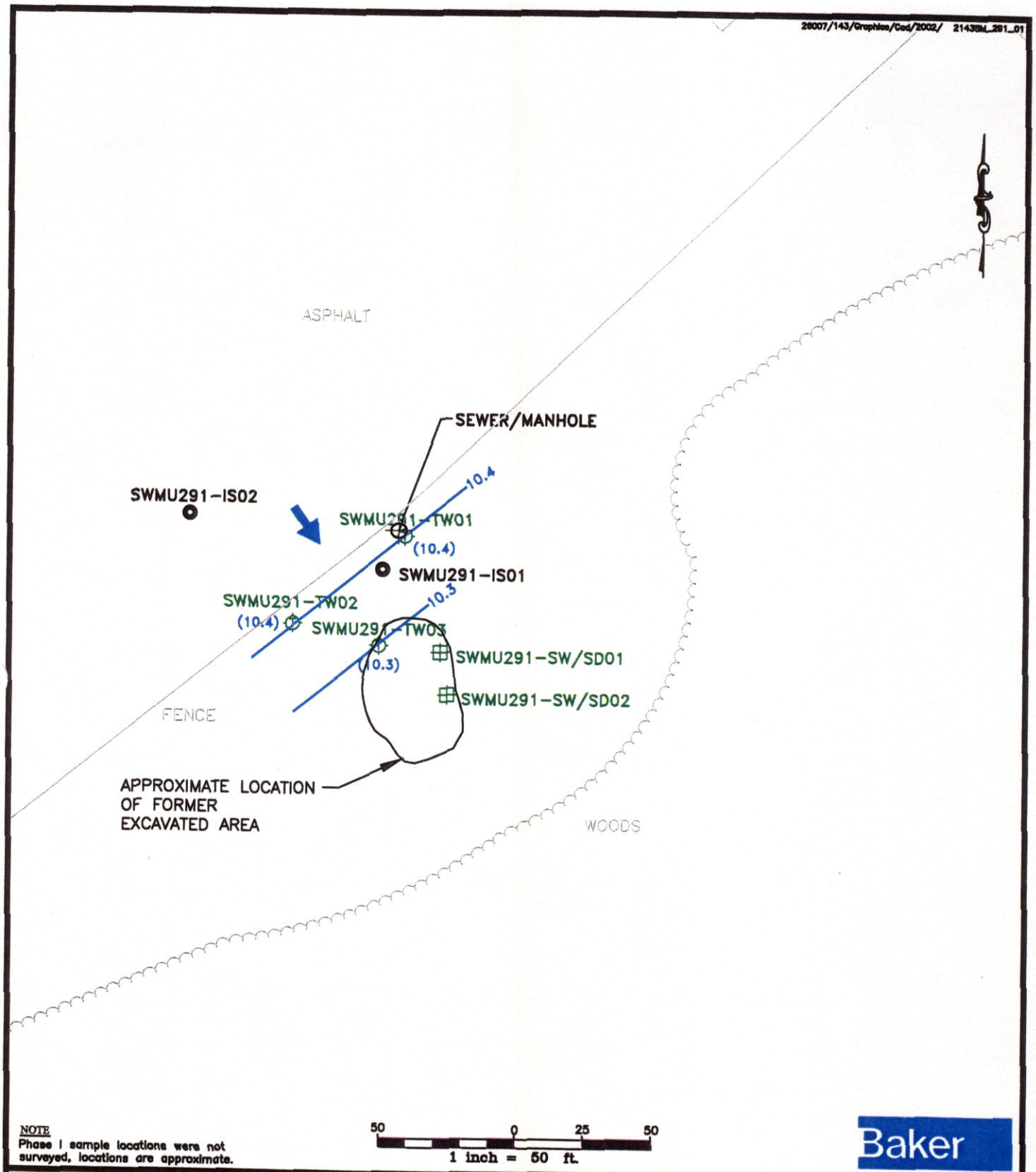
8/29/02
SWMU291_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 291
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 1/3 | 23.6 | 1 | 1 |
| Barium | 145 | 2000 | 3/3 | 42.5 - 137 J | 0 | 0 |
| Cadmium | 0.23 | 5 | 1/3 | 0.64 J | 1 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 1 J - 1.9 J | 0 | 0 |
| Lead | 3.6 | 15 | 2/3 | 2.1 J - 3.9 J | 1 | 0 |
| Selenium | 2.8 | 50 | 3/3 | 2.3 J - 4.4 J | 1 | 0 |
| Silver | 0.74 | 18 | 1/3 | 0.5 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE
Phase I sample locations were not surveyed, locations are approximate.

Baker

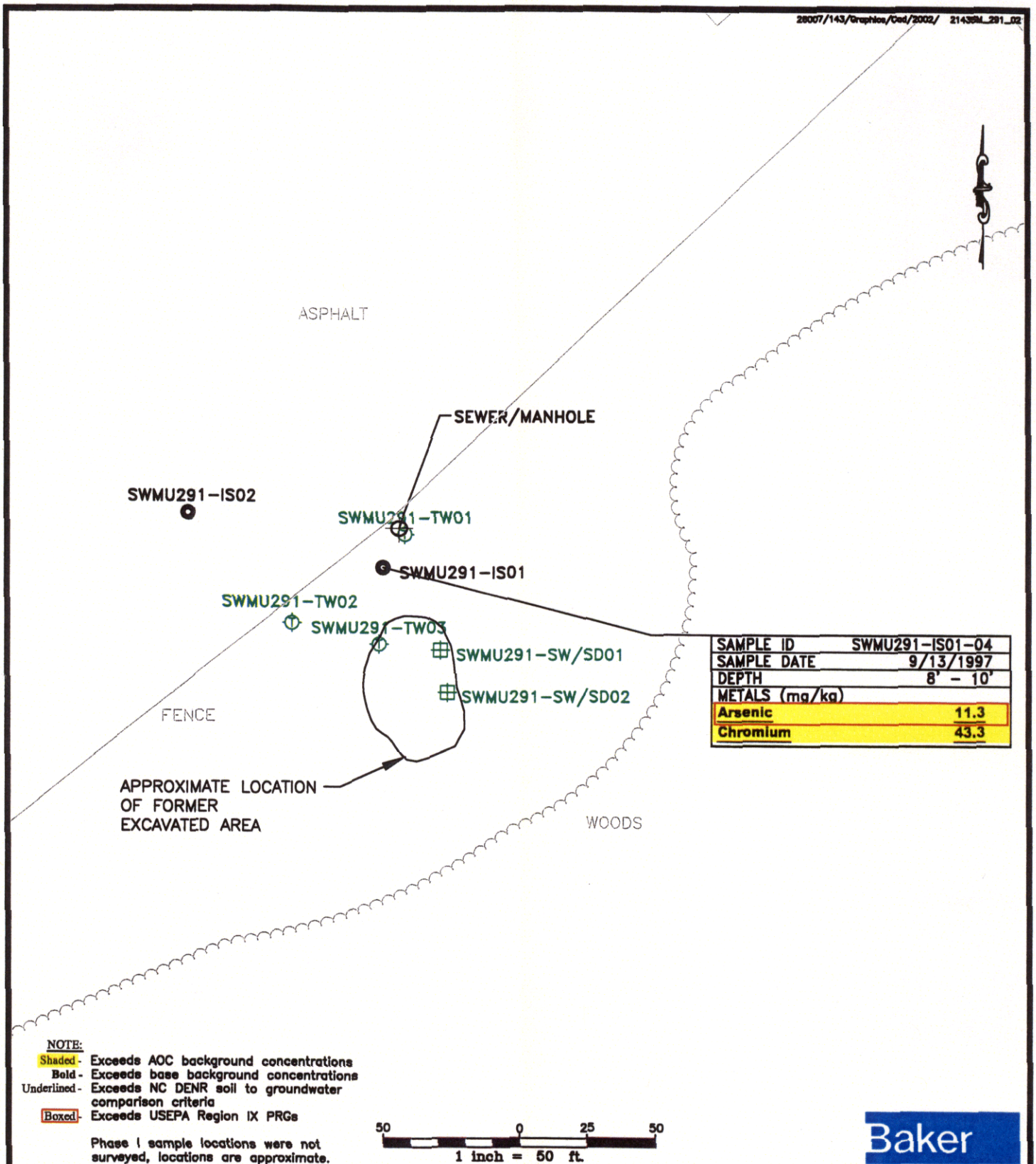
## LEGEND

- TEMPORARY WELL
- PHASE I SURFACE WATER/ SEDIMENT SAMPLE LOCATION
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 10.3 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 291
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753FB174

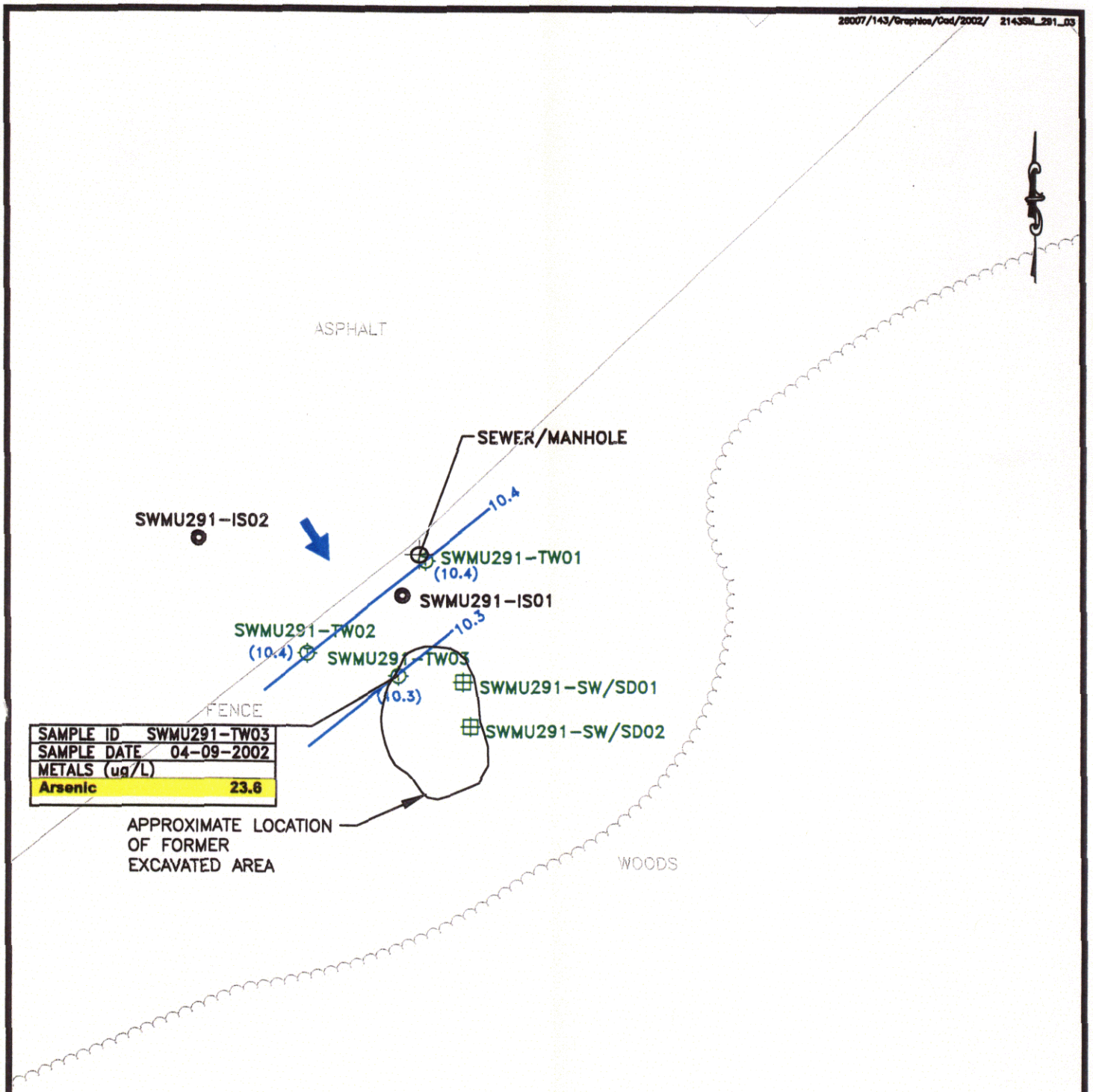



## LEGEND

- TEMPORARY WELL
- PHASE I SURFACE WATER/ SEDIMENT SAMPLE LOCATION
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 291
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

## LEGEND

- TEMPORARY WELL
- PHASE I SURFACE WATER/ SEDIMENT SAMPLE LOCATION
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 10.3 - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 291
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.16 SWMU 293 (1106/1107 Oil/Water Separator)

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.16.1 SWMU Description and History

SWMU 293 is a poured concrete in-ground oil/water separator with baffles that has been in operation since 1980. The outlet for the oil/water separator is connected to the wastewater treatment plant. The oil/water separator contains waste oil, antifreeze, and possibly solvents. During the site visit conducted by Baker in 1996, oil was observed in the grit chambers of the oil/water separator, and the wash pad was stained and cracked. It is suspected that solvents used for degreasing may have been disposed through the oil/water separator. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Soil samples were collected from three soil borings that were advanced in the vicinity of the SWMU (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background concentrations, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, lead exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 293 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.16.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 8.1 to 9.7 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 20.0 to 20.1 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northwest.

### 4.16.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Six metals were detected in the surface soil sample set, as follows: barium, cadmium, chromium, lead, mercury, and silver. The majority of the metals detected exceeded the established background screening criteria. Mercury exceeded the AOC background screening criteria and/or the NC DENR soil to groundwater screening criteria in three of the surface soil samples. However, concentrations did not exceed the USEPA Region IX industrial PRG or the Base background criteria. Lead exceeded the AOC and Base background screening criteria, and the NC DENR soil to groundwater screening criteria in surface soil sample SWMU293-IS02-00, which was collected during the Phase I CSI conducted in September 1997. None of the other detected metals exceeded the NC DENR soil to groundwater screening criteria or USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Four metals were detected in the groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium and lead. Arsenic was detected above the background criteria and the 2L Standards in sample SWMU293-GW03. Chromium and lead also were detected above the background criteria in this sample; however, the concentrations were below the 2L standards. It should be noted that the elevated concentrations of metals detected in sample SWMU293-GW03 may be attributable to the turbidity of the sample, which was 503 NTU.

All of the metals detected in the groundwater (except arsenic) were detected in soils at the SWMU.

### 4.16.4 Conclusions

A few metals were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Lead was the only metal that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil.

Arsenic was the only metal that exceeded the Base background screening criteria and 2L standards in groundwater.

Based on evaluation of the analytical results, additional investigation at SWMU 293 is warranted with respect to lead in the surface soil. The additional investigation activities are presented in Section 5.0. In addition, the origin of arsenic in groundwater should be investigated because it was detected above the screening criteria in groundwater but was not detected in soils.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU293-TW01 | 3/22/02 | BAKER | 29.71 | 29.5 | 16 | 16 | 4 | 2 | 5.9 | 9.68 | 20.0 |
| SWMU293-TW02 | 3/22/02 | BAKER | 29.65 | 29.4 | 16 | 16 | 4 | 2 | 6 | 9.69 | 20.0 |
| SWMU293-TW03 | 3/22/02 | BAKER | 28.21 | 28.7 | 15 | 15 | 3 | 1 | 5 | 8.11 | 20.1 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU293

TAB

DETECTION SUMMARY
SURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU293-IS01-00 09-14-1997 0' - 2' | SWMU293-IS02-00 09-14-1997 0' - 2' | SWMU293-IS03-00 09-14-1997 0' - 2' | SWMU293-TW01-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 12 | 17 | 848 | 100000 | ND | 41.5 | ND | 9.4 |
| Cadmium | 0.06 | 0.05 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 6.4 | 15 | 27 | 450 | 12 | 10.6 | 9.1 | 5 J |
| Lead | 20 | 21 | 270 | 750 | **66** | **295** | **26.2** | 19.6 |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 0.043 | 0.045 | 0.04 | 0.04 J |
| Silver | 0.04 | 0.07 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TAB

DETECTION SUMMARY
SURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU293-TW02-00 03-22-2002 0' - 1' | | SWMU293-TW03-00 03-22-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 12 | 17 | 848 | 100000 | 14.4 | | **26.9** | |
| Cadmium | 0.06 | 0.05 | 2.7 | 810 | **0.75** | | **0.35** | J |
| Chromium | 6.4 | 15 | 27 | 450 | 4.7 | | 8.8 | |
| Lead | 20 | 21 | 270 | 750 | **23.8** | J | **103** | J |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 0.04 | | 0.07 | |
| Silver | 0.04 | 0.07 | 12 | 10000 | ND | | **0.24** | J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TAB

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 12 | 17 | 848 | 100000 | 4/6 | 9.4 - 41.5 | 3 | 2 | 0 | 0 |
| Cadmium | 0.06 | 0.05 | 2.7 | 810 | 2/6 | 0.35 J - 0.75 | 2 | 2 | 0 | 0 |
| Chromium | 6.4 | 15 | 27 | 450 | 6/6 | 4.7 - 12 | 4 | 0 | 0 | 0 |
| Lead | 20 | 21 | 270 | 750 | 6/6 | 19.6 - 295 | 5 | 5 | 1 | 0 |
| Mercury | 0.04 | 0.1 | 0.015 | 610 | 6/6 | 0.04 - 0.07 | 3 | 0 | 6 | 0 |
| Silver | 0.04 | 0.07 | 12 | 10000 | 1/6 | 0.24 J | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 6 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU293-IS01-03 09-14-1997 6' - 8' | SWMU293-IS01-03D 09-14-1997 6' - 8' | SWMU293-IS02-03 09-14-1997 6' - 8' | SWMU293-IS03-02 09-14-1997 4' - 6' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 10 | 22 | 848 | 100000 | ND | ND | ND | ND |
| Chromium | 11 | 16 | 27 | 450 | 4.5 | 4.1 | 3.2 | 9.4 |
| Lead | 6.9 | 8.2 | 270 | 750 | 6.6 | 6.4 | 2.7 | **20.8** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

8/29/02
SWMU293a_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU293-TW01-04 03-22-2002 7' - 9' | SWMU293-TW02-04 03-22-2002 7' - 9' | SWMU293-TW03-03 03-22-2002 5' - 7' |
|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | |
| Barium | 10 | 22 | 848 | 100000 | ND | 3.1 | 4.6 |
| Chromium | 11 | 16 | 27 | 450 | 3.5 J | 3.4 | 5 |
| Lead | 6.9 | 8.2 | 270 | 750 | 2.1 | 2.3 J | 2.8 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

8/29/02
SWMU293a_SOIL.xls

TAB

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 10 | 22 | 848 | 100000 | 2/7 | 3.1 - 4.6 | 0 | 0 | 0 | 0 |
| Chromium | 11 | 16 | 27 | 450 | 7/7 | 3.2 - 9.4 | 0 | 0 | 0 | 0 |
| Lead | 6.9 | 8.2 | 270 | 750 | 7/7 | 2.1 - 20.8 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 6 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU293-TW01 04-05-2002 | | SWMU293-TW02 04-05-2002 | | SWMU293-TW03 04-05-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | 6.7 | J | 3.7 | J | **20.6** | |
| Barium | 145 | 2000 | 16.8 | | 13.6 | | 32.7 | |
| Chromium | 5.8 | 50 | 4.3 | J | 2.8 | J | 16.1 | |
| Lead | 3.6 | 15 | 2.5 | J | ND | | 9.2 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

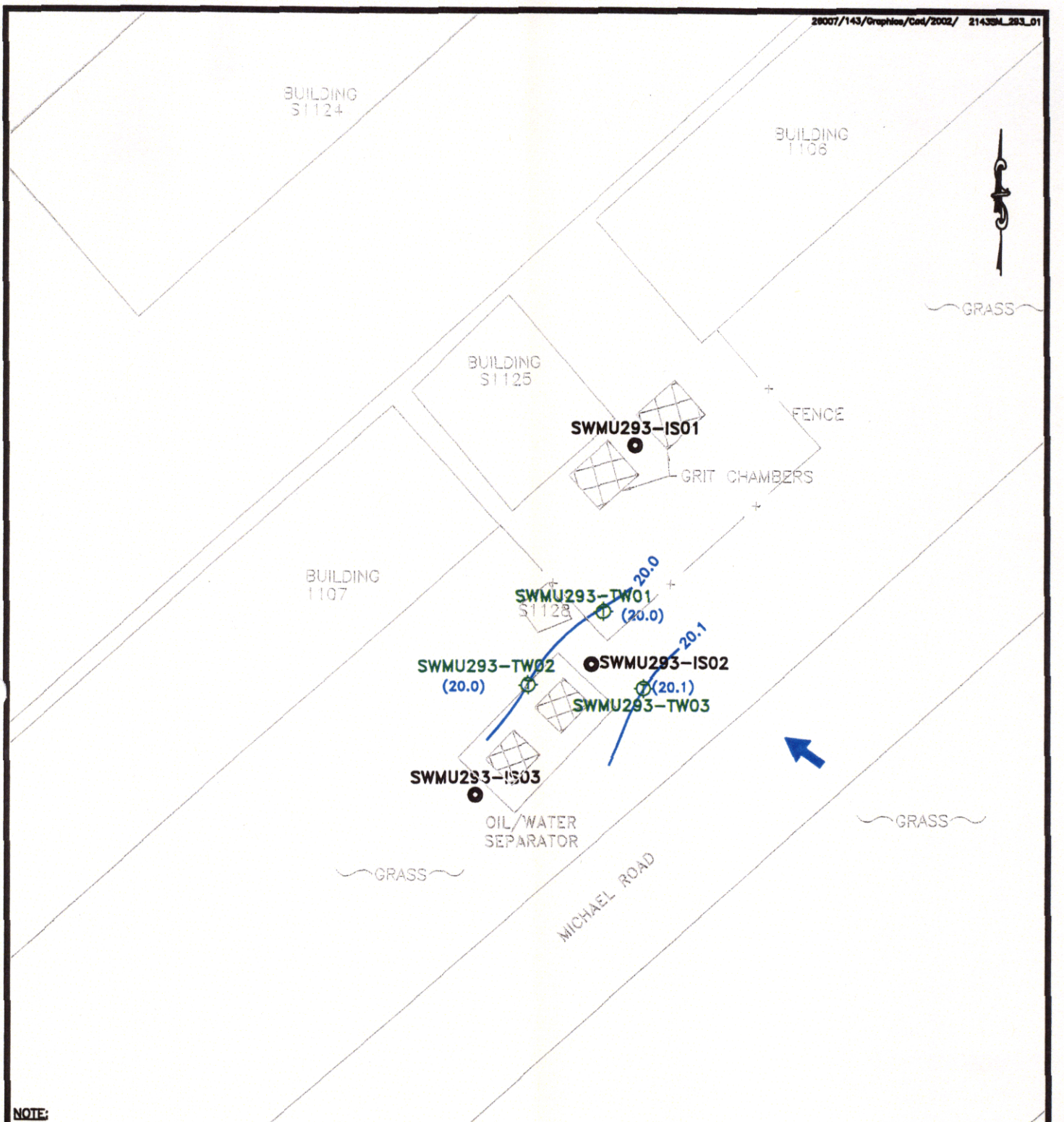
8/29/02
SWMU293_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 293
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 3/3 | 3.7 J - 20.6 | 1 | 1 |
| Barium | 145 | 2000 | 3/3 | 13.6 - 32.7 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 2.8 J - 16.1 | 1 | 0 |
| Lead | 3.6 | 15 | 2/3 | 2.5 J - 9.2 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

25 0 12.5 25
1 inch = 25 ft.

Baker

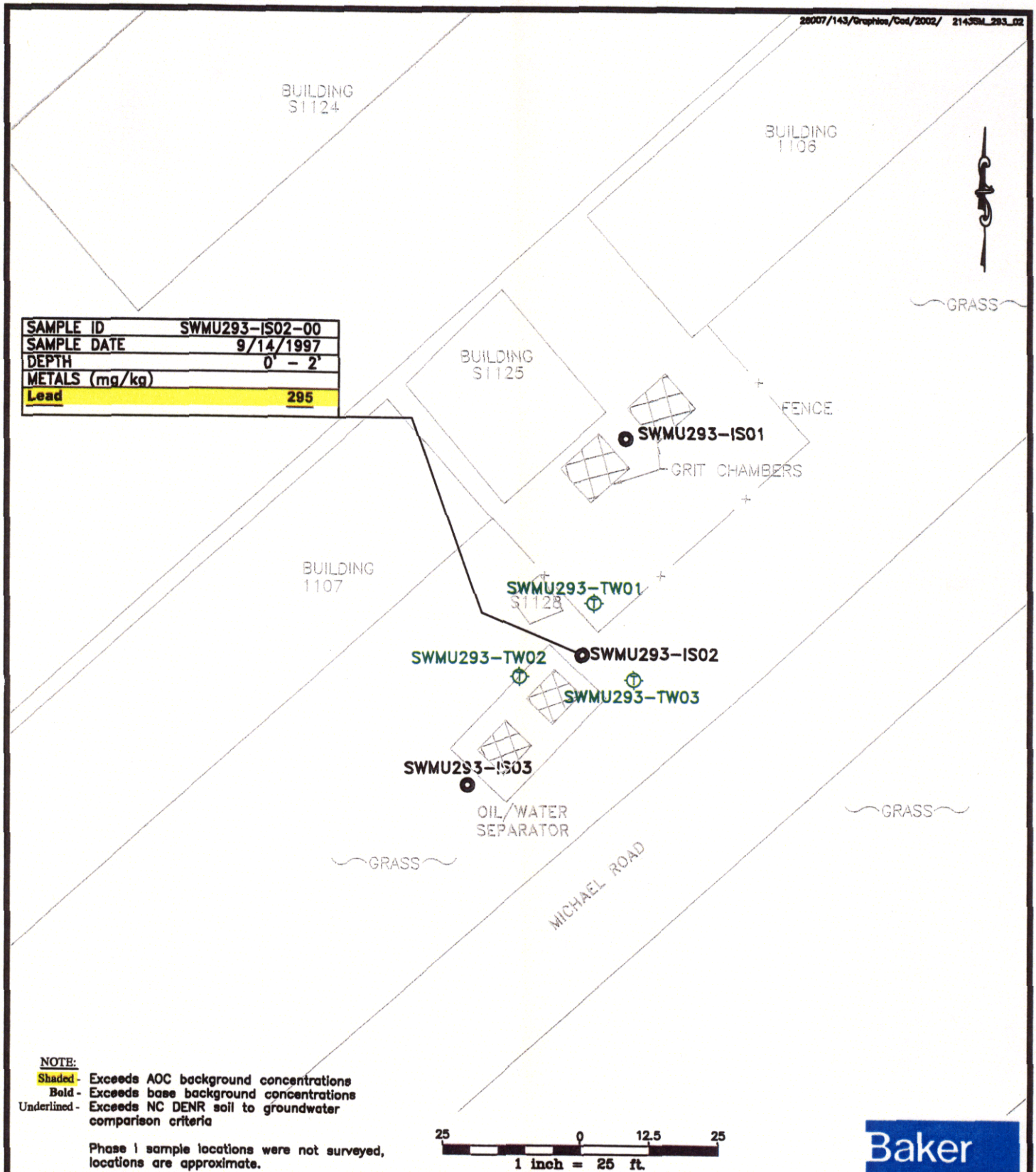
## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 20.1 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 293
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03752E B18V




| SAMPLE ID | SWMU293-IS02-00 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Lead** | **295** |

NOTE:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Phase I sample locations were not surveyed, locations are approximate.

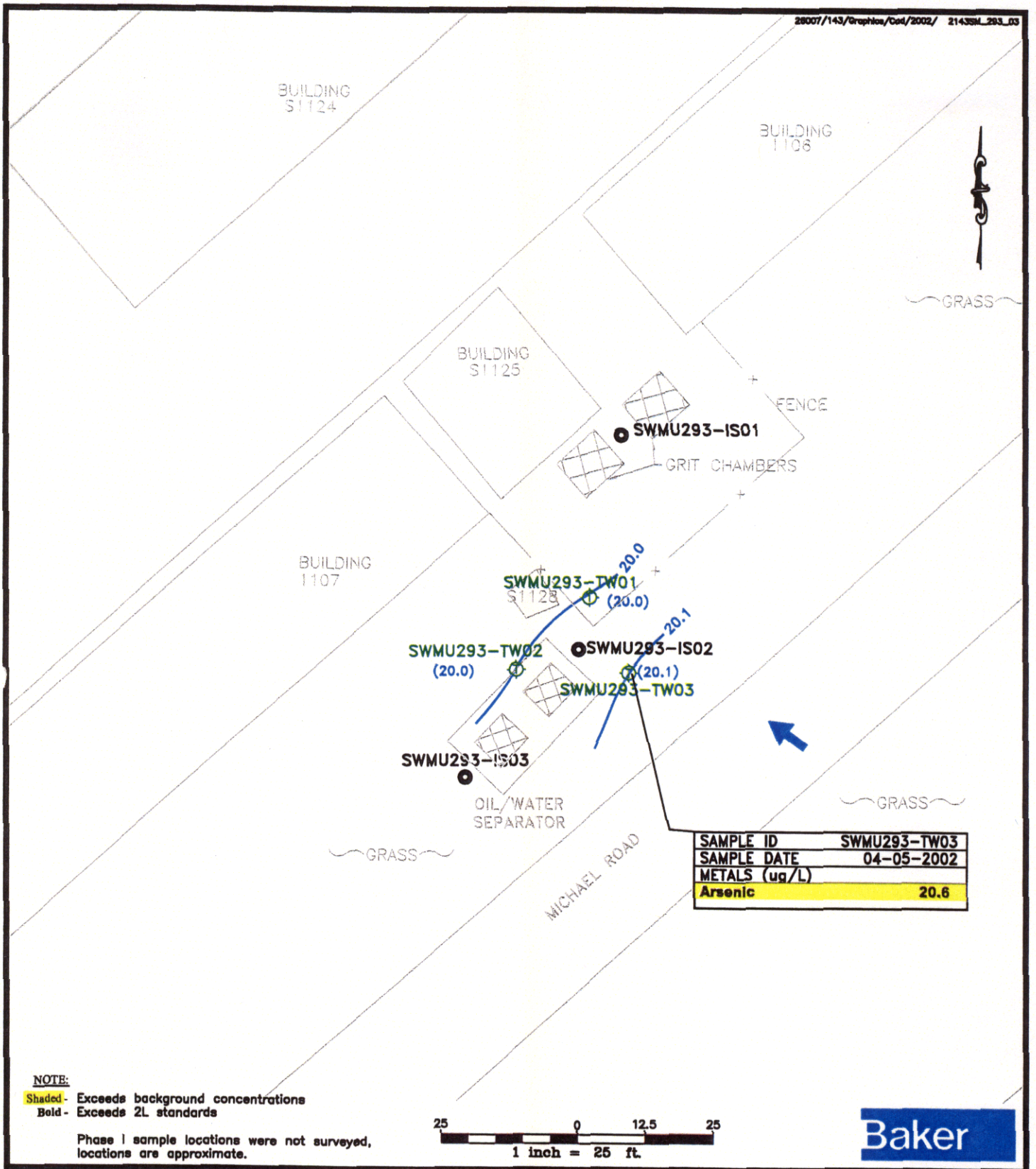
Baker

LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 293
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

25 0 12.5 25
1 inch = 25 ft.

Baker

LEGEND
- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
—20.1— - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 293
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.17 SWMU 294 -1203 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.17.1 SWMU Description and History

SWMU 294 is a concrete oil/water separator and grit chamber located in the Hadnot Point industrial area south of Hammond Road between Birch and Cedar Streets. The SWMU collects water, soap, oil, grease, and dirt from the vehicle wash rack located between Buildings 1203 and 1204. The liquids are channeled to a collection basin and then transported to the grit chamber via underground piping. After passing over a series of baffles, the liquids are transported to the oil/water separator and segregated. The vehicle wash area is covered with concrete; however, the area surrounding the SWMU is covered with grass. A drainage ditch is located adjacent to the SWMU. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the wash area and oil/water separator have impacted surface and subsurface soils in the vicinity of the SWMU. Soil samples were collected from six soil borings that were advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX Residential PRGs. Based on evaluation of the analytical results, benzo(a)pyrene and mercury exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 294 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I data should be re-evaluated against the industrial PRGs.

### 4.17.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and 24 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at six temporary well borings
- Surface soil sampling at three locations along the drainage ditch
- Groundwater sampling at six temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the six wells at a depth of approximately 9.7 to 11.0 feet below the ground surface. Groundwater elevations in the well were 19.0 feet. The groundwater flow direction at the SWMU could not be determined because the groundwater elevations in the six wells were the same.

### 4.17.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 though 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Fifteen SVOCs (mostly PAHs) were detected in the surface soil sample set. Benzo(a)pyrene was detected at a concentration exceeding the NC DENR soil to groundwater screening criteria and USEPA Region IX industrial PRG in sample SWMU294-SS02-00, which was collected from the drainage ditch adjacent to the SWMU. Bis-2-ethylhexylphthalate was detected at concentration above the NC DENR soil to groundwater screening criteria in sample SWMU294-TW06-00. None of the other SVOCs detected in the surface soil samples exceeded the applicable screening criteria. No SVOCs were detected in the subsurface soil sample.

All eight RCRA metals were detected in the surface soil sample set. Most of the metals exceeded the Base and/or AOC background screening criteria. Mercury exceeded the NC DENR soil to groundwater screening criteria in one sample, SWMU294-IS02-00. None of the other metals detected in the surface soil samples exceeded the NC DENR soil to groundwater criteria or the USEPA Region IX industrial PRGs.

Five metals were detected in the subsurface soil sample set, as follows: arsenic, barium, chromium, lead and selenium. Arsenic was the only metal that exceeded the AOC and Base background criteria. There were not any exceedances of the USEPA Region IX industrial PRGs NC DENR soil to groundwater screening criteria.

Groundwater

The analytical results and statistical summary for positive detentions are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

One SVOC (4-methylphenol) was detected in the groundwater sample from well SWMU294-TW03. The concentration was below the 2L standard. No other SVOCs that were detected in the groundwater samples. It should be noted that 4-Methylphenol was not detected in any of the soil samples.

Three metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, and lead. None of the concentrations exceeded the established screening criteria. These three metals were also detected in the soil samples.

### 4.17.4 Conclusions

Several SVOCs and metals were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene and bis(2-ethylhexyl)phthalate
- Metals - mercury

There were no SVOCs or metals that exceeded the Base background screening criteria or the 2L standards in groundwater.

The constituents were detected in surface soil samples collected during the investigation of this SWMU. These samples were collected along a drainage ditch which could have multiple sources including roadway and parking lot run-off or an upgradient source. The constituents detected in these samples could be indicative of several sources including those previously mentioned in this paragraph. Therefore, no further action is warranted at SWMU 294.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU294-TW01 | 3/22/02 | BAKER | 28.90 | 29.1 | 18 | 18 | 6 | 4.5 | 8 | 9.95 | 19.0 |
| SWMU294-TW02 | 3/24/02 | BAKER | 29.87 | 30.1 | 18 | 18 | 6 | 4.5 | 8 | 10.9 | 19.0 |
| SWMU294-TW03 | 3/24/02 | BAKER | 30.04 | 30.2 | 18 | 18 | 6 | 4.5 | 8 | 11 | 19.0 |
| SWMU294-TW04 | 3/22/02 | BAKER | 29.56 | 29.7 | 18 | 18 | 6 | 4.5 | 8 | 10.6 | 19.0 |
| SWMU294-TW05 | 3/22/02 | BAKER | 28.77 | 29.2 | 18 | 18 | 6 | 4.5 | 8 | 9.8 | 19.0 |
| SWMU294-TW06 | 3/22/02 | BAKER | 28.62 | 28.8 | 18 | 18 | 6 | 4.5 | 8 | 9.65 | 19.0 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-IS01-00 09-12-1997 0' - 2' | SWMU294-IS02-00 09-12-1997 0' - 2' | SWMU294-IS03-00 09-12-1997 0' - 2' | SWMU294-IS04-00 09-12-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 142 (1) | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1800 (2) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 18000 (2) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 10400 (1) | 180000 | ND | 250 J | ND | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | 46 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.54 | 1.3 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 12 | 23 | 848 | 100000 | ND | 25.7 | ND | 22.3 |
| Cadmium | 0.06 | 0.04 | 2.7 | 810 | ND | ND | ND | **0.53** |
| Chromium | 6.4 | 12 | 27 | 450 | 5.4 | 10.5 | 5.4 | 11.3 |
| Lead | 20 | 26 | 270 | 750 | 12.8 | 36.1 | 33.7 | **89.9** |
| Mercury | 0.04 | 0.13 | 0.015 | 610 | 0.059 | 0.16 | 0.036 | 0.068 |
| Selenium | 0.42 | 2.9 | 12 | 10000 | ND | ND | ND | ND |
| Silver | 0.04 | 0.07 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1559 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1559mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-IS05-00 09-12-1997 0' - 2' | SWMU294-IS06-00 09-12-1997 0' - 2' | SWMU294-SS01-00 03-22-2002 0' - 1' | SWMU294-SS02-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | 31 J |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | 72 J | 83 J | 330 J |
| Benzo(a)pyrene | NE | NE | 142 (1) | 290 | ND | 71 J | 93 J | 380 |
| Benzo(b)fluoranthene | NE | NE | 1800 (2) | 2900 | ND | 93 J | 140 J | 590 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | 51 J | 59 J | 210 J |
| Benzo(k)fluoranthene | NE | NE | 18000 (2) | 29000 | ND | 68 J | 120 J | 480 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 10400 (1) | 180000 | ND | 120 J | ND | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | 65 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | 94 J | 140 J | 500 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | 80 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | 180 J | 180 J | 870 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | 49 J | 110 J | 390 |
| Phenanthrene | NE | NE | 59600 | NE | ND | 68 J | 59 J | 210 J |
| Pyrene | NE | NE | 286000 | 54000000 | ND | 140 J | 180 J | 830 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.54 | 1.3 | 5.24 | 2.7 | ND | ND | 0.43 J | 0.27 J |
| Barium | 12 | 23 | 848 | 100000 | ND | ND | 26.5 | 25.4 |
| Cadmium | 0.06 | 0.04 | 2.7 | 810 | ND | ND | 1.3 | 1.4 |
| Chromium | 6.4 | 12 | 27 | 450 | 6.5 | 7.4 | 8.4 | 9.7 |
| Lead | 20 | 26 | 270 | 750 | 33.3 | 8.6 | 123 J | 108 J |
| Mercury | 0.04 | 0.13 | 0.015 | 610 | 0.045 | 0.037 | 0.12 | 0.1 |
| Selenium | 0.42 | 2.9 | 12 | 10000 | ND | ND | ND | ND |
| Silver | 0.04 | 0.07 | 0.22 | 10000 | ND | ND | ND | 0.17 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1559 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1559mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-SS03-00 03-22-2002 0' - 1' | SWMU294-TW01-00 03-22-2002 0' - 1' | SWMU294-TW02-00 03-24-2002 0' - 1' | SWMU294-TW03-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 99 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 142 (1) | 290 | 130 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1800 (2) | 2900 | 180 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 74 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 18000 (2) | 29000 | 160 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 10400 (1) | 180000 | 610 | ND | 140 J | ND |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 150 J | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 37 J | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 340 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 140 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 92 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 240 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.54 | 1.3 | 5.24 | 2.7 | 0.89 J | ND | ND | ND |
| Barium | 12 | 23 | 848 | 100000 | 14.3 | 9.7 | 10 J | 7.6 J |
| Cadmium | 0.06 | 0.04 | 2.7 | 810 | **0.41** J | ND | ND | ND |
| Chromium | 6.4 | 12 | 27 | 450 | 7.7 | 2.2 | 3.7 J | 4 J |
| Lead | 20 | 26 | 270 | 750 | **62.7** J | 3 J | 4.6 J | 7.8 J |
| Mercury | 0.04 | 0.13 | 0.015 | 610 | 0.08 | 0.02 J | 0.03 J | 0.05 J |
| Selenium | 0.42 | 2.9 | 12 | 10000 | 0.8 | ND | 0.32 J | 0.4 J |
| Silver | 0.04 | 0.07 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1559 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1559mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-TW04-00 03-22-2002 0' - 1' | | SWMU294-TW05-00 03-22-2002 0' - 1' | | SWMU294-TW06-00 03-22-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | ND | | ND | | ND | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | | ND | | ND | |
| Benzo(a)pyrene | NE | NE | 142 (1) | 290 | ND | | ND | | ND | |
| Benzo(b)fluoranthene | NE | NE | 1800 (2) | 2900 | ND | | ND | | ND | |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | | ND | | ND | |
| Benzo(k)fluoranthene | NE | NE | 18000 (2) | 29000 | ND | | ND | | ND | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 10400 (1) | 180000 | ND | | ND | | 11000 | J |
| Carbazole | NE | NE | NE | 120000 | ND | | ND | | ND | |
| Chrysene | NE | NE | 39800 | 290000 | ND | | ND | | ND | |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | | ND | | ND | |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | | ND | | 38 | J |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | | ND | | ND | |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | | ND | | ND | |
| Phenanthrene | NE | NE | 59600 | NE | ND | | ND | | ND | |
| Pyrene | NE | NE | 286000 | 54000000 | ND | | ND | | ND | |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 0.54 | 1.3 | 5.24 | 2.7 | 0.5 | J | ND | | 0.97 | J |
| Barium | 12 | 23 | 848 | 100000 | 15.8 | | 21.6 | | 13.8 | |
| Cadmium | 0.06 | 0.04 | 2.7 | 810 | 0.03 | J | **0.16** | J | **0.08** | J |
| Chromium | 6.4 | 12 | 27 | 450 | 6.2 | | 4.2 | | 11.4 | |
| Lead | 20 | 26 | 270 | 750 | 38.7 | J | 10.4 | J | 5.3 | J |
| Mercury | 0.04 | 0.13 | 0.015 | 610 | 0.02 | J | 0.02 | J | 0.03 | J |
| Selenium | 0.42 | 2.9 | 12 | 10000 | ND | | ND | | 0.52 | J |
| Silver | 0.04 | 0.07 | 0.22 | 10000 | ND | | ND | | ND | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1559 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1559mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Anthracene | NE | NE | 995000 | 100000000 | 1/15 | 31 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 4/15 | 72 J - 330 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 142 (1) | 290 | 4/15 | 71 J - 380 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 1800 (2) | 2900 | 4/15 | 93 J - 590 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 4/15 | 51 J - 210 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 18000 (2) | 29000 | 4/15 | 68 J - 480 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 10400 (1) | 180000 | 5/15 | 120 J - 11000 | NA | NA | 1 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/15 | 65 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 4/15 | 94 J - 500 | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 2/15 | 37 J - 80 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/15 | 38 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 5/15 | 46 J - 870 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 4/15 | 49 J - 390 | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 4/15 | 68 J - 210 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 3/15 | 140 J - 830 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 0.54 | 1.3 | 5.24 | 2.7 | 5/15 | 0.27 J - 0.97 J | 2 | 0 | 0 | 0 |
| Barium | 12 | 23 | 848 | 100000 | 11/15 | 7.6 J - 26.5 | 8 | 3 | 0 | 0 |
| Cadmium | 0.06 | 0.04 | 2.7 | 810 | 7/15 | 0.03 J - 1.4 | 6 | 6 | 0 | 0 |
| Chromium | 6.4 | 12 | 27 | 450 | 15/15 | 2.2 - 11.4 | 8 | 0 | 0 | 0 |
| Lead | 20 | 26 | 270 | 750 | 15/15 | 3 J - 123 | 8 | 8 | 0 | 0 |
| Mercury | 0.04 | 0.13 | 0.015 | 610 | 15/15 | 0.02 J - 0.16 | 8 | 1 | 15 | 0 |
| Selenium | 0.42 | 2.9 | 12 | 10000 | 4/15 | 0.32 J - 0.8 | 2 | 0 | 0 | 0 |
| Silver | 0.04 | 0.07 | 0.22 | 10000 | 1/15 | 0.17 J | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1559 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1559mg/kg.
AOC comparison - AOC 6 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-IS01-03 09-12-1997 6' - 8' | SWMU294-IS02-03 09-12-1997 6' - 8' | SWMU294-IS03-03 09-12-1997 6' - 8' | SWMU294-IS04-03 09-12-1997 6' - 8' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 10 | 22 | 848 | 100000 | ND | ND | ND | ND |
| Chromium | 11 | 16 | 27 | 450 | 4.4 | 4.3 | 5 | 4.1 |
| Lead | 6.9 | 8.2 | 270 | 750 | 2.6 | 2.4 | 3.2 | 2.3 |
| Selenium | 0.64 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

**No SVOCs were detected in the samples**

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU294_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-IS05-03 09-12-1997 6' - 8' | SWMU294-IS06-03 09-12-1997 6' - 8' | SWMU294-TW01-04 03-22-2002 7' - 9' | SWMU294-TW02-04 03-24-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 10 | 22 | 848 | 100000 | ND | ND | 2.2 | ND |
| Chromium | 11 | 16 | 27 | 450 | 5.7 | 5.8 | 1.5 | 2.8 |
| Lead | 6.9 | 8.2 | 270 | 750 | 4.1 | 3.4 | 1.4 J | 2.1 |
| Selenium | 0.64 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

**No SVOCs were detected in the samples**

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU294-TW03-04 03-24-2002 7' - 9' | | SWMU294-TW04-04 03-22-2002 7' - 9' | | SWMU294-TW05-04 03-22-2002 7' - 9' | | SWMU294-TW06-04 03-22-2002 7' - 9' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | ND | | **1.8** | | ND | | **1.7** | |
| Barium | 10 | 22 | 848 | 100000 | 5.7 | J | 3.1 | | 1.1 | | 4.2 | |
| Chromium | 11 | 16 | 27 | 450 | 6 | J | 3.2 | | 0.99 | | 4.1 | |
| Lead | 6.9 | 8.2 | 270 | 750 | 3.5 | J | 2 | J | 1.3 | J | 2.2 | J |
| Selenium | 0.64 | 0.69 | 12 | 10000 | 0.32 | J | ND | | ND | | ND | |

**No SVOCs were detected in the samples**

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU294_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.6 | 1.6 | 5.24 | 2.7 | 2/12 | 1.7 - 1.8 | 2 | 2 | 0 | 0 |
| Barium | 10 | 22 | 848 | 100000 | 5/12 | 1.1 - 5.7 J | 0 | 0 | 0 | 0 |
| Chromium | 11 | 16 | 27 | 450 | 12/12 | 0.99 - 6 J | 0 | 0 | 0 | 0 |
| Lead | 6.9 | 8.2 | 270 | 750 | 12/12 | 1.3 J - 4.1 | 0 | 0 | 0 | 0 |
| Selenium | 0.64 | 0.69 | 12 | 10000 | 1/12 | 0.32 J | 0 | 0 | 0 | 0 |

**No SVOCs were detected in the samples**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 6 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU294-TW01 04-05-2002 | SWMU294-TW02 04-05-2002 | SWMU294-TW03 04-05-2002 | SWMU294-TW04 04-05-2002 | SWMU294-TW05 04-05-2002 | SWMU294-TW06 04-05-2002 |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 4-Methylphenol | NE | 3.5 | 2 J | ND | 2 J | ND | ND | ND |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 15.7 J | 44.2 J | 24.8 J | 66.4 J | 20.9 J | 25.8 J |
| Chromium | 5.8 | 50 | 3.5 J | 0.96 J | 0.88 J | 1.9 J | 1.4 J | 0.88 J |
| Lead | 3.6 | 15 | 2 J | 2.3 J | ND | ND | ND | ND |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

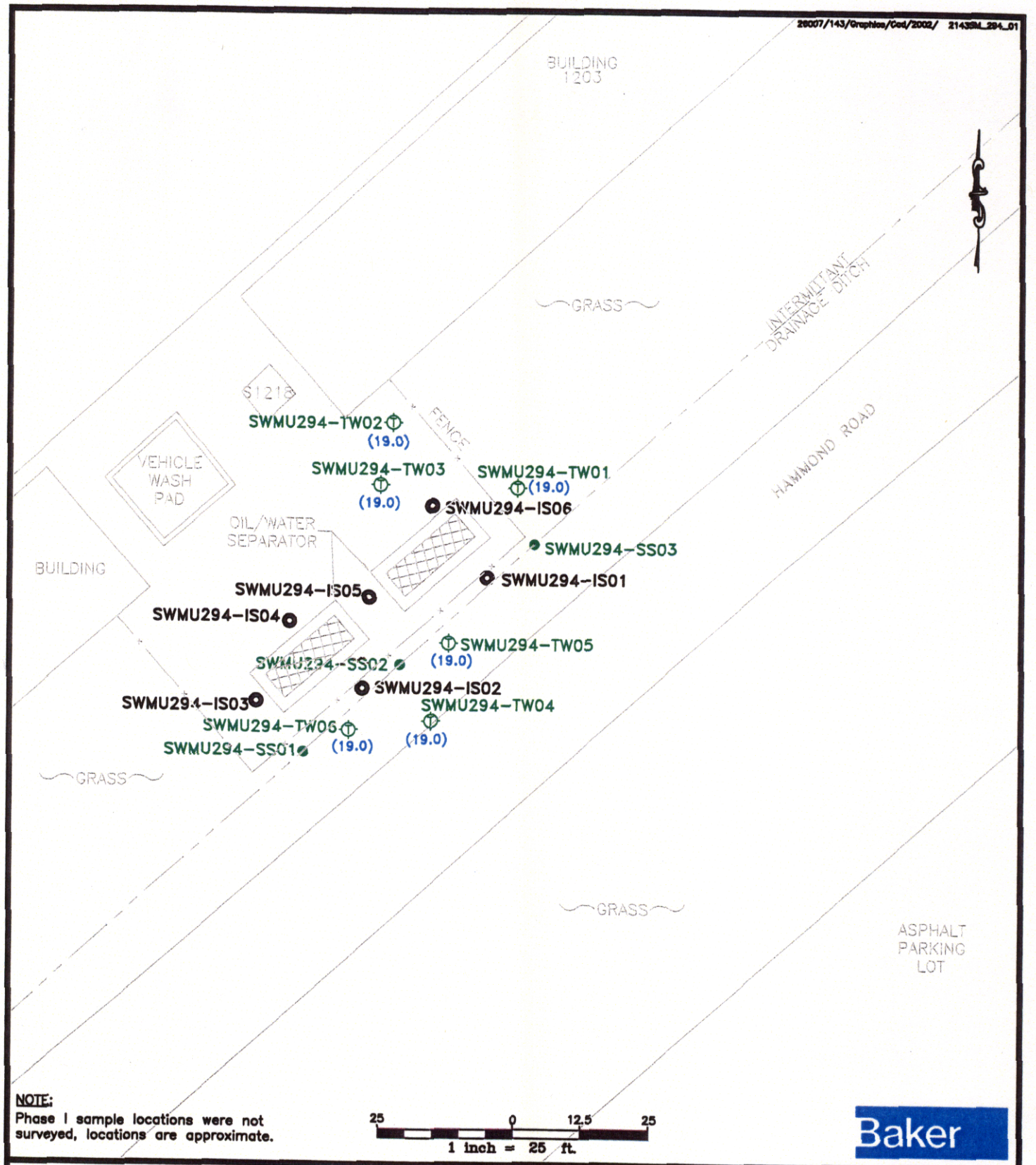
9/3/02
SWMU294_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 294
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 4-Methylphenol | NE | 3.5 | 2/6 | 2 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 6/6 | 15.7 J - 66.4 J | 0 | 0 |
| Chromium | 5.8 | 50 | 6/6 | 0.88 J - 3.5 J | 0 | 0 |
| Lead | 3.6 | 15 | 2/6 | 2 J - 2.3 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.



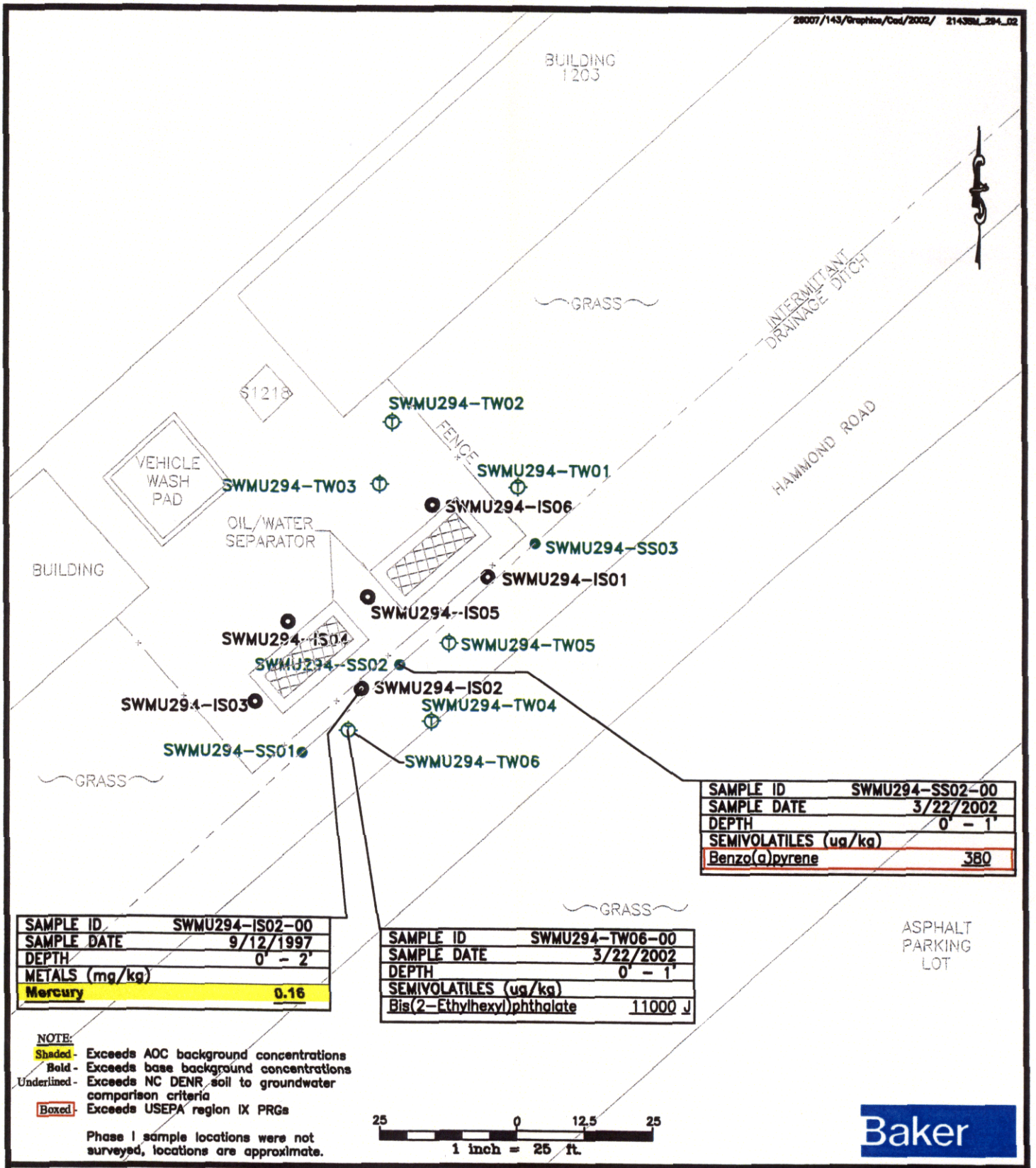

**LEGEND**

- ⊕ – TEMPORARY WELL
- ● – SURFACE SOIL SAMPLE
- ◉ – PHASE I SOIL BORING
- (19.0) – GROUNDWATER ELEVATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 294
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB19V




## LEGEND

- TEMPORARY WELL
- SURFACE SOIL SAMPLE
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
# PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 294
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.18 SWMU 295 - 1601 Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.18.1 SWMU Description and History

SWMU 295 is a former AST located in the Hadnot Point Industrial Area along Fir Street, between the intersections of Fir Street and Gibb Road and Fir Street and East Road. Groundwater in the vicinity of the SWMU is known to be contaminated with trichloroethene from IR Site 78 South (Baker, 1994). A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the AST has impacted surface and subsurface soils in the vicinity of the SWMU. Soil samples were collected from three soil borings that were advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, a few SVOCs and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 295 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.18.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and 24, 2002 and April 5, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two soil borings and three temporary well borings
- Groundwater sampling at three temporary wells and one existing well

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 11.9 to 13.2 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 13.5 to 15.9 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow east.

### 4.18.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Fourteen SVOCs were detected in the soil sample set. All SVOC detections were below established screening criteria.

Seven metals were detected in the sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Cadmium, lead and selenium exceeded the AOC and/or Base background criteria; however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX industrial PRGs. Mercury exceeded the NC DENR soil to groundwater screening criteria in a few surface soil samples; however, the concentrations were below the background criteria. Arsenic exceeded the AOC and Base background criteria and USEPA Region IX industrial PRG in two subsurface soil samples. None of the other metals detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

There were no detections of SVOCs in the groundwater samples.

Four metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, and selenium. Selenium exceeded the Base background screening criteria in one sample; however, the concentration was below the 2L standard. None of the other metals detected in the samples exceeded the established screening criteria. Although several SVOCs and arsenic were detected in soils at this SWMU, these compounds were not detected in the groundwater.

### 4.18.4 Conclusions

Several SVOCs and metals were detected in soil at concentrations exceeding applicable screening criteria. Arsenic was the only compound that exceeded both the AOC and Base background screening criteria and USEPA Region IX industrial PRG in soil.

No SVOCs were detected in the groundwater. None of the metals detected in the groundwater exceeded the Base background screening criteria and the 2L standards.

Based on evaluation of the results, no further action is warranted at SWMU 295 because arsenic was detected at concentrations below NC DENR soil to groundwater criteria and concentrations were slightly above background. Arsenic detections were not detected in groundwater and is not indicative of SWMU failure or release. Furthermore, Building 1601 (Site 78 South) is being addressed under the IR Program.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU295-TW01 | 3/22/02 | BAKER | 26.68 | 26.8 | 16 | 16 | 4 | 2 | 5.9 | 13.16 | 13.5 |
| SWMU295-TW02 | 3/24/02 | BAKER | 25.35 | 25.5 | 17 | 17 | 5 | 3 | 7 | 11.89 | 13.5 |
| SWMU295-TW03 | 3/22/02 | BAKER | 25.91 | 26.0 | 16 | 16 | 4 | 2 | 6 | 12.42 | 13.5 |
| 78GW09-1 | 1987 | BAKER | 28.13 | NA | 27 | 25 | 3 | 2 | 5 | 12.2 | 15.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU295

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU295-IS01-00 09-12-1997 0' - 2' | SWMU295-IS02-00 09-12-1997 0' - 2' | SWMU295-IS03-00 09-12-1997 0' - 2' | SWMU295-SB01-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 110 J | 82 J | 57 J | ND |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 64 J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 45 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 39 | 17 | 848 | 100000 | ND | ND | ND | 7.9 J |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 3.3 | 9.3 | 4.9 | 4.2 |
| Lead | 69 | 21 | 270 | 750 | 7.9 | **23.2** | 3.1 | 11.5 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 1.0 | 0.46 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU295-SB02-00 03-22-2002 0' - 1' | SWMU295-TW01-00 03-22-2002 0' - 1' | SWMU295-TW02-00 03-24-2002 0' - 1' | SWMU295-TW03-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | 47 J | ND |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | ND | ND | 0.62 J |
| Barium | 39 | 17 | 848 | 100000 | 10 J | 8.1 | 8.8 J | 8 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | ND | ND | ND | 0.27 J |
| Chromium | 16 | 15 | 27 | 450 | 1.8 | 3.7 | 5.5 J | 7.2 |
| Lead | 69 | 21 | 270 | 750 | 2.6 | 3 J | 3.5 J | 8.4 J |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | 0.03 J | 0.04 J | ND |
| Selenium | 1.0 | 0.46 | 12 | 10000 | ND | ND | 0.29 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 4/8 | 47 J - 110 J | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 1/8 | 64 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/8 | 45 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 1/8 | 0.62 J | 0 | 0 | 0 | 0 |
| Barium | 39 | 17 | 848 | 100000 | 5/8 | 7.9 J - 10 J | 0 | 0 | 0 | 0 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 1/8 | 0.27 J | 1 | 1 | 0 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 8/8 | 1.8 - 9.3 | 0 | 0 | 0 | 0 |
| Lead | 69 | 21 | 270 | 750 | 8/8 | 2.6 - 23.2 | 0 | 1 | 0 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 2/8 | 0.03 J - 0.04 J | 0 | 0 | 2 | 0 |
| Selenium | 1.0 | 0.46 | 12 | 10000 | 1/8 | 0.29 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU295-IS01-05 09-12-1997 10' - 12' | SWMU295-IS02-05 09-12-1997 10' - 12' | SWMU295-IS03-05 09-12-1997 10' - 12' | SWMU295-SB01-04 03-22-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2580 (3) | 41000000 (1) | ND | ND | 2200 | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | 150 J | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | 59 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 68 J | 160 J | 1300 J | ND |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | ND | ND | 86 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | 140 J | ND |
| Isophorone | NE | NE | 182 | 2600000 | ND | ND | 60 J | ND |
| N-Nitrosodiphenylamine | NE | NE | NE | 500000 | ND | ND | 380 | ND |
| Naphthalene | NE | NE | 1070 (2) | 190000 | ND | ND | 940 | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | 340 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 93 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | **1.7** | **1.7** | 2.5 |
| Barium | 26 | 22 | 848 | 100000 | ND | ND | ND | 8.4 J |
| Chromium | 12 | 16 | 27 | 450 | 2.6 | 6 | 8.8 | 7.7 |
| Lead | 8.6 | 8.2 | 270 | 750 | 3.1 | 5.1 | 6.3 | 5.9 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1966 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 1966mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU295_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU295-SB02-04 03-22-2002 7' - 9' | SWMU295-TW01-04 03-22-2002 7' - 9' | SWMU295-TW02-05 03-24-2002 9' - 11' | SWMU295-TW03-04 03-22-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2580 (3) | 41000000 (1) | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | 890 | 48 J | ND |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | 44 J | ND | 52 J |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Isophorone | NE | NE | 182 | 2600000 | ND | ND | ND | ND |
| N-Nitrosodiphenylamine | NE | NE | NE | 500000 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 1070 (2) | 190000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 1.4 | 4.3 | 4.8 J | ND |
| Barium | 26 | 22 | 848 | 100000 | ND | 6.2 | 10.6 J | 9.4 |
| Chromium | 12 | 16 | 27 | 450 | 5 | 7.3 | 11 J | 6 |
| Lead | 8.6 | 8.2 | 270 | 750 | 4.4 | 3.7 J | 5.6 J | 4.1 J |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | 0.67 | 0.44 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1966 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 1966mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU295_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2580 (3) | 41000000 (1) | 1/8 | 2200 | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 1/8 | 150 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 100000000 | 1/8 | 59 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 5/8 | 48 J - 1300 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | 1/8 | 86 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 2/8 | 44 J - 52 J | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/8 | 140 J | NA | NA | 0 | 0 |
| Isophorone | NE | NE | 182 | 2600000 | 1/8 | 60 J | NA | NA | 0 | 0 |
| N-Nitrosodiphenylamine | NE | NE | NE | 500000 | 1/8 | 380 | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 1070 (2) | 190000 | 1/8 | 940 | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/8 | 340 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/8 | 93 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 6/8 | 1.4 - 4.8 J | 3 | 5 | 0 | 2 |
| Barium | 26 | 22 | 848 | 100000 | 4/8 | 6.2 - 10.6 J | 0 | 0 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 8/8 | 2.6 - 11 J | 0 | 0 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 8/8 | 3.1 - 6.3 | 0 | 0 | 0 | 0 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | 2/8 | 0.44 J - 0.67 | 2 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1966 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 1966mg/kg.
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU295-78GW09-1 04-07-2002 | SWMU295-TW01 04-05-2002 | | SWMU295-TW02 04-05-2002 | | SWMU295-TW03 04-05-2002 | |
|---|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | | |
| Barium | 145 | 2000 | 44.9 | 15.5 | J | 31.7 | J | 34.2 | J |
| Chromium | 5.8 | 50 | ND | 1.2 | J | 4.6 | J | 0.89 | J |
| Lead | 3.6 | 15 | ND | 1.8 | J | 2.9 | J | ND | |
| Selenium | 2.8 | 50 | ND | ND | | ND | | 16.1 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

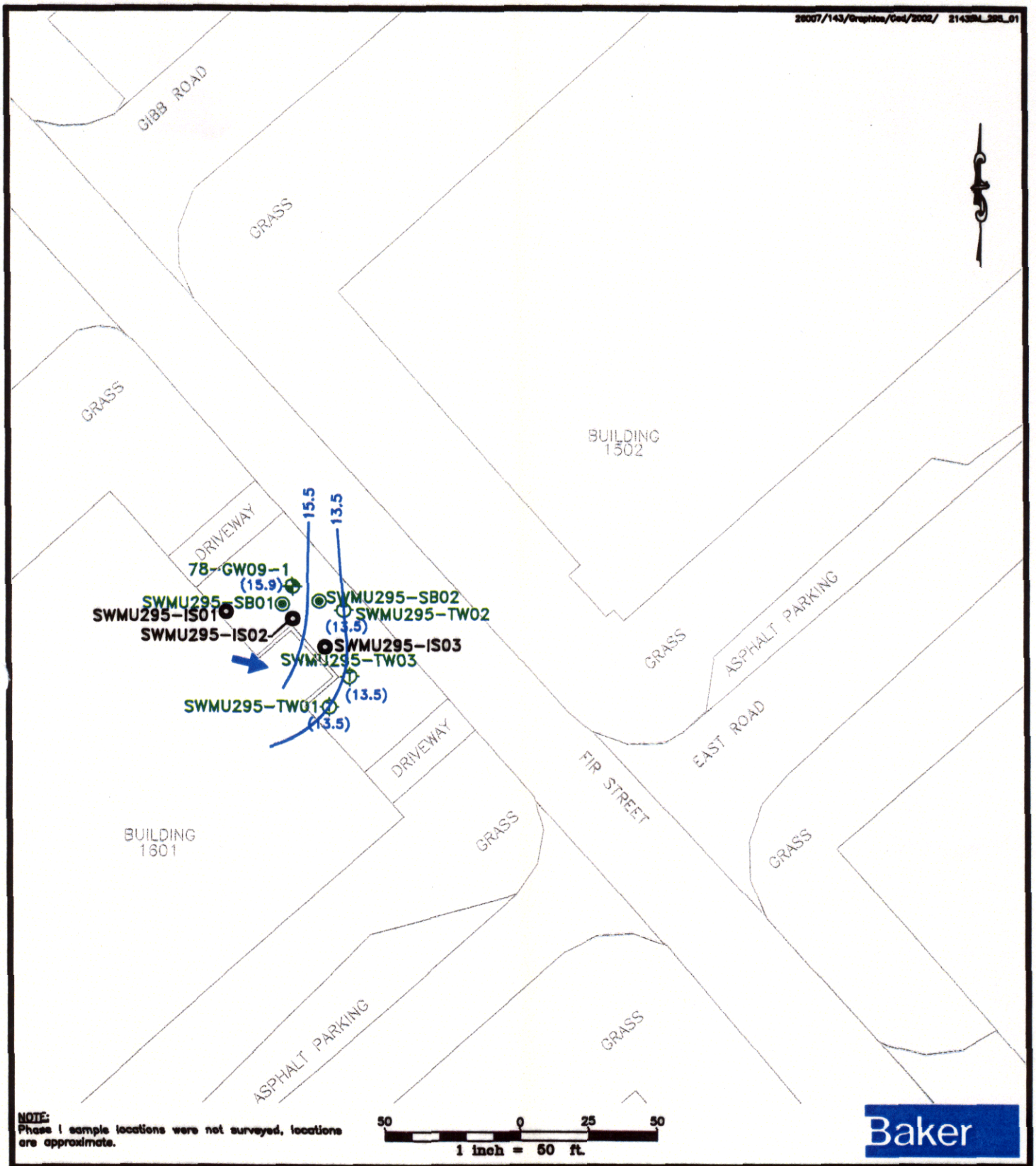
8/30/02
SWMU295_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 295
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 4/4 | 15.5 J - 44.9 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/4 | 0.89 J - 4.6 J | 0 | 0 |
| Lead | 3.6 | 15 | 2/4 | 1.8 J - 2.9 J | 0 | 0 |
| Selenium | 2.8 | 50 | 1/4 | 16.1 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.



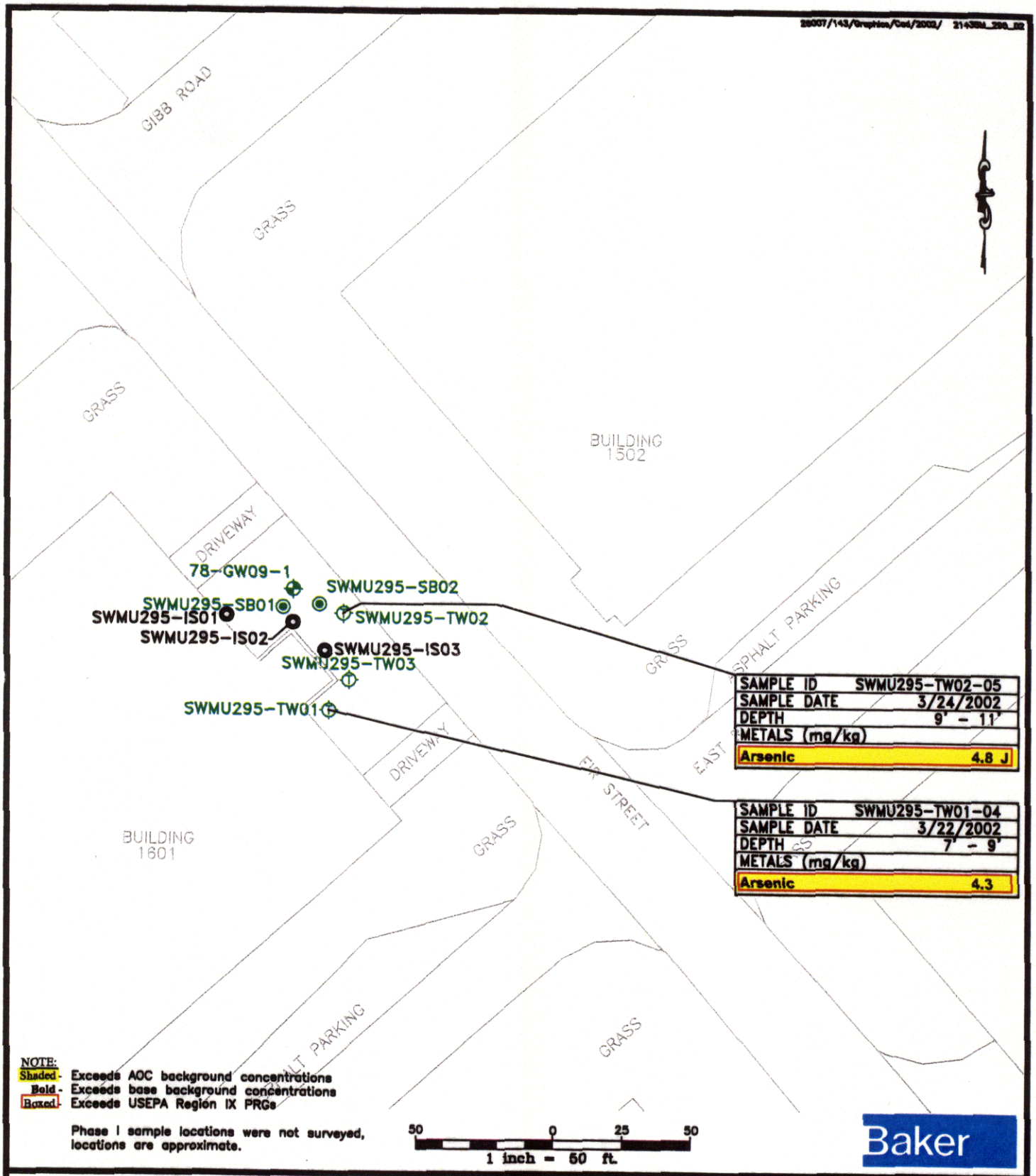

## LEGEND

- TEMPORARY WELL
- PHASE II SOIL BORING
- EXISTING MONITORING WELL SAMPLE
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 13.5 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 295
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037538B20Y




## LEGEND

- TEMPORARY WELL
- PHASE II SOIL BORING
- EXISTING MONITORING WELL SAMPLE
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 295
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.19 SWMU 299 - AS114 Aboveground Storage Tank MCAS Auto Hobby Shop

The following sections present the SWMU description and history, the investigation activities conducted during the Phase I and II CSIs, investigation findings, and conclusions.

### 4.19.1 SWMU Description and History

SWMU 299 consists of an AST that stores used oil generated from a Hobby Shop located at the MCAS. The SWMU is located west of Bancroft Road adjacent to Buildings AS-114 and AS-116. The steel AST was installed in 1992 and is still used. The ground surface surrounding the SWMU is covered with asphalt except for a small grassy area located to the north. Stormwater travels across the pavement to the narrow grassy area north of the SWMU. The SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. At the time of the investigation, significant staining was noted on the outside of the tank. The purpose of the investigation was to determine if operation of the AST has impacted surface and subsurface soils in the vicinity of the SWMU. Surface soil samples were collected from four soil borings advanced in the grassy area just north of the SWMU (see Figure 1). In addition, a single subsurface soil sample was collected from one of the soil borings at a depth of 2 to 4 feet below the ground surface. Groundwater was encountered at a depth of 2 feet below the ground surface in the remaining three borings, which precluded the collection of subsurface soil samples in these borings. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on the evaluation of the results, several SVOCs and metals exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 299 was recommended in the form of a Phase II CSI.

### 4.19.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 19 and April 2, 2002 in general accordance with the Final Project Plans (Baker, 2002). Based on the findings of the 2002 Phase II CSI, additional soil sampling was conducted June 21, 2003 to complete the Phase II CSI. Three soil borings and four temporary wells were completed in 2002. Seven additional soil borings were advanced and soil samples were collected for SVOCs and metals in 2003.

The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation at SWMU 299 included the following:

- Surface and subsurface soil sampling at four temporary well borings and eleven soil borings
- Groundwater sampling at four temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 0.9 to 2.2 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 16.0 to 16.6 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northeast.

### 4.19.3 Investigation Findings

The soil and groundwater samples collected in 2002 were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. All soil samples collected in 2003 were submitted to Chemtech Laboratories and also analyzed for SVOCs and RCRA metals. A summary of laboratory analytical results is included in Appendix G.

Soil

The analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II (March 2002) and Phase II additional sampling (June 2003). The analytical results and statistical summaries for positive detections from the Phase I and Phase II sampling events were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX Residential PRGs

Figures 2 and 3 present the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Twenty-seven SVOCs (mostly PAHs) were detected in the sample set. In general, the majority of SVOCs were detected in surface and subsurface soil samples from borings advanced in the grassy area adjacent to (north of) the SWMU (e.g., SWMU299-IS01 through SWMU299-IS04, SWMU299-SB01, and SWMU299-TW01). 2-Methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno (1,2,3-cd)pyrene, and isophorone exceeded the NC DENR soil to groundwater criteria and/or the USEPA Region IX residential PRGs in one or more of the surface soil samples. In addition, benzo(a)pyrene and dibenz(a,h)anthracene exceeded the USEPA Region IX residential PRGs in one or more of the subsurface soil samples. None of the other SVOCs detected in the samples exceeded the applicable screening criteria. Through the additional sampling effort, SVOC surface and subsurface soil contamination was delineated.

All eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) were detected in the sample set. Most of these metals exceeded the background criteria in the surface and/or subsurface soil samples. Arsenic, chromium, lead and silver were detected at concentrations exceeding AOC and Base background criteria, NC DENR soil to groundwater screening criteria and/or the USEPA Region IX Residential PRGs in one or more of the surface soil samples (Figure 2). Cadmium exceeded the NC DENR soil to groundwater screening criteria in two soil samples. Lead, mercury, selenium, and silver each exceeded AOC and/or Base background criteria. Mercury and silver each exceeded AOC background and NC DENR soil to groundwater screening criteria in one sample (Figure 3).

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria, and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX Tap Water PRGs (as a secondary comparison)

Figure 4 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Five SVOCs and were detected in groundwater samples from one or more of the wells, as follows: 2,4-dimethylphenol, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, naphthalene, and phenanthrene. Naphthalene exceeded the North Carolina 2L standard in the sample from well SWMU299-TW03 (Figure 4). None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Four metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, and lead. Barium and chromium exceeded the background screening criteria. Arsenic was detected above the USEPA Region IX Tap Water PRG in three samples; however, concentrations were below the background screening criteria.

All of the compounds (except for 2,4-dimethylphenol) detected in groundwater were detected in soils at the SWMU.

### 4.19.4 Conclusions

Several SVOCs and metals were detected in soil at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria (metals only) as well as NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, isophorone, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and 2-methylnaphthalene
- Metals - arsenic, cadmium, chromium, lead and silver

Groundwater appears to have been impacted minimally. Naphthalene was the only COPC detected in groundwater that exceeded the applicable screening criteria.

Many of the COPCs appear to be related to the SWMU. The types of compounds detected are consistent with SWMU usage. Additionally, the distribution of these COPCs appears to be in a pattern that is limited to the vicinity of the SWMU. The additional Phase II sampling effort bounded the extent of COPCs in surface and subsurface soil. Silver was detected in surface and subsurface soil samples in the additional Phase II sampling, however, two of the three locations

where concentrations exceeded comparison criteria were in samples located relatively far from the SWMU and appeared to be randomly distributed.

Based on evaluation of the results, additional action at SWMU 299 is warranted. The recommended additional activities are presented in Section 5.0.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU299-TW01 | 3/19/2002 | BAKER | 17.54 | 17.9 | 13 | 13 | 2 | 0 | 3 | 0.91 | 16.63 |
| SWMU299-TW02 | 3/19/2002 | BAKER | 18.44 | 18.7 | 13 | 13 | 2 | 0 | 3 | 2.15 | 16.29 |
| SWMU299-TW03 | 3/19/2002 | BAKER | 18.12 | 18.4 | 13 | 13 | 2 | 0 | 3 | 1.85 | 16.27 |
| SWMU299-TW04 | 3/19/2002 | BAKER | 18.21 | 18.5 | 13 | 13 | 2 | 0 | 3 | 2.17 | 16.04 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-IS01-00<br>09-14-1997<br>0' - 2' | SWMU299-IS02-00<br>09-14-1997<br>0' - 2' | SWMU299-IS03-00<br>09-14-1997<br>0' - 2' | SWMU299-IS04-00<br>09-14-1997<br>0' - 2' | SWMU299-SB01-00<br>03-19-2002<br>0' - 1' |
|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | NA | NA | NA | NA | ND |
| 2-Chloronaphthalene | NE | NE | NE | 4900000 | ND | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 14400 (3) | 1600000 (1) | 1200 J | 3100 J | 6600 | 1900 J | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | 830 J | 780 J | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | 490 J | 1100 J | ND | 810 J | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | NA | NA | NA | NA | ND |
| Benzo(a)anthracene | NE | NE | 3910 (2) | 620 | 2000 J | 3400 J | 1200 J | 3200 J | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 2500 J | 2400 J | 1500 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (3) | 620 | 3300 J | 5900 | 3000 J | 6100 | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 1000 J | 1500 J | 810 J | 1800 J | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (3) | 6200 | 3500 J | 3600 J | 2000 J | 6700 J | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 76000 (2) | 35000 | 11000 J | 16000 J | 7600 J | 6600 J | 57 J |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 7800 | 2600 J | 3800 J | 2900 J | ND |
| Carbazole | NE | NE | NE | 24000 | ND | 870 J | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | 3500 J | 4800 | 2000 J | 4800 | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | 590 J | 830 J | ND | 810 J | ND |
| Dibenzofuran | NE | NE | 52000 (3) | 290000 | ND | 730 J | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | 3700 J | 1600 J | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | ND | 140 J |
| Fluoranthene | NE | NE | 276000 | 2300000 | 4900 | 7500 | 2600 J | 6100 | ND |
| Fluorene | NE | NE | 44300 | 2700000 | 510 J | 1700 J | 1100 J | 560 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 1200 J | 1500 J | 860 J | 1900 J | ND |
| Isophorone | NE | NE | 540 (2) | 510000 | ND | ND | 990 J | 4400 | ND |
| Naphthalene | NE | NE | 5790 (2) | 56000 | 970 J | 1900 J | 640 J | 950 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | 2300 J | 7000 | 4200 J | 3100 J | ND |
| Pyrene | NE | NE | 286000 | 2300000 | 4200 J | 7100 | 3000 J | 7600 | ND |
| **Metals (mg/kg)** | | | | | | | | | |
| Arsenic | 1.71 | 1.34 | 5.24 | 0.39 | ND | 2.7 | 2.1 | ND | ND |
| Barium | 32.62 | 23.3 | 848 | 5400 | **29.7** | 185 | 72.2 | ND | ND |
| Cadmium | NE | NE | 2.72 | 37 | 1.8 | 3.6 | 5 | ND | ND |
| Chromium | 19.03 | 12.25 | 27.2 | 210 | 38.9 | 33.3 | 44 | **14** | 3.6 |
| Lead | 22.65 | 26.0 | 270 | 400 | 193 | 300 | 636 | 86.1 | 3.7 |
| Mercury | 0.10 | 0.128 | 0.0154 | 23 | 0.078 | 0.1 | 0.069 | ND | 0.031 J |
| Selenium | 1.21 | 2.88 | 12.2 | 390 | ND | ND | ND | ND | ND |
| Silver | 0.23 | NE | 0.223 | 390 | ND | 1.8 | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-SB02-00<br>03-19-2002<br>0' - 1' | SWMU299-SB03-00<br>03-19-2002<br>0' - 1' | SWMU299-SB04-00<br>03-19-2002<br>0' - 1' | SWMU299-TW01-00<br>03-19-2002<br>0' - 1' | SWMU299-TW02-00<br>03-19-2002<br>0' - 1' |
|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | 330 J | ND | ND | ND |
| 2-Chloronaphthalene | NE | NE | NE | 4900000 | ND | 1000 J | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 14400 (3) | 1600000 (1) | ND | 16000 | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | 330 J | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | 43 J | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | 130 J | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | ND | ND | ND | 36 J | ND |
| Benzo(a)anthracene | NE | NE | 3910 (2) | 620 | 99 J | ND | 35 J | 1000 | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 120 J | ND | ND | 1500 | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (3) | 620 | 270 J | ND | 52 J | 3100 | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 80 J | ND | ND | 960 | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (3) | 6200 | 300 J | ND | 58 J | 2400 | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 76000 (2) | 35000 | 89 J | ND | 250 J | 420 J | 69 J |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | 640 | ND |
| Carbazole | NE | NE | NE | 24000 | 38 J | ND | ND | 580 | ND |
| Chrysene | NE | NE | 38150 | 62000 | 180 J | ND | 42 J | 2400 | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | ND | ND | ND | 430 J | ND |
| Dibenzofuran | NE | NE | 52000 (3) | 290000 | ND | ND | ND | 63 J | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | 120 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | 110 J | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 290 J | ND | 82 J | 3400 | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | 42 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 120 J | ND | ND | 2000 | ND |
| Isophorone | NE | NE | 540 (2) | 510000 | ND | ND | ND | ND | ND |
| Naphthalene | NE | NE | 5790 (2) | 56000 | ND | 1100 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 160 J | ND | 98 J | 1400 | ND |
| Pyrene | NE | NE | 286000 | 2300000 | 200 J | ND | 69 J | 2600 | ND |
| **Metals (mg/kg)** | | | | | | | | | |
| Arsenic | 1.71 | 1.34 | 5.24 | 0.39 | ND | ND | ND | ND | ND |
| Barium | 32.62 | 23.3 | 848 | 5400 | 19.1 | ND | 10.9 | 33.2 | ND |
| Cadmium | NE | NE | 2.72 | 37 | 1.1 | 0.049 J | ND | 1.1 | ND |
| Chromium | 19.03 | 12.25 | 27.2 | 210 | 17.5 | 4.3 | 7.1 | 20.7 J | 2.4 J |
| Lead | 22.65 | 26.0 | 270 | 400 | 144 | 6.2 | 5.5 | 119 | 2.6 |
| Mercury | 0.10 | 0.128 | 0.0154 | 23 | 0.047 | 0.024 J | 0.035 J | ND | ND |
| Selenium | 1.21 | 2.88 | 12.2 | 390 | ND | ND | 0.74 | 0.9 | ND |
| Silver | 0.23 | NE | 0.223 | 390 | ND | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-TW03-00<br>03-19-2002<br>0' - 1' | SWMU299-TW04-00<br>03-19-2002<br>0' - 1' | SWMU299-SB05-00<br>R3028-01<br>06-21-2003<br>0-1 | SWMU299-SB06-00<br>R3028-04<br>06-21-2003<br>0-1 | SWMU299-SB07-00<br>R3028-06<br>06-21-2003<br>0-1 |
|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | ND | ND | ND | ND |
| 2-Chloronaphthalene | NE | NE | NE | 4900000 | ND | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 14400 (3) | 1600000 (1) | ND | ND | ND | ND | 370 |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | ND | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 3910 (2) | 620 | 44 J | ND | 49 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 42 J | ND | 41 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (3) | 620 | 60 J | ND | 64 J | ND | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (3) | 6200 | 50 J | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 76000 (2) | 35000 | 180 J | ND | ND | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | ND | ND |
| Carbazole | NE | NE | NE | 24000 | ND | ND | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | 70 J | ND | 53 J | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | ND | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 52000 (3) | 290000 | ND | ND | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 110 J | ND | 93 J | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 46 J | ND | ND | ND | ND |
| Isophorone | NE | NE | 540 (2) | 510000 | ND | ND | ND | ND | ND |
| Naphthalene | NE | NE | 5790 (2) | 56000 | ND | ND | ND | ND | 320 J |
| Phenanthrene | NE | NE | 59600 | NE | 56 J | ND | 56 J | ND | 410 |
| Pyrene | NE | NE | 286000 | 2300000 | 90 J | ND | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | | | |
| Arsenic | 1.71 | 1.34 | 5.24 | 0.39 | ND | ND | 1 J | ND | ND |
| Barium | 32.62 | 23.3 | 848 | 5400 | 12.5 | ND | 5 J | 4.6 J | 47.7 |
| Cadmium | NE | NE | 2.72 | 37 | ND | ND | 0.15 J | ND | 0.36 J |
| Chromium | 19.03 | 12.25 | 27.2 | 210 | 11.5 J | 4.1 J | ND | ND | 5.6 |
| Lead | 22.65 | 26.0 | 270 | 400 | 16.3 | 3.5 | 3 | 4.1 | 203 |
| Mercury | 0.10 | 0.128 | 0.0154 | 23 | ND | ND | ND | ND | ND |
| Selenium | 1.21 | 2.88 | 12.2 | 390 | 0.64 | ND | 0.75 J | 1 J | 0.9 J |
| Silver | 0.23 | NE | 0.223 | 390 | ND | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-SB08-00<br>R3028-08<br>06-21-2003<br>0-1 | SWMU299-SB09-00<br>R3028-10<br>06-21-2003<br>0-1 | SWMU299-SB10-00<br>R3028-12<br>06-21-2003<br>0-1 | SWMU299-SB11-00<br>R3028-14<br>06-21-2003<br>0-1 |
|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | ND | ND | ND | ND |
| 2-Chloronaphthalene | NE | NE | NE | 4900000 | ND | ND | ND | ND |
| 2-Methylnaphthalene | NE | NE | 14400 (3) | 1600000 (1) | ND | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 3910 (2) | 620 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (3) | 620 | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (3) | 6200 | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 76000 (2) | 35000 | ND | ND | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | ND |
| Carbazole | NE | NE | NE | 24000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 52000 (3) | 290000 | ND | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | ND | ND | ND | ND |
| Isophorone | NE | NE | 540 (2) | 510000 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 5790 (2) | 56000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.71 | 1.34 | 5.24 | 0.39 | ND | ND | ND | ND |
| Barium | 32.62 | 23.3 | 848 | 5400 | 7.9 J | 15.3 J | 18.9 J | 8.8 J |
| Cadmium | NE | NE | 2.72 | 37 | ND | 0.42 J | 0.55 J | ND |
| Chromium | 19.03 | 12.25 | 27.2 | 210 | ND | ND | ND | ND |
| Lead | 22.65 | 26.0 | 270 | 400 | 3.9 | 40.8 | 82 | 9.4 |
| Mercury | 0.10 | 0.128 | 0.0154 | 23 | ND | ND | ND | ND |
| Selenium | 1.21 | 2.88 | 12.2 | 390 | 1.4 J | NA | NA | NA |
| Silver | 0.23 | NE | 0.223 | 390 | ND | ND | 0.29 J | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg
(3) Site-Specific criteria calculated with interim 2L and TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established
NA - Not Analyzed

**TABLE 3**

**STATISTICAL SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 2 | Base Background Criteria Surface-Loam/Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Postive Detects | Number of Exceedances: Background Criteria AOC 2 | Number of Exceedances: Base Background Criteria Surface-Loam/Silt | Number of Exceedances: North Carolina Soil to Groundwater Stds | Number of Exceedances: USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 1,1-Biphenyl | NE | NE | 8910 | 350000 | 1/15 | 330 J - 330 J | NA | NA | 0 | 0 |
| 2-Chloronaphthalene | NE | NE | NE | 4900000 | 1/19 | 1000 J - 1000 J | NA | NA | NA | 0 |
| 2-Methylnaphthalene | NE | NE | 14400 (3) | 1600000 (1) | 6/19 | 370 - 16000 | NA | NA | 1 | 0 |
| Acenaphthene | NE | NE | 8160 | 3700000 | 3/19 | 330 J - 830 J | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 1/19 | 43 J - 43 J | NA | NA | 0 | NA |
| Anthracene | NE | NE | 995000 | 22000000 | 4/19 | 130 J - 1100 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 6100000 | 1/15 | 36 J - 36 J | NA | NA | NA | 0 |
| Benzo(a)anthracene | NE | NE | 3910 (2) | 620 | 9/19 | 35 J - 3400 J | NA | NA | 0 | 5 |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 7/19 | 41 J - 2500 J | NA | NA | 4 | 5 |
| Benzo(b)fluoranthene | NE | NE | 13200 (3) | 620 | 9/19 | 52 J - 6100 | NA | NA | 0 | 5 |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 6/19 | 80 J - 1800 J | NA | NA | 0 | NA |
| Benzo(k)fluoranthene | NE | NE | 132000 (3) | 6200 | 8/19 | 50 J - 6700 J | NA | NA | 0 | 1 |
| bis(2-Ethylhexyl)phthalate | NE | NE | 76000 (2) | 35000 | 10/19 | 57 J - 16000 J | NA | NA | 0 | 0 |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 5/19 | 640 - 7800 | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 24000 | 3/19 | 38 J - 870 J | NA | NA | NA | 0 |
| Chrysene | NE | NE | 38150 | 62000 | 9/19 | 42 J - 4800 | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | 4/19 | 430 J - 830 J | NA | NA | 0 | 4 |
| Dibenzofuran | NE | NE | 52000 (3) | 290000 | 2/19 | 63 J - 730 J | NA | NA | 0 | 0 |
| Di-n-butylphthalate | NE | NE | 24800 | 6100000 | 3/19 | 120 J - 3700 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | 2/19 | 110 J - 140 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 9/19 | 82 J - 7500 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 2700000 | 5/19 | 42 J - 1700 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 7/19 | 46 J - 2000 | NA | NA | 0 | 5 |
| Isophorone | NE | NE | 540 (2) | 510000 | 1/19 | 990 J - 990 J | NA | NA | 1 | 0 |
| Naphthalene | NE | NE | 5790 (2) | 56000 | 6/19 | 320 J - 1900 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 10/19 | 56 J - 7000 | NA | NA | 0 | NA |
| Pyrene | NE | NE | 286000 | 2300000 | 8/19 | 69 J - 7600 | NA | NA | 0 | 0 |

**TABLE 3**

**STATISTICAL SUMMARY**
**SURFACE SOIL - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Postive Detects | Number of Exceedances: Background Criteria AOC 2 | **Base Background Criteria Surface-Loam/Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.71 | 1.34 | 5.24 | 0.39 | 3/19 | 1 J - 2.1 | 2 | 2 | 0 | 3 |
| Barium | 32.62 | 23.3 | 848 | 5400 | 14/19 | 4.6 J - 185 | 4 | 5 | 0 | 0 |
| Cadmium | NE | NE | 2.72 | 37 | 10/19 | 0.049 J - 5 | NA | NA | 2 | 0 |
| Chromium | 19.03 | 12.25 | 27.2 | 210 | 13/19 | 2.4 J - 44 | 4 | 6 | 3 | 0 |
| Lead | 22.65 | 26.0 | 270 | 400 | 19/19 | 2.6 - 636 | 9 | 9 | 2 | 1 |
| Mercury | 0.10 | 0.128 | 0.0154 | 23 | 7/19 | 0.024 J - 0.1 | 0 | 0 | 7 | 0 |
| Selenium | 1.21 | 2.88 | 12.2 | 390 | 7/16 | 0.64 - 1.4 J | 1 | 0 | 0 | 0 |
| Silver | 0.23 | NE | 0.223 | 390 | 2/19 | 0.29 J - 1.8 | 2 | NA | 2 | 0 |

Notes:

(1) Region III PRG Residential Soil

(2) Detected concentrations exceed NC DENR generic soil-to-water criteria Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg

(3) Site-Specific criteria calculated with interim 2L and TOC of 11408 mg/kg

NE - Not established
NA- Not analyzed
J - Analyte detected. Reported value is estimated.
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 2 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-IS04-01 | SWMU299-SB01-01 | SWMU299-SB02-02 | SWMU299-SB03-02 | SWMU299-SB04-02 | SWMU299-TW01-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 09-14-1997 | 03-19-2002 | 03-19-2002 | 03-19-2002 | 03-19-2002 | 03-19-2002 |
| Depth Range | | | | | 2' - 4' | 1' - 3' | 3' - 5' | 3' - 5' | 3' - 5' | 3' - 5' |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 14400 (2) | 1600000 (1) | 54 J | ND | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | 61 J | ND | ND | ND | 94 J | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | NA | ND | ND | 36 J | ND | ND |
| Benzo(a)anthracene | NE | NE | 343 | 620 | 200 J | ND | 150 J | ND | 140 J | 86 J |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 200 J | ND | 170 J | ND | 87 J | 130 J |
| Benzo(b)fluoranthene | NE | NE | 13200 (2) | 620 | 330 J | ND | 190 J | ND | 160 J | 200 J |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 120 J | ND | 100 J | ND | ND | 95 J |
| Benzo(k)fluoranthene | NE | NE | 132000 (2) | 6200 | 350 J | ND | 280 J | ND | 180 J | 230 J |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 160 J | ND | 150 J | ND | 330 J | 240 J |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 43 J | ND | ND | ND | ND | 79 J |
| Carbazole | NE | NE | NE | 24000 | ND U | ND | 50 J | ND | 81 J | 45 J |
| Chrysene | NE | NE | 38150 | 62000 | 260 J | ND | 240 J | ND | 140 J | 230 J |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | 75 J | ND | 50 J | ND | ND | 46 J |
| Dibenzofuran | NE | NE | 52000 (2) | 290000 | ND | ND | ND | ND | 55 J | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | ND | ND | 36 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 640 | ND | 370 J | ND | 360 J | 280 J |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | 26 J | ND | 40 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 130 J | ND | 170 J | ND | 53 J | 170 J |
| Naphthalene | NE | NE | 585 | 56000 | 48 J | ND | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 320 J | ND | 200 J | ND | 470 | 110 J |
| Pyrene | NE | NE | 286000 | 2300000 | 380 J | ND | 280 J | ND | 330 J | 210 J |
| **Metals (mg/kg)** | | | | | | | | | | |
| Barium | 46.53 | 22.58 | 848 | 5400 | ND | ND | 19.4 | ND | 14.4 | 11.5 |
| Cadmium | NE | NE | 2.72 | 37 | ND | ND | 0.81 | 0.12 J | 0.074 J | ND |
| Chromium | 37.71 | 25.0 | 27.2 | 210 | 4.9 | 7 | 21.3 | 22.6 | 10.1 | 8.3 J |
| Lead | 15.24 | 9.19 | 270 | 400 | 5.7 | 5.2 | 114 | 5.6 | 8.2 | 28.6 |
| Mercury | 0.07 | 0.129 | 0.0154 | 23 | ND | 0.057 | 0.038 J | 0.029 J | 0.084 | ND |
| Selenium | 0.86 | 0.625 | 12.2 | 390 | ND | ND | ND | ND | 0.85 | ND |
| Silver | 0.35 | NE | 0.223 | 390 | ND | ND | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and
a TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 2 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-TW02-02 | SWMU299-TW03-02 | SWMU299-TW04-02 | SWMU299-SB05-02 | SWMU299-SB06-01 | SWMU299-SB07-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 03-19-2002 | 03-19-2002 | 03-19-2002 | 06-21-2003 | 06-21-2003 | 06-21-2003 |
| Depth Range | | | | | 3' - 5' | 3' - 5' | 3' - 5' | 3-5 | 1-3 | 3-5 |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 14400 (2) | 1600000 (1) | ND | ND | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | 53 J | 41 J | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 343 | 620 | ND | ND | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | ND | ND | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (2) | 620 | ND | ND | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (2) | 6200 | ND | ND | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 88 J | 95 J | 370 J | ND | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | ND | ND | ND |
| Carbazole | NE | NE | NE | 24000 | ND | ND | ND | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | ND | ND | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | ND | ND | ND | ND | ND | ND |
| Dibenzofuran | NE | NE | 52000 (2) | 290000 | ND | ND | ND | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | 210 J | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 30 J | ND | ND | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | ND | ND | ND | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 56000 | ND | ND | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | | | | |
| Barium | 46.53 | 22.58 | 848 | 5400 | ND | 13.7 | ND | 6.6 J | 6.8 J | 15.5 J |
| Cadmium | NE | NE | 2.72 | 37 | ND | ND | ND | ND | ND | ND |
| Chromium | 37.71 | 25.0 | 27.2 | 210 | 8.6 J | 11 J | 2.5 J | ND | ND | ND |
| Lead | 15.24 | 9.19 | 270 | 400 | 4.5 | 7 | 3.3 | 4.6 | 3.9 | 4.9 |
| Mercury | 0.07 | 0.129 | 0.0154 | 23 | ND | ND | ND | ND | ND | ND |
| Selenium | 0.86 | 0.625 | 12.2 | 390 | ND | ND | ND | 1.3 J | 0.72 J | 0.83 R |
| Silver | 0.35 | NE | 0.223 | 390 | ND | ND | ND | 0.33 J | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and
a TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 2 | **Base Background Criteria Subsurface-Silt** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU299-SB08-02<br>06-21-2003<br>3-5 | SWMU299-SB09-01<br>06-21-2003<br>1-3 | SWMU299-SB10-01<br>06-21-2003<br>1-3 |
|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 14400 (2) | 1600000 (1) | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND |
| Benzaldehyde | NE | NE | NE | 6100000 | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 343 | 620 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 13200 (2) | 620 | ND | ND | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 132000 (2) | 6200 | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | ND | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND |
| Carbazole | NE | NE | NE | 24000 | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | ND | ND | ND |
| Dibenzofuran | NE | NE | 52000 (2) | 290000 | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 2700000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 56000 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | |
| Barium | 46.53 | 22.58 | 848 | 5400 | 7.5 J | 3.5 J | 5.1 J |
| Cadmium | NE | NE | 2.72 | 37 | ND | ND | ND |
| Chromium | 37.71 | 25.0 | 27.2 | 210 | ND | ND | ND |
| Lead | 15.24 | 9.19 | 270 | 400 | 4.7 | 3.1 | 4.1 |
| Mercury | 0.07 | 0.129 | 0.0154 | 23 | ND | ND | ND |
| Selenium | 0.86 | 0.625 | 12.2 | 390 | 0.94 R | 0.95 J | 0.72 R |
| Silver | 0.35 | NE | 0.223 | 390 | ND | 0.5 J | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam/Silt Data Set for Surface Soil
(1) Region III PRG Residential Soil
(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and
a TOC of 11408 mg/kg
J - Analyte detected. Reported value is estimated.
ND - Not Detected
NE - Not established

**TABLE 5**

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 2 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detects | Number of Exceedances: Background Criteria AOC 2 | Base Background Criteria Subsurface-Silt | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 14400 (2) | 1600000 (1) | 1/15 | 54 J - 54 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 22000000 | 2/15 | 61 J - 94 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 6100000 | 3/14 | 36 J - 53 J | NA | NA | NA | 0 |
| Benzo(a)anthracene | NE | NE | 343 | 620 | 4/15 | 86 J - 200 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 1040 (2) | 62 | 4/15 | 87 J - 200 J | NA | NA | 0 | 4 |
| Benzo(b)fluoranthene | NE | NE | 13200 (2) | 620 | 4/15 | 160 J - 330 J | NA | NA | 0 | 0 |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 3/15 | 95 J - 120 J | NA | NA | 0 | NA |
| Benzo(k)fluoranthene | NE | NE | 132000 (2) | 6200 | 4/15 | 180 J - 350 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 7/15 | 88 J - 370 J | NA | NA | 0 | 0 |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 2/15 | 43 J - 79 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 24000 | 3/15 | 45 J - 81 J | NA | NA | NA | 0 |
| Chrysene | NE | NE | 38150 | 62000 | 4/15 | 140 J - 260 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 1920 (2) | 62 | 3/15 | 46 J - 75 J | NA | NA | 0 | 1 |
| Dibenzofuran | NE | NE | 52000 (2) | 290000 | 1/15 | 55 J - 55 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 24800 | 6100000 | 1/15 | 36 J - 36 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 2400000 | 1/15 | 210 J - 210 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 5/15 | 30 J - 640 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 2700000 | 2/15 | 26 J - 40 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 4/15 | 53 J - 170 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 585 | 56000 | 1/15 | 48 J - 48 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 4/15 | 110 J - 470 | NA | NA | 0 | NA |
| Pyrene | NE | NE | 286000 | 2300000 | 4/15 | 210 J - 380 J | NA | NA | 0 | 0 |
| **Metals (mg/kg)** | | | | | | | | | 0 | 0 |
| Barium | 46.53 | 22.58 | 848 | 5400 | 10/15 | 3.5 J - 19.4 | 0 | 0 | 0 | 0 |
| Cadmium | NE | NE | 2.72 | 37 | 3/15 | 0.074 J - 0.81 | NA | NA | 0 | 0 |
| Chromium | 37.71 | 25.0 | 27.2 | 210 | 9/15 | 2.5 J - 22.6 | 0 | 0 | 0 | 0 |
| Lead | 15.24 | 9.19 | 270 | 400 | 15/15 | 3.1 - 114 | 2 | 2 | 0 | 0 |
| Mercury | 0.07 | 0.129 | 0.0154 | 23 | 4/15 | 0.029 J - 0.084 | 1 | 0 | 4 | 0 |
| Selenium | 0.86 | 0.625 | 12.2 | 390 | 4/12 | 0.72 J - 1.3 J | 2 | 4 | 0 | 0 |
| Silver | 0.35 | NE | 0.223 | 390 | 2/15 | 0.33 J - 0.5 J | 1 | NA | 2 | 0 |

(1) Region III PRG Residential Soil

(2) Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L and a TOC of 11408 mg/kg

NA -Not analyzed

NE - Not established

J - Analyte detected. Reported value is estimated.

AOC comparison - AOC 2 Surface Soil

Base comparison - Loam/Silt Data Set for Surface Soil

**TABLE 6**

**DETECTION SUMMARY GROUNDWATER - SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water | SWMU299-GW01TW<br>04-02-2002 | SWMU299-GW02TW<br>04-02-2002 | SWMU299-GW03TW<br>04-02-2002 | SWMU299-GW04TW<br>04-02-2002 |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | |
| 2,4-Dimethylphenol | NE | 140 | 730 | 10 U | 10 U | 36 | 10 U |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | 10 U | 10 U | 10 U | 1 J |
| Di-n-butyl phthalate | NE | 700 | 3600 (1) | 0.8 J | 10 U | 10 U | 10 U |
| Naphthalene | NE | 21 | 6.2 | 10 U | 10 U | **35** | 10 U |
| Phenanthrene | NE | 210 | NE | 10 U | 0.9 J | 10 U | 10 U |
| **METALS (ug/L)** | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 2.4 U | 9.6 J | 7 J | 3.3 J |
| Barium | 37.31 | 2000 | 2600 | 50.3 J | 95.4 J | 103 J | 74.8 J |
| Chromium | 5.76 | 50 | 110 | 3.2 J | 4.7 J | 3.3 J | 5.8 J |
| Lead | 3.61 | 15 | NE | 1.8 U | 1.8 U | 1.8 J | 1.8 U |

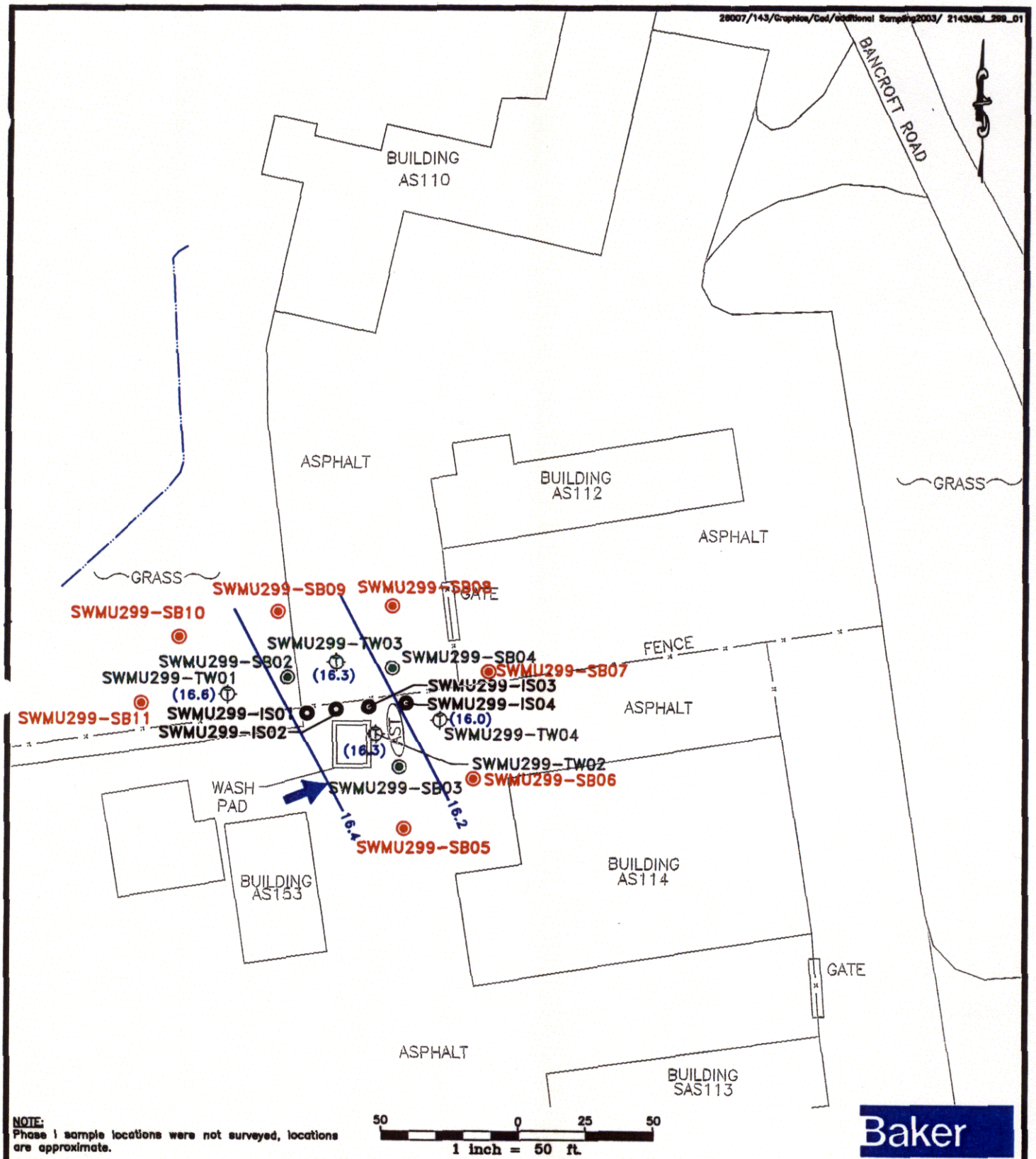
Notes:
Shaded - Exceeds Base Background Concentrations
Bold - Exceeds NC 2L groundwater protection standards
Underline - Exceeds USEPA Region IX PRGs for Tap Water
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established
(1) - If NC2L Standard was not available, Interim standards were used.

**TABLE 7**

**STATISTICAL SUMMARY**
**GROUNDWATER -SWMU 299**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water | Frequency of Detection | Range of Positive Detects | Number of Exceedances: Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 2,4-Dimethylphenol | NE | 140 | 730 | 1/4 | 36 - 36 | NA | 0 | 0 |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | 1/4 | 1 J - 1 J | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | 700 | 3600 (1) | 1/4 | 0.8 J - 0.8 J | NA | 0 | 0 |
| Naphthalene | NE | 21 | 6.2 | 1/4 | 35 - 35 | NA | 1 | 1 |
| Phenanthrene | NE | 210 | NE | 1/4 | 0.9 J - 0.9 J | NA | 0 | NA |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 3/4 | 3.3 J - 9.6 J | 0 | 0 | 3 |
| Barium | 37.31 | 2000 | 2600 | 4/4 | 50.3 J - 103 J | 4 | 0 | 0 |
| Chromium | 5.76 | 50 | 110 | 4/4 | 3.2 J - 5.8 J | 1 | 0 | 0 |
| Lead | 3.61 | 15 | NE | 1/4 | 1.8 J - 1.8 J | 0 | 0 | NA |

Notes:
J - Analyte detected. Reported value is estimated.
NE - Not established
NA- Not analyzed
(1) - If NC2L Standard was not available, Interim standards were used.



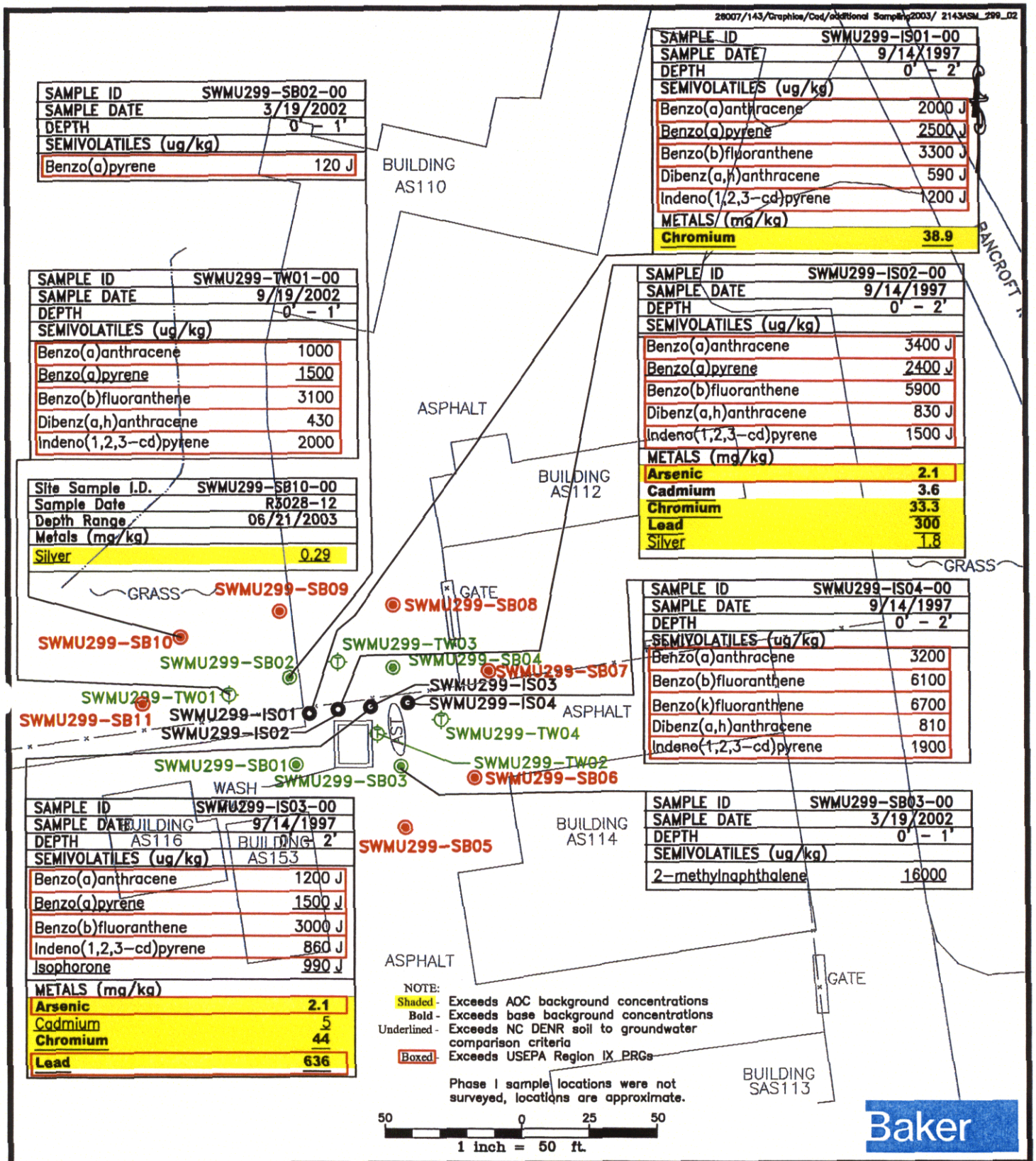

## LEGEND

- TEMPORARY WELL
- PHASE II SOIL BORING
- ADDITIONAL PHASE II SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 16.2 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 1
# PHASE II CONFIRMATORY SAMPLING INVESTIGATION
# SWMU 299
# CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU299-SB02-00 |
|---|---|
| SAMPLE DATE | 3/19/2002 |
| DEPTH | 0' - 1' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 120 J |

| SAMPLE ID | SWMU299-TW01-00 |
|---|---|
| SAMPLE DATE | 9/19/2002 |
| DEPTH | 0' - 1' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 1000 |
| Benzo(a)pyrene | 1500 |
| Benzo(b)fluoranthene | 3100 |
| Dibenz(a,h)anthracene | 430 |
| Indeno(1,2,3-cd)pyrene | 2000 |

| Site Sample I.D. | SWMU299-SB10-00 |
|---|---|
| Sample Date | R3028-12 |
| Depth Range | 06/21/2003 |
| Metals (mg/kg) | |
| Silver | 0.29 |

| SAMPLE ID | SWMU299-IS03-00 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 1200 J |
| Benzo(a)pyrene | 1500 J |
| Benzo(b)fluoranthene | 3000 J |
| Indeno(1,2,3-cd)pyrene | 860 J |
| Isophorone | 990 J |
| METALS (mg/kg) | |
| **Arsenic** | **2.1** |
| Cadmium | 5 |
| **Chromium** | **44** |
| **Lead** | **636** |

| SAMPLE ID | SWMU299-IS01-00 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 2000 J |
| Benzo(a)pyrene | 2500 J |
| Benzo(b)fluoranthene | 3300 J |
| Dibenz(a,h)anthracene | 590 J |
| Indeno(1,2,3-cd)pyrene | 1200 J |
| METALS (mg/kg) | |
| **Chromium** | **38.9** |

| SAMPLE ID | SWMU299-IS02-00 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 3400 J |
| Benzo(a)pyrene | 2400 J |
| Benzo(b)fluoranthene | 5900 |
| Dibenz(a,h)anthracene | 830 J |
| Indeno(1,2,3-cd)pyrene | 1500 J |
| METALS (mg/kg) | |
| **Arsenic** | **2.1** |
| **Cadmium** | **3.6** |
| **Chromium** | **33.3** |
| **Lead** | **300** |
| Silver | 1.8 |

| SAMPLE ID | SWMU299-IS04-00 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)anthracene | 3200 |
| Benzo(b)fluoranthene | 6100 |
| Benzo(k)fluoranthene | 6700 |
| Dibenz(a,h)anthracene | 810 |
| Indeno(1,2,3-cd)pyrene | 1900 |

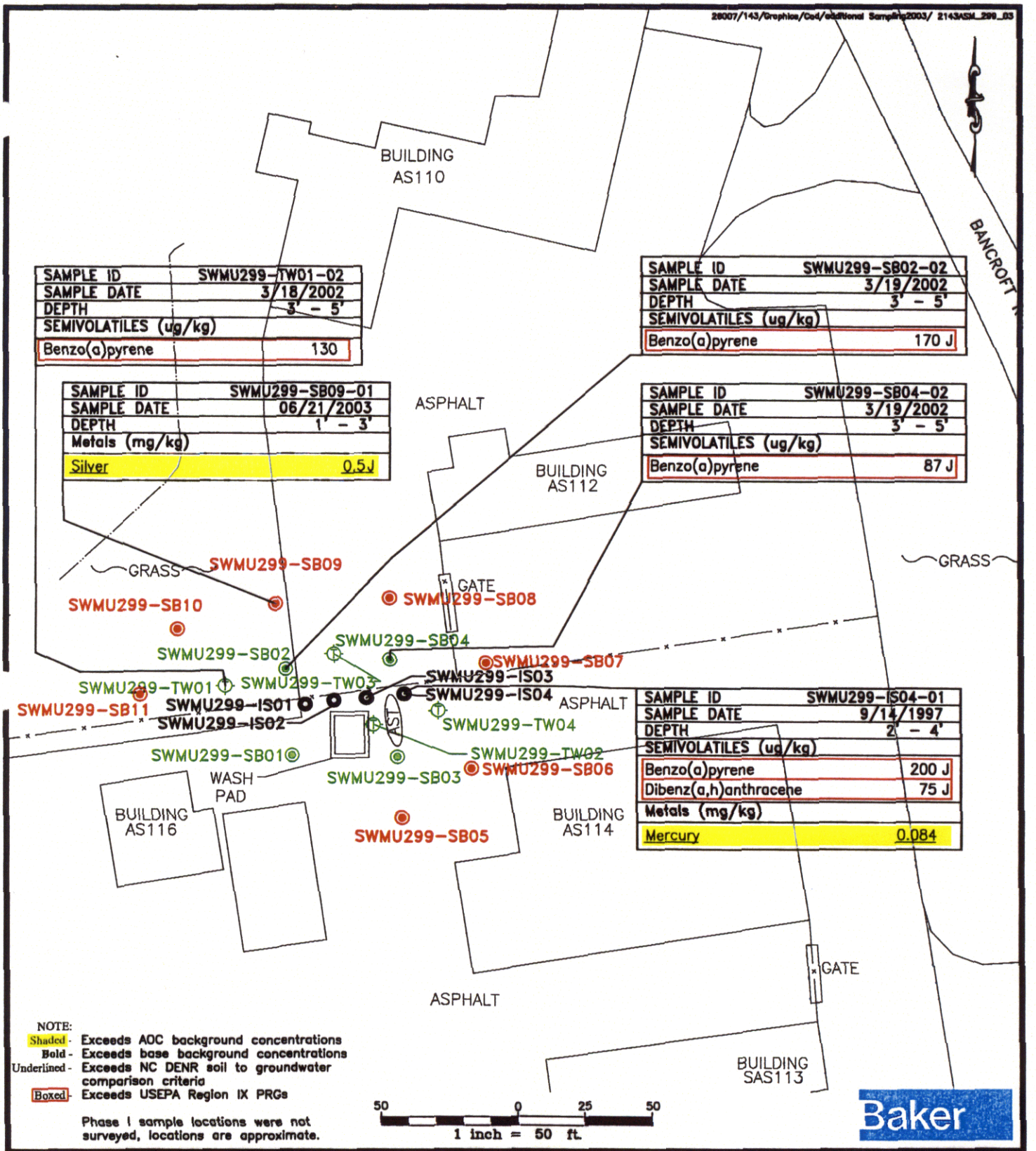
| SAMPLE ID | SWMU299-SB03-00 |
|---|---|
| SAMPLE DATE | 3/19/2002 |
| DEPTH | 0' - 1' |
| SEMIVOLATILES (ug/kg) | |
| 2-methylnaphthalene | 16000 |

## LEGEND

- TEMPORARY WELL
- PHASE II SOIL BORING
- ADDITIONAL PHASE II SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SURFACE SOIL
## SWMU 299
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU299-TW01-02 |
|---|---|
| SAMPLE DATE | 3/18/2002 |
| DEPTH | 3' - 5' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 130 |

| SAMPLE ID | SWMU299-SB02-02 |
|---|---|
| SAMPLE DATE | 3/19/2002 |
| DEPTH | 3' - 5' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 170 J |

| SAMPLE ID | SWMU299-SB09-01 |
|---|---|
| SAMPLE DATE | 06/21/2003 |
| DEPTH | 1' - 3' |
| Metals (mg/kg) | |
| Silver | 0.5J |

| SAMPLE ID | SWMU299-SB04-02 |
|---|---|
| SAMPLE DATE | 3/19/2002 |
| DEPTH | 3' - 5' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 87 J |

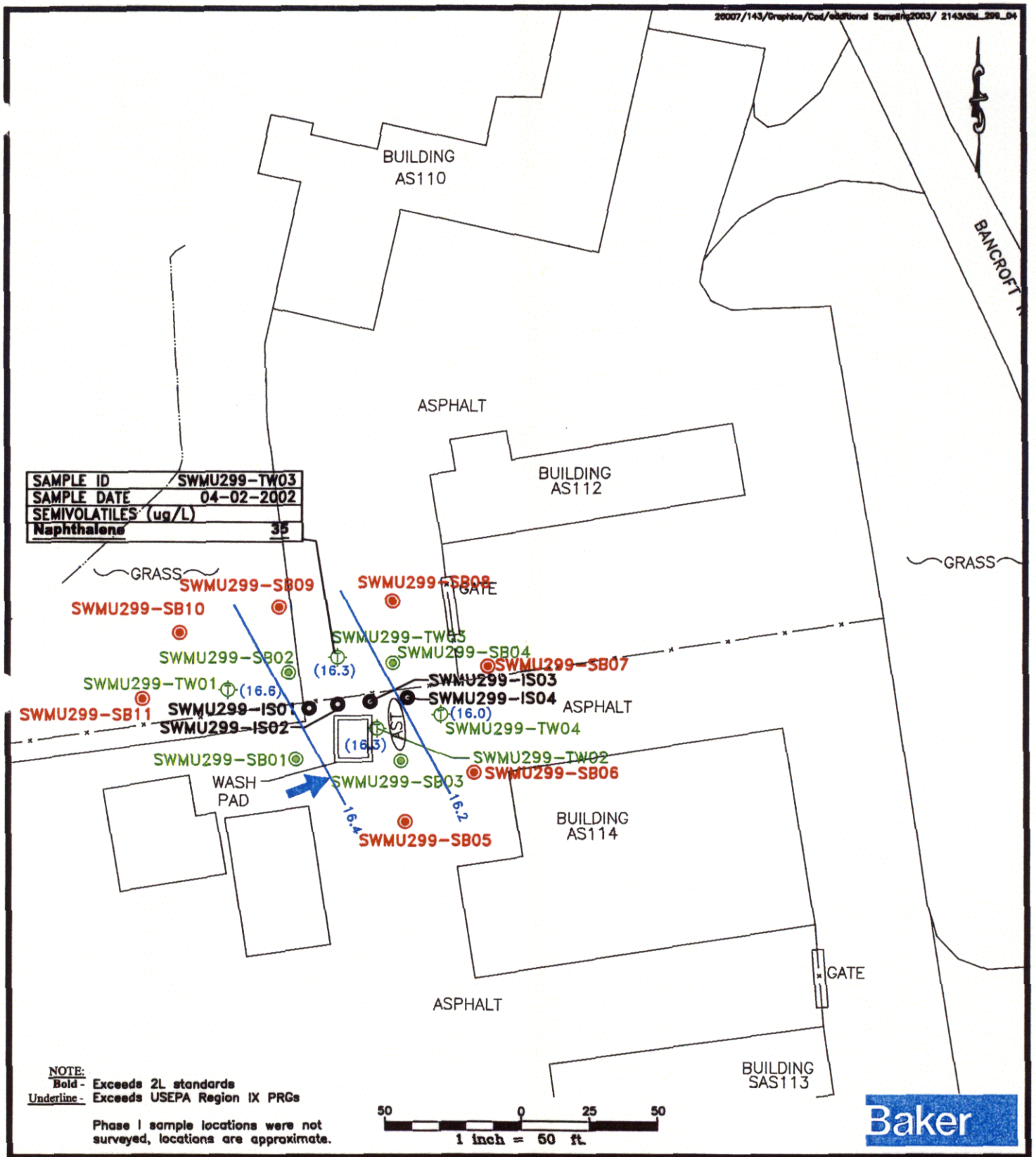
| SAMPLE ID | SWMU299-IS04-01 |
|---|---|
| SAMPLE DATE | 9/14/1997 |
| DEPTH | 2' - 4' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 200 J |
| Dibenz(a,h)anthracene | 75 J |
| Metals (mg/kg) | |
| Mercury | 0.084 |

## LEGEND

- T – TEMPORARY WELL
- – PHASE II SOIL BORING
- – ADDITIONAL PHASE II SOIL BORING
- – PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SUBSURFACE SOIL
SWMU 299
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- PHASE II SOIL BORING
- ADDITIONAL PHASE II SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 16.2 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 4
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
## SWMU 299
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.20 SWMU 300 - AS118 Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.20.1 SWMU Description and History

SWMU 300 consists of a steel AST used to store used motor oil from a vehicle maintenance facility (Building AS-118). The SWMU is located adjacent to Bancroft Road at the Marine Corps Air Station (MCAS). Several drums of various products stored on pallets are located in the vicinity of the SWMU. Used motor oil collected from vehicles is hand transferred from Building AS-118 to the storage tank. The ground surface between the building and the AST as well as the area surrounding the AST is covered with asphalt. No evidence of contamination/spills were observed in the vicinity of the SWMU during the Phase I CSI. An investigation plan is presented in Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the AST has impacted surface and subsurface soils in the area of the SWMU. Soil samples were collected from three soil borings that were advanced in the vicinity of the AST (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, two SVOCs (benzo(a)pyrene and benzo(b)fluoranthene) exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 300 was recommended in the form of a Phase II CSI.

### 4.20.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 19 and 20, 2002 and April 2, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 0.9 to 1.8 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 16.4 to 16.8 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow north.

### 4.20.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Fourteen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in surface soil sample SWMU300-IS03-00 which was collected in September 1997 during the Phase I CSI. Benzo(a)pyrene and benzo(b)fluoranthene were detected in surface soil SWMU300-IS03-00 at concentrations exceeding the NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs. None of the other SVOCs detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- North Carolina 2L standards

One SVOC (napthalene) was detected in groundwater samples SWMU 300-GW02. The concentration was below the 2L standard. No other SVOCs were detected in the samples.

### 4.20.4 Conclusions

Benzo(a)pyrene and benzo(b)fluoranthene were detected in soil at concentrations exceeding the NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRG.

None of the SVOCs detected in the groundwater exceeded the established screening criteria.

The detections of benzo(a)pyrene and benzo(b)fluoranthene in surface soil samples were suspected to be related to paving operations at the SWMU. The entire area is covered with asphalt and these detections are likely associated with the asphalt. Based on the lack of detections in groundwater or soil collected during the Phase II CSI, no further action is warranted at this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU300-TW01 | 3/19/02 | BAKER | 17.56 | 17.9 | 12 | 12 | 1.2 | 0 | 2 | 0.89 | 16.7 |
| SWMU300-TW02 | 3/20/02 | BAKER | 18.22 | 18.9 | 12 | 12 | 1 | 0 | 2 | 1.82 | 16.4 |
| SWMU300-TW03 | 3/19/02 | BAKER | 17.72 | 17.9 | 11 | 11 | 0.5 | 0 | 1 | 0.92 | 16.8 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU300

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU300-IS01-00 09-08-1997 0' - 2' | SWMU300-IS02-00 09-08-1997 0' - 2' | SWMU300-IS03-00 09-08-1997 0' - 2' | SWMU300-TW01-00 03-19-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Anthracene | 995000 | 22000000 | ND | ND | 22 J | ND |
| Benzaldehyde | NE | 6100000 | NA | NA | NA | ND |
| Benzo(a)anthracene | 358 | 620 | ND | ND | 46 J | ND |
| Benzo(a)pyrene | 393(1) | 62 | ND | ND | 5000 | ND |
| Benzo(b)fluoranthene | 4980 (2) | 620 | ND | ND | 3000 | ND |
| Benzo(k)fluoranthene | 49800 (2) | 6200 | ND | ND | 4800 | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 97 J | 57 J | 83 J | 61 J |
| Butyl benzyl phthalate | 27800 | 12000000 | ND | ND | 56 J | ND |
| Carbazole | NE | 24000 | ND | ND | 110 J | ND |
| Chrysene | 39800 | 62000 | ND | ND | 71 J | ND |
| Di-n-butyl phthalate | 24800 | 6100000 | ND | ND | 46 J | ND |
| Fluoranthene | 276000 | 2300000 | ND | 41 J | 140 J | ND |
| Phenanthrene | 59600 | NE | ND | ND | 47 J | ND |
| Pyrene | 286000 | 2300000 | ND | 42 J | 110 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1)- Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L standard or interim 2L standard and TOC of 4310 mg/kg.

(2) - Site-specific criteria calculated with interim 2L and TOC of 4310mg/kg.

J - Analyte detected. Report value is estimated.

NA - Not analyzed. Not on the Phase I Target Compound List

ND - Analyte not detected.

NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU300-TW02-00 03-20-2002 0' - 1' | | SWMU300-TW03-00 03-19-2002 0' - 1' | |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Anthracene | 995000 | 22000000 | ND | | ND | |
| Benzaldehyde | NE | 6100000 | ND | | 41 | J |
| Benzo(a)anthracene | 358 | 620 | ND | | ND | |
| Benzo(a)pyrene | 393(1) | 62 | ND | | ND | |
| Benzo(b)fluoranthene | 4980 (2) | 620 | ND | | ND | |
| Benzo(k)fluoranthene | 49800 (2) | 6200 | ND | | ND | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 57 | J | 50 | J |
| Butyl benzyl phthalate | 27800 | 12000000 | ND | | ND | |
| Carbazole | NE | 24000 | ND | | ND | |
| Chrysene | 39800 | 62000 | ND | | ND | |
| Di-n-butyl phthalate | 24800 | 6100000 | ND | | ND | |
| Fluoranthene | 276000 | 2300000 | ND | | 28 | J |
| Phenanthrene | 59600 | NE | ND | | ND | |
| Pyrene | 286000 | 2300000 | ND | | ND | |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1)- Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L standard or interim 2L standard and TOC of 4310 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4310mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Anthracene | 995000 | 22000000 | 1/6 | 22 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | 6100000 | 1/3 | 41 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | 358 | 620 | 1/6 | 46 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | 393 (1) | 62 | 1/6 | 5000 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | 4980 (2) | 620 | 1/6 | 3000 | NA | NA | 0 | 1 |
| Benzo(k)fluoranthene | 49800 (2) | 6200 | 1/6 | 4800 | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 6/6 | 50 J - 97 J | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | 27800 | 12000000 | 1/6 | 56 J | NA | NA | 0 | 0 |
| Carbazole | NE | 24000 | 1/6 | 110 J | NA | NA | 0 | 0 |
| Chrysene | 39800 | 62000 | 1/6 | 71 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | 24800 | 6100000 | 1/6 | 46 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 2300000 | 3/6 | 28 J - 140 J | NA | NA | 0 | 0 |
| Phenanthrene | 59600 | NE | 1/6 | 47 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 2300000 | 2/6 | 42 J - 110 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
(1)- Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L standard or interim 2L standard and TOC of 4310 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4310mg/kg.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU300-IS01-01 09-08-1997 2' - 4' | SWMU300-IS02-01 09-08-1997 2' - 4' | SWMU300-IS03-01 09-08-1997 2' - 4' | SWMU300-TW01-02 03-19-2002 3' - 5' | SWMU300-TW02-02 03-20-2002 3' - 5' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 1400 | ND | ND | 310 J | ND |
| Butyl benzyl phthalate | 27800 | 12000000 | 54 J | ND | ND | ND | ND |
| Fluoranthene | 276000 | 2300000 | 67 J | ND | ND | ND | ND |
| Pyrene | 286000 | 2300000 | 51 J | ND | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/11/02
SWMU300_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU300-TW03-02<br>03-19-2002<br>3' - 5' |
|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 71 J |
| Butyl benzyl phthalate | 27800 | 12000000 | ND |
| Fluoranthene | 276000 | 2300000 | ND |
| Pyrene | 286000 | 2300000 | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/11/02
SWMU300_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 3/6 | 71 J - 1400 | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | 27800 | 12000000 | 1/6 | 54 J | NA | NA | 0 | 0 |
| Fluoranthene | 276000 | 2300000 | 1/6 | 67 J | NA | NA | 0 | 0 |
| Pyrene | 286000 | 2300000 | 1/6 | 51 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
(1) - Background concentrations were collected for inorganics

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | SWMU300-TW01 04-02-2002 | SWMU300-TW02 04-02-2002 | SWMU300-TW03 04-02-2002 |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | |
| Naphthalene | 21 | ND | 2 J | ND |

J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

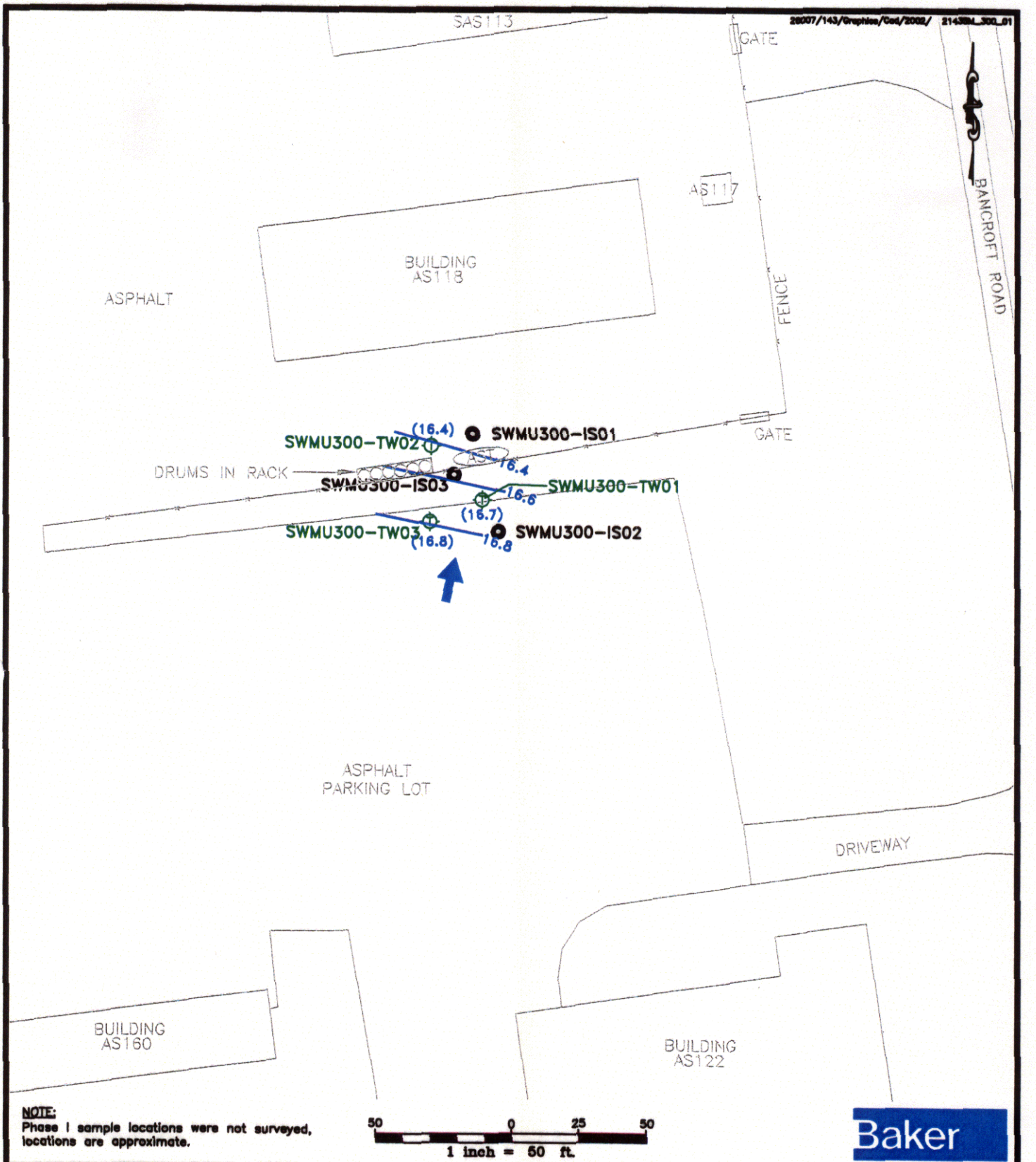
9/11/02
SWMU300_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 300
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| Naphthalene | 21 | 1/3 | 2 J | NA | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

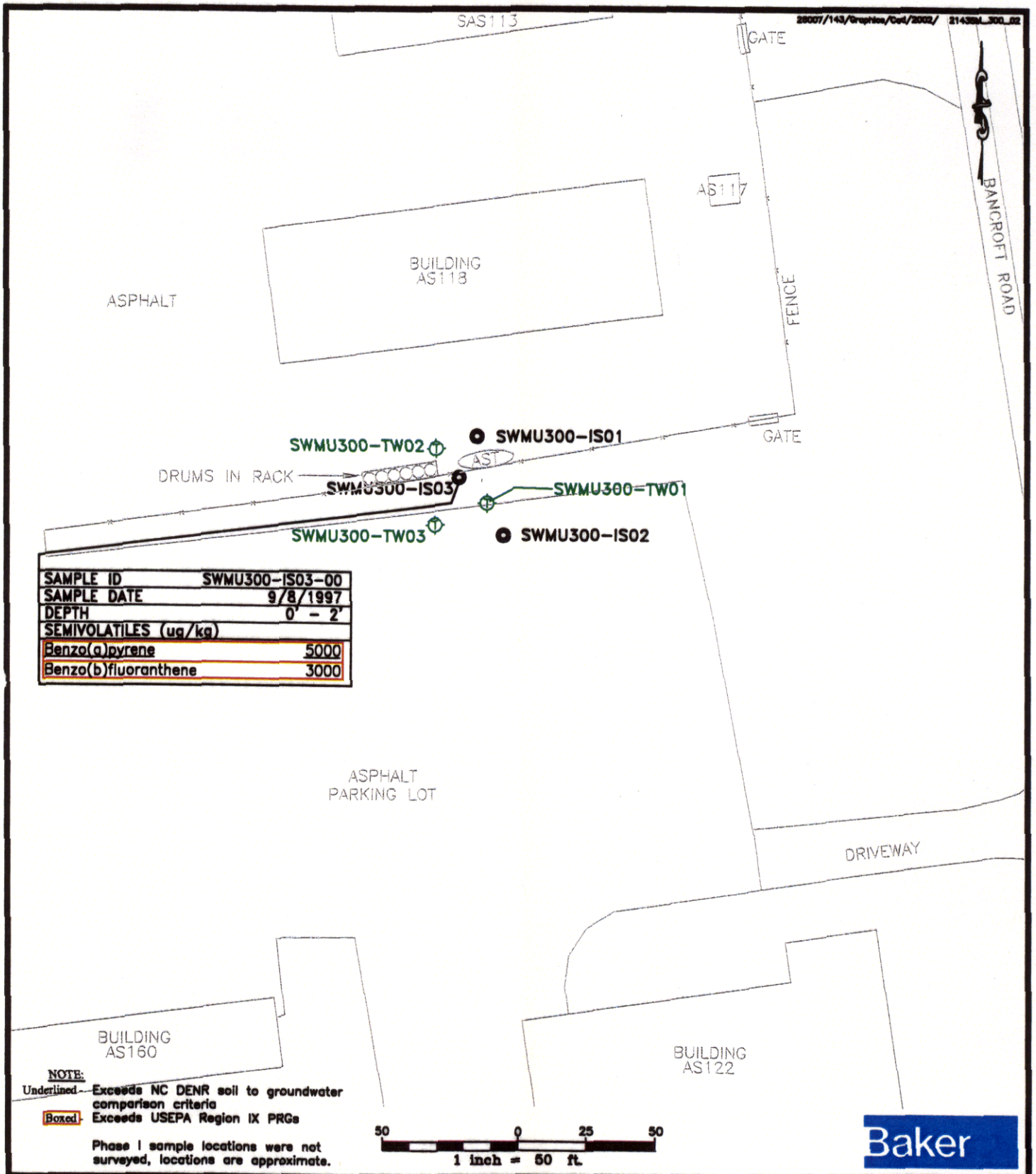
Baker

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 16.8 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 300
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU300-IS03-00 |
|---|---|
| SAMPLE DATE | 9/8/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Benzo(a)pyrene | 5000 |
| Benzo(b)fluoranthene | 3000 |

NOTE:
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

Baker

LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 300
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.21 SWMU 302 - AS563 Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.21.1 SWMU Description and History

SWMU 302 is located north of the MCAS behind the Fire Rescue Building at the intersection of Campbell and Foster Streets. The SWMU consists of an AST with secondary containment. The AST was installed in 1983 and is still in use. The AST receives used engine, hydraulic, and transmission oils. During the 1996 site visit conducted by Baker, petroleum stains were observed on the steps to the AST. In addition, four drums were situated adjacent to the AST on a pallet surrounded by sandbags. The area surrounding the SWMU is covered with asphalt and grass. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the AST has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the AST. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on the evaluation of the results, Benzo(a)pyrene, dibenz(a,h)anthracene, and cadmium exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 302 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.21.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 19 and April 2, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 0.9 to 7.8 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 11.1 to 17.4 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south/southwest.

### 4.21.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Fifteen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in the surface and subsurface soil samples from boring SWMU302-IS03. Benzo(a)pyrene was detected in surface soil sample SWMU302-IS03-00 at concentrations exceeding NC DENR soil to groundwater screening criteria and the USEPA Region IX industrial PRGs. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Seven metals (arsenic, barium, cadmium, chromium, lead, mercury and selenium) were detected in the sample set. Cadmium and mercury were detected at concentrations exceeding AOC and Base background screening criteria and NC DENR soil to groundwater criteria in surface soil sample SWMU302-IS02-00 and in subsurface soil sample SWMU302-TW02-04, respectively. Arsenic was detected at concentrations exceeding the Base background criteria or USEPA Region IX industrial PRG in two of the samples. However, the concentrations were below the NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs. The remaining four metals (barium, chromium, lead and selenium) exceeded the AOC and/or Base background screening criteria; however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Three SVOCs were detected in the groundwater samples from one or more of the wells as follows: Acenaphthene, bis(2-ethylhexyl)phthalate, and naphthalene. None of the detected SVOCs exceeded the applicable screening criteria.

Five metals were detected in the groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, lead, and selenium. These five metals exceeded the background criteria. However, the concentrations (except for arsenic) were below the 2L standards. Arsenic was detected in the sample from well SWMU302-TW01 at a concentration exceeding Base background criteria and North Carolina 2L standard. It should be noted that turbidity was elevated in the groundwater samples from the temporary wells and may have caused artificially high metals concentrations in the samples. The elevated turbidity may be attributable to clay layers that were encountered during the drilling and installation of the temporary wells.

All of the compounds detected in groundwater, except for acenaphthalene and naphthalene, were detected in soils at the SWMU.

### 4.21.4 Conclusions

One SVOC and a few metals were detected in soil and/or groundwater at concentrations exceeding applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene
- Metals - cadmium and mercury

One metal (arsenic) exceeded both the Base background screening criteria and 2L standards in groundwater.

The elevated turbidity in the groundwater samples from the temporary wells may have caused artificially high metals concentrations in the samples.

Based on evaluation of the results, only a few isolated detections in soil and groundwater were slightly above screening criteria. The COPCs are not typical petroleum related compounds and not indicative of SWMU failure or release. Therefore, no further action is warranted at this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU302-TW01 | 3/19/02 | BAKER | 19.04 | 19.2 | 18 | 18 | 6 | 4 | 8 | 7.8 | 11.2 |
| SWMU302-TW02 | 3/19/02 | BAKER | 18.57 | 18.7 | 18 | 18 | 6 | 4 | 8 | 7.5 | 11.1 |
| SWMU302-TW03 | 3/19/02 | BAKER | 18.32 | 18.5 | 18 | 18 | 6 | 4 | 8 | 0.9 | 17.4 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU302

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU302-IS01-00 09-08-1997 0' - 2' | SWMU302-IS02-00 09-08-1997 0' - 2' | SWMU302-IS03-00 09-08-1997 0' - 2' | SWMU302-IS04-00 09-08-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | 240 J | 170 J |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | ND | ND | 420 | ND |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | 51 J | ND | 570 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | 270 J | ND |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | ND | ND | 210 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 89 J | ND | 390 | 240 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 360 | 140 J |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | ND | ND | 54 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | 66 J | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | 370 | 200 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | 250 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | 47 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 360 | 340 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 33 | 17 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | ND | 2.9 | ND | 0.64 |
| Chromium | 19 | 15 | 27 | 450 | 6 | 7.1 | 8.2 | 11.4 |
| Lead | 23 | 21 | 270 | 750 | 4.5 | 18.7 | 15.5 | 78.7 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 1.2 | 0.46 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceeded NC DENR generic soil-to-groundwater criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU302-TW01-00 03-19-2002 0' - 1' | SWMU302-TW02-00 03-19-2002 0' - 1' | SWMU302-TW03-00 03-19-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | 67 J | 51 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 59 J | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | ND | ND | **0.96** J |
| Barium | 33 | 17 | 848 | 100000 | 9.5 | 8.5 | **20.1** |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | 0.04 J | ND | **1.9** |
| Chromium | 19 | 15 | 27 | 450 | 5.2 | 3.6 | **21.1** |
| Lead | 23 | 21 | 270 | 750 | 4.9 J | 2.9 J | **80.9** J |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | 0.03 J | 0.02 J | 0.04 |
| Selenium | 1.2 | 0.46 | 12 | 10000 | **0.51** J | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceeded NC DENR generic soil-to-groundwater criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 2/7 | 170 J - 240 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | 1/7 | 420 | NA | NA | 0 | 1 |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | 2/7 | 51 J - 570 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/7 | 270 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | 1/7 | 210 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 5/7 | 51 J - 390 | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/7 | 140 J - 360 | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | 1/7 | 54 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/7 | 59 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/7 | 66 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 2/7 | 200 J - 370 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/7 | 250 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/7 | 47 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/7 | 340 J - 360 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | 1/7 | 0.96 J | 0 | 1 | 0 | 0 |
| Barium | 33 | 17 | 848 | 100000 | 3/7 | 8.5 - 20.1 | 0 | 1 | 0 | 0 |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | 4/7 | 0.04 J - 2.9 | 3 | 3 | 1 | 0 |
| Chromium | 19 | 15 | 27 | 450 | 7/7 | 3.6 - 21.1 | 1 | 1 | 0 | 0 |
| Lead | 23 | 21 | 270 | 750 | 7/7 | 2.9 J - 80.9 J | 2 | 2 | 0 | 0 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | 3/7 | 0.02 J - 0.04 | 0 | 0 | 3 | 0 |
| Selenium | 1.2 | 0.46 | 12 | 10000 | 1/7 | 0.51 J | 0 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceeded NC DENR generic soil-to-groundwater criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU302-IS01-01 09-08-1997 2' - 4' | SWMU302-IS02-01 09-08-1997 2' - 4' | SWMU302-IS03-01 09-08-1997 2' - 4' | SWMU302-IS04-01 09-08-1997 2' - 4' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | 150 J | ND |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | ND | ND | 200 J | ND |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | ND | ND | 270 J | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | 98 J | ND |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | ND | ND | 78 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | 420 | 90 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 260 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | 180 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | 100 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | 84 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 330 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 47 | 29 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 38 | 27 | 27 | 450 | 3.7 | 7 | 7.6 | 4.5 |
| Lead | 15 | 14 | 270 | 750 | 2.8 | 4.6 | 7.9 | 4.3 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 0.86 | 1.7 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU302_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU302-TW01-05 03-19-2002 9' - 11' | SWMU302-TW02-04 03-19-2002 7' - 9' | SWMU302-TW03-05 03-19-2002 9' - 11' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | 36 J | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | 2700 | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | 73 J | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 3.3 | 0.82 J | 1 J |
| Barium | 47 | 29 | 848 | 100000 | 12.9 | 15.8 | 16.6 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 0.04 J | 0.05 J | 0.05 J |
| Chromium | 38 | 27 | 27 | 450 | 7.7 | 16.5 | 15.4 |
| Lead | 15 | 14 | 270 | 750 | 2.7 J | 9.7 J | 9.4 J |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 0.03 J | 0.5 | 0.03 J |
| Selenium | 0.86 | 1.7 | 12 | 10000 | 0.57 J | 0.58 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU302_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzaldehyde | NE | NE | NE | 88000000 | 1/3 | 36 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/7 | 150 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 317 (1) | 290 | 1/7 | 200 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 4030 (2) | 2900 | 1/7 | 270 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/7 | 98 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 40300 (2) | 29000 | 1/7 | 78 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 3/7 | 90 J - 2700 | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/7 | 260 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/7 | 73 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/7 | 180 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/7 | 100 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/7 | 84 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/7 | 330 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 3/7 | 0.82 J - 3.3 | 0 | 0 | 0 | 1 |
| Barium | 47 | 29 | 848 | 100000 | 3/7 | 12.9 - 16.6 | 0 | 0 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 3/7 | 0.04 J - 0.05 J | 3 | 3 | 0 | 0 |
| Chromium | 38 | 27 | 27 | 450 | 7/7 | 3.7 - 16.5 | 0 | 0 | 0 | 0 |
| Lead | 15 | 14 | 270 | 750 | 7/7 | 2.7 J - 9.7 J | 0 | 0 | 0 | 0 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 3/7 | 0.03 J - 0.5 | 1 | 1 | 3 | 0 |
| Selenium | 0.86 | 1.7 | 12 | 10000 | 2/7 | 0.57 J - 0.58 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3482 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 3482mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Clay Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU302-TW01 04-02-2002 | | SWMU302-TW02 04-02-2002 | | SWMU302-TW03 04-02-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| Acenaphthene | NE | 80 | ND | | 0.7 | J | 0.8 | J |
| bis(2-Ethylhexyl)phthalate | NE | 3 | ND | | 1 | J | ND | |
| Naphthalene | NE | 21 | ND | | 1 | J | 1 | J |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | 12.7 | J | 7 | J | 3.6 | J |
| Barium | 145 | 2000 | 527 | J | 287 | J | 189 | J |
| Chromium | 5.8 | 50 | 42.4 | J | 25.1 | J | 16.1 | J |
| Lead | 3.6 | 15 | 10.6 | J | 6.9 | J | 4.3 | J |
| Selenium | 2.8 | 50 | 5 | J | ND | | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

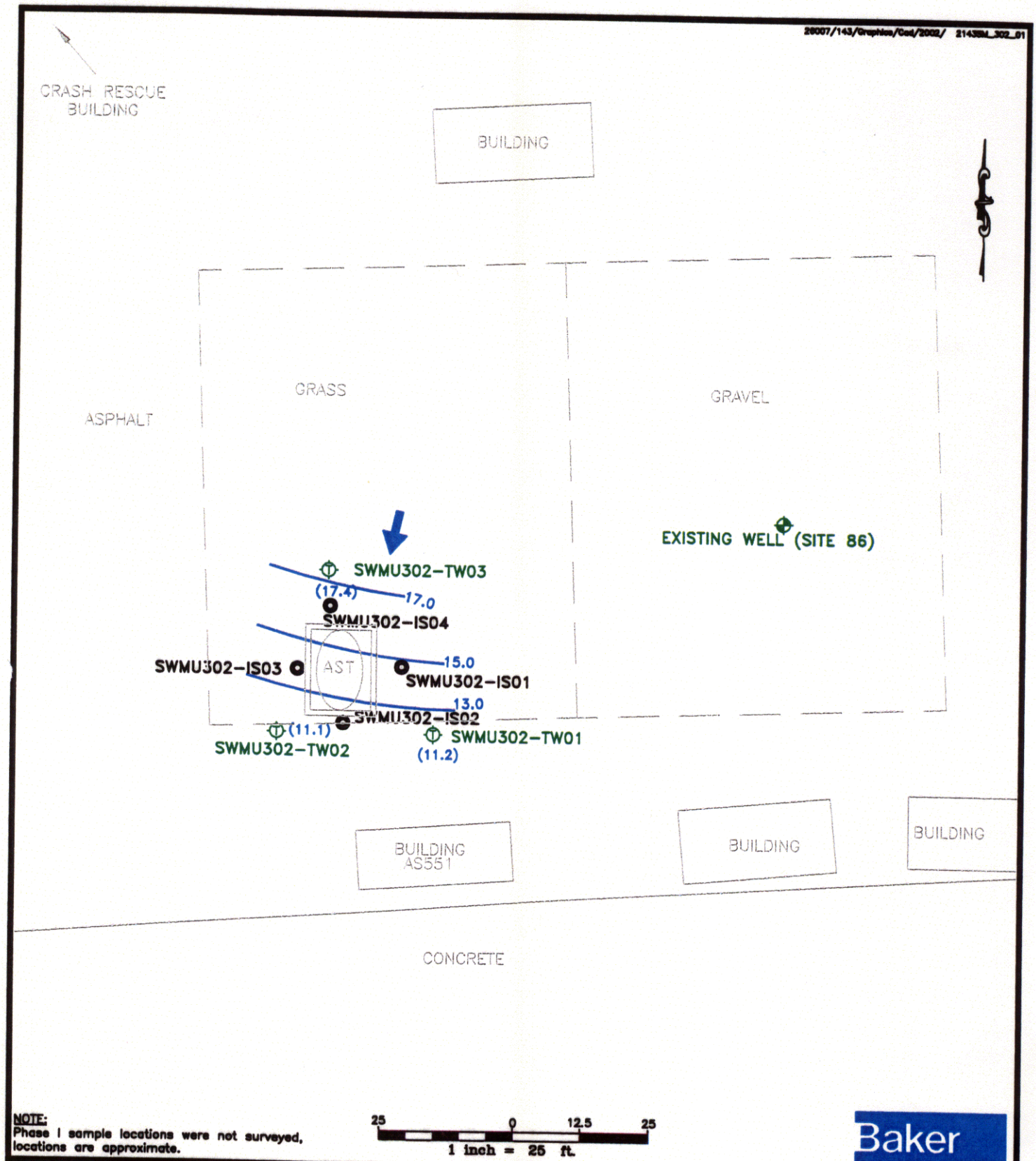
8/30/02
SWMU302_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 302
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| Acenaphthene | NE | 80 | 2/3 | 0.7 J - 0.8 J | NA | 0 |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 1/3 | 1 J | NA | 0 |
| Naphthalene | NE | 21 | 2/3 | 1 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 3/3 | 3.6 J - 12.7 J | 1 | 1 |
| Barium | 145 | 2000 | 3/3 | 189 J - 527 J | 3 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 16.1 J - 42.4 J | 3 | 0 |
| Lead | 3.6 | 15 | 3/3 | 4.3 J - 10.6 J | 3 | 0 |
| Selenium | 2.8 | 50 | 1/3 | 5 J | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.

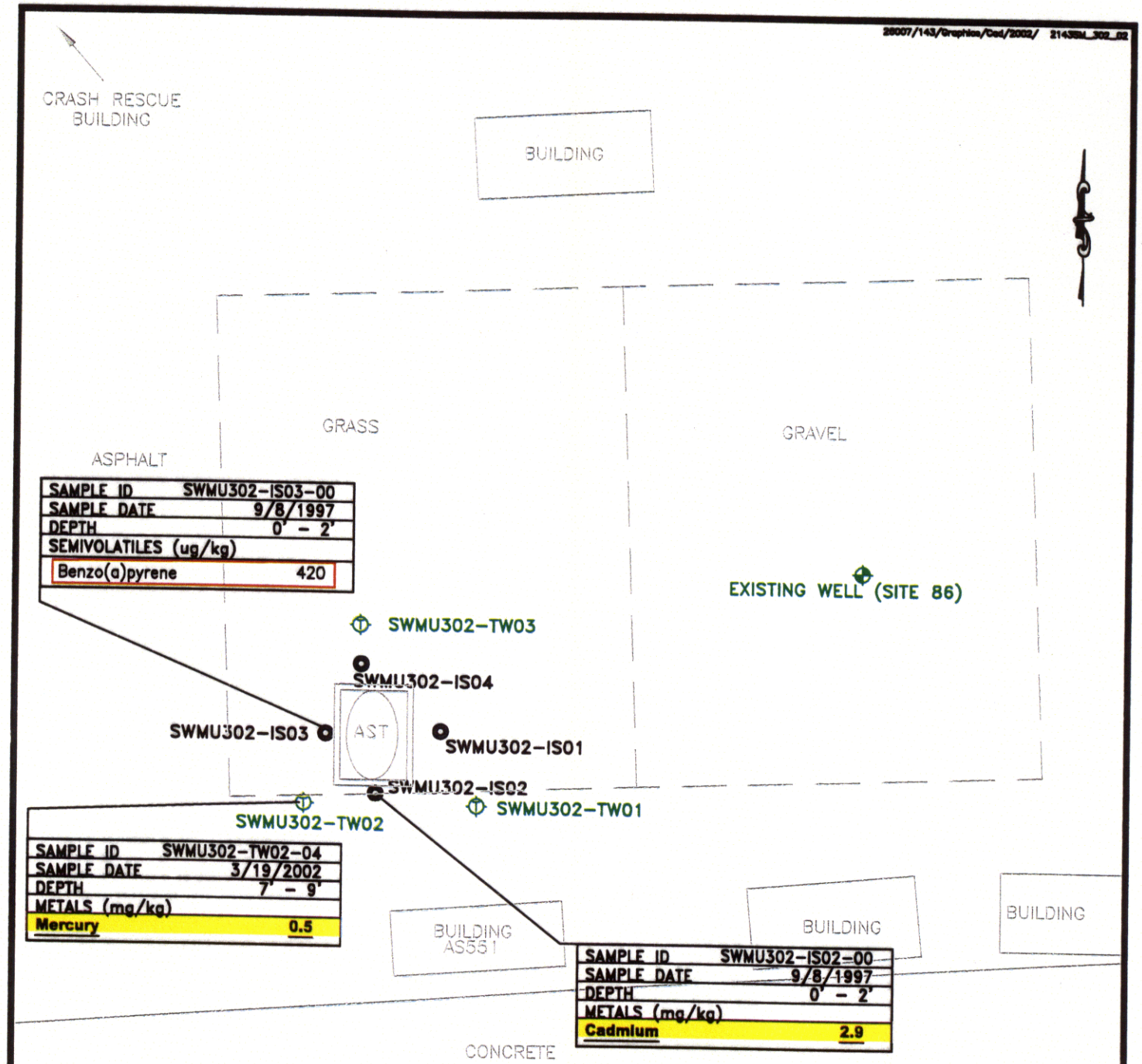



## LEGEND

- TEMPORARY WELL
- EXISTING WELL (SITE86)
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 13.0 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 302
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

Phase I sample locations were not surveyed, locations are approximate.

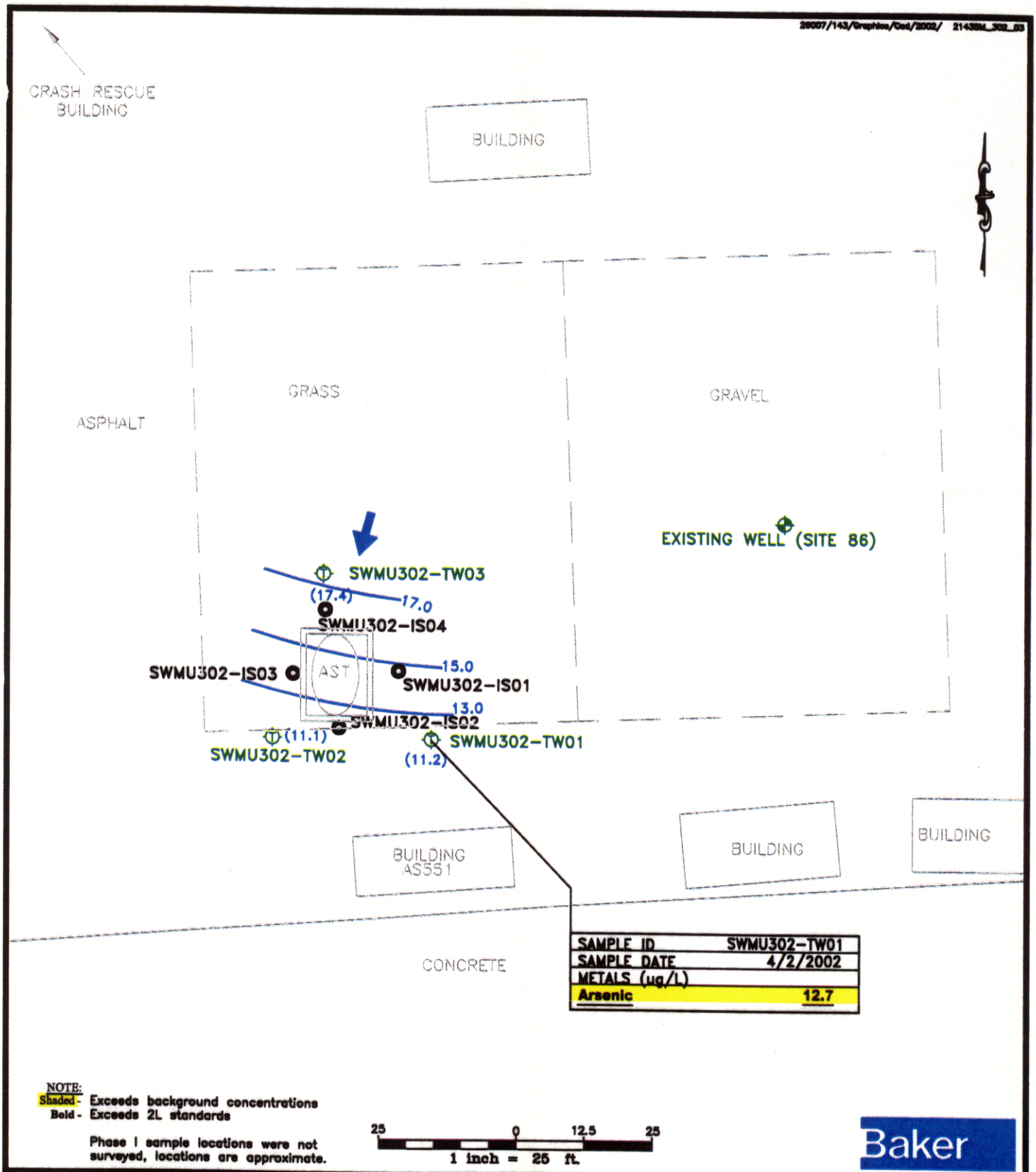
25 0 12.5 25
1 inch = 25 ft.

Baker

LEGEND
- TEMPORARY WELL
- EXISTING WELL (SITE86)
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 302
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

Baker

## LEGEND

- TEMPORARY WELL
- EXISTING WELL (SITE86)
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 13.0 - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 302
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.22 SWMU 303 - Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.22.1 SWMU Description and History

SWMU 303 is located in the MCAS area east of Bancroft Street between the aircraft parking apron and Building AS-515. The SWMU consists of two ASTs that are contained within a concrete, bermed structure. The tanks are labeled as "Hydraulic Fluid, Engine and Transmission Oils Only, No Solvents or Other Chemicals". The steel tanks were installed in 1983 and are still in use. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the ASTs has impacted surface and subsurface soils in the vicinity of the SWMU. At the time of the investigation, petroleum staining was noted on the outside of the concrete berm. Surface and subsurface soil samples were collected from four borings advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on the evaluation of the results, acetone, a few SVOCs, and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 303 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.22.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 19, 20 and April 2, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings and two soil borings
- Groundwater sampling at three temporary wells
- Re-sampling surface soil at location SWMU303-IS04-00

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 6.6 to 6.7 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 11.9 to 12.1 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow north/northeast.

### 4.22.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. In addition, the surface soil sample location that was resampled (SWMU303-IS04-00) was analyzed for VOCs only, to confirm the presence of acetone. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Six VOCs were detected in the soil sample set. Acetone (14,000 ug/kg) exceeded the NC DENR soil to groundwater screening criteria in surface soil sample SWMU303-IS04-00, which was collected in September 1997 during the Phase I CSI. The presence of acetone in this sample was suspect and likely attributable to decontamination or analytical procedures. Acetone was detected in the associated equipment rinsate blank (371ER01B) collected during Phase I at a concentration of 59 µg/L. Even though acetone was detected at higher concentrations in the surface soil sample, the source of the contamination is not suspected to be SWMU-related. This SWMU has not had a history of accepting acetone contaminated waste. Sample location SWMU303-IS04-00 was re-sampled during the Phase II CSI to confirm the presence of acetone. Acetone (27 J ug/kg) was not detected at concentrations exceeding the applicable screening criteria. Therefore, acetone is not considered as a COPC at SWMU 303. None of the other VOCs exceeded the applicable screening criteria.

Sixteen SVOCs (mostly PAHs) were detected in the soil sample set. Most of the SVOCs were detected in surface soil sample SWMU303-IS04-00 and subsurface sample SWMU303-TW01-04. Benzo(a)pyrene exceeded the NC DENR soil to groundwater screening criteria and the USEPA Region IX industrial PRG in surface soil sample SWMU 303-IS04-00. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Seven metals were detected in the soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Arsenic exceeded the AOC and Base background screening criteria and USEPA Region IX industrial PRGs in surface soil sample SWMU303-TW01-00. Chromium and mercury exceeded the NC DENR soil to groundwater criteria in one or more of the samples. However, the concentrations did not exceed both the AOC and Base background criteria and the USEPA Region IX industrial PRGs. Barium, cadmium, lead and selenium exceeded background criteria; however, these metals did not exceed the NC DENR soil to groundwater criteria or the USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Eleven SVOCs were detected in groundwater samples from one or more of the wells. Naphthalene and 4-methylphenol were detected in the sample from well SWMU303-TW03 at concentrations exceeding the North Carolina 2L standards. In addition, 4-methylphenol exceeded the 2L standard in the sample from well SWMU303-TW02. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Four metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, and lead. These four metals exceeded the background criteria. In addition, arsenic, chromium and lead were detected at concentrations exceeding the North Carolina 2L standards. It should be noted that turbidity was elevated in the groundwater samples from the temporary wells and may have caused artificially high metals concentrations in the samples. The elevated turbidity may be attributable to clay layers that were encountered during drilling and installation of the temporary wells.

### 4.22.4 Conclusions

A few SVOCs and metals were detected in soil and groundwater at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or Region IX industrial PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene
- Metals - Arsenic

Compounds that exceeded the Base background screening criteria and the North Carolina 2L standards in groundwater were as follows:

- SVOCs - 4-methylphenol and naphthalene
- Metals - arsenic, chromium and lead

The elevated turbidity in the groundwater samples from the temporary wells may have caused artificially high concentrations in the samples.

Based on evaluation of the analytical results, additional investigation at SWMU 303 is warranted. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU303-TW01 | 3/20/02 | BAKER | 18.68 | 18.7 | 16 | 16 | 4 | 2 | 6 | 6.68 | 12.0 |
| SWMU303-TW02 | 3/20/02 | BAKER | 18.68 | 18.8 | 15 | 15 | 2.9 | 1 | 5 | 6.55 | 12.1 |
| SWMU303-TW03 | 3/20/02 | BAKER | 18.89 | 19.2 | 15 | 15 | 2.8 | 0.8 | 5 | 6.95 | 11.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU303

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-IS01-00 09-09-1997 0' - 2' | SWMU303-IS02-00 09-09-1997 0' - 2' | SWMU303-IS03-00 09-09-1997 0' - 2' | SWMU303-IS04-00 09-09-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | 1.6 | 1.8 | ND | 3.4 |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | ND | ND | ND |
| Acetone | NE | NE | 2850 (1) | 6200000 | 1900 | 30 | 510 | 14000 |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | ND | ND | ND |
| Chloroethane | NE | NE | 13600 | 6500 | ND | ND | ND | ND |
| Methylene chloride | NE | NE | 22 | 21000 | 8 | ND | 7.1 | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1850 (1) | 2900 | ND | 52 J | ND | 1000 |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | ND | 59 J | 59 J | 650 |
| Benzo(b)fluoranthene | NE | NE | 6250 (3) | 2900 | ND | 98 J | 71 J | 1100 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | 200 J |
| Benzo(k)fluoranthene | NE | NE | 62500 (3) | 29000 | ND | 48 J | 37 J | 350 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 130 J | 75 J | 55 J | 290 J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND | ND | 86 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | 82 J | ND | 830 |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | ND | ND | ND | 1800 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | 42 J |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | 1400 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | 250 J |
| Naphthalene | NE | NE | 585 | 190000 | ND | ND | ND | ND |
| Phenol | NE | NE | 1750 | 100000000 | ND | ND | ND | 160 J |
| Pyrene | NE | NE | 286000 | 54000000 | ND | 88 J | ND | 1300 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | ND | **1.9** | **1.3** | ND |
| Barium | 33 | 17 | 848 | 100000 | ND | **40.3** | **107** | **50.9** |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | **0.69** | ND | **1.1** | ND |
| Chromium | 19 | 15 | 27 | 450 | 10.3 | 10.1 | **16.9** | 7.9 |
| Lead | 23 | 21 | 270 | 750 | 12.3 | 10.1 | 13.6 | 16.3 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 1.2 | 0.46 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Phase I (1997) volatiles were run for SW8260 and SW8020 (BTEX).
(3) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-IS04-00 03-19-2002 0' - 1' | SWMU303-SB01-00 03-19-2002 0' - 1' | SWMU303-SB02-00 03-19-2002 0' - 1' | SWMU303-TW01-00 03-20-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | ND | NA | NA | NA |
| 2-Butanone | NE | NE | 692 | 28000000 | 7 J | NA | NA | NA |
| Acetone | NE | NE | 2850 (1) | 6200000 | 27 J | NA | NA | NA |
| Carbon disulfide | NE | NE | 4940 | 720000 | 2 J | NA | NA | NA |
| Chloroethane | NE | NE | 13600 | 6500 | 44 J | NA | NA | NA |
| Methylene chloride | NE | NE | 22 | 21000 | 2 J | NA | NA | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1850 (1) | 2900 | NA | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | NA | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 6250 (3) | 2900 | NA | ND | ND | 34 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | NA | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 62500 (3) | 29000 | NA | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | NA | 110 J | 46 J | 96 J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | NA | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | NA | ND | ND | ND |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | NA | ND | ND | 31 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | NA | ND | 30 J | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | NA | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | NA | ND | ND | 21 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | NA | ND | ND | 36 J |
| Naphthalene | NE | NE | 585 | 190000 | NA | ND | ND | ND |
| Phenol | NE | NE | 1750 | 100000000 | NA | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | NA | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | NA | 0.48 J | **1.1** | 6.1 |
| Barium | 33 | 17 | 848 | 100000 | NA | 13.4 | 47.5 | **22** |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | NA | 0.087 J | 0.081 J | ND |
| Chromium | 19 | 15 | 27 | 450 | NA | 7.2 | 6.9 | 14.4 J |
| Lead | 23 | 21 | 270 | 750 | NA | 6.3 | 3.4 | 7.4 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | NA | 0.044 | 0.018 J | ND |
| Selenium | 1.2 | 0.46 | 12 | 10000 | NA | **0.58** | ND | **0.82** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Phase I (1997) volatiles were run for SW8260 and SW8020 (BTEX).
(3) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-TW02-00 03-20-2002 0' - 1' | SWMU303-TW03-00 03-20-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | NA | NA |
| 2-Butanone | NE | NE | 692 | 28000000 | NA | NA |
| Acetone | NE | NE | 2850 (1) | 6200000 | NA | NA |
| Carbon disulfide | NE | NE | 4940 | 720000 | NA | NA |
| Chloroethane | NE | NE | 13600 | 6500 | NA | NA |
| Methylene chloride | NE | NE | 22 | 21000 | NA | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| Benzo(a)anthracene | NE | NE | 1850 (1) | 2900 | ND | ND |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 6250 (3) | 2900 | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 62500 (3) | 29000 | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | ND | 120 J |
| Phenol | NE | NE | 1750 | 100000000 | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | **1.1** J | ND |
| Barium | 33 | 17 | 848 | 100000 | 15 | 9.9 |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | ND | ND |
| Chromium | 19 | 15 | 27 | 450 | 8 J | 4.5 J |
| Lead | 23 | 21 | 270 | 750 | 7.1 | 3.2 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | ND | ND |
| Selenium | 1.2 | 0.46 | 12 | 10000 | **0.76** | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Phase I (1997) volatiles were run for SW8260 and SW8020 (BTEX).
(3) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | 3/5 | 1.6 - 3.4 | NA | NA | 0 | 0 |
| 2-Butanone | NE | NE | 692 | 28000000 | 1/5 | 7 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2850 (1) | 6200000 | 5/5 | 27 J - 14000 | NA | NA | 1 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/5 | 2 J | NA | NA | 0 | 0 |
| Chloroethane | NE | NE | 13600 | 6500 | 1/5 | 44 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 22 | 21000 | 3/5 | 2 J - 8 | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1850 (1) | 2900 | 2/9 | 52 J - 1000 | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | 3/9 | 59 J - 650 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 6250 (2) | 2900 | 4/9 | 34 J - 1100 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/9 | 200 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 62500 (2) | 29000 | 3/9 | 37 J - 350 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 7/9 | 46 J - 290 J | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 1/9 | 86 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/9 | 82 J - 830 | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 248000 | 88000000 | 2/9 | 31 J - 1800 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/9 | 30 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/9 | 42 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 2/9 | 21 J - 1400 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 2/9 | 36 J - 250 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 585 | 190000 | 1/9 | 120 J | NA | NA | 0 | 0 |
| Phenol | NE | NE | 1750 | 100000000 | 1/9 | 160 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/9 | 88 J - 1300 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.7 | 0.67 | 5.24 | 2.7 | 6/9 | 0.48 J - 6.1 | 2 | 5 | 1 | 1 |
| Barium | 33 | 17 | 848 | 100000 | 8/9 | 9.9 - 107 | 4 | 5 | 0 | 0 |
| Cadmium | 0.04 | 0.05 | 2.7 | 810 | 4/9 | 0.081 J - 1.1 | 4 | 4 | 0 | 0 |
| Chromium | 19 | 15 | 27 | 450 | 9/9 | 4.5 J - 16.9 | 0 | 1 | 0 | 0 |
| Lead | 23 | 21 | 270 | 750 | 9/9 | 3.2 - 16.3 | 0 | 0 | 0 | 0 |
| Mercury | 0.1 | 0.1 | 0.015 | 610 | 2/9 | 0.018 J - 0.044 | 0 | 0 | 2 | 0 |
| Selenium | 1.2 | 0.46 | 12 | 10000 | 3/9 | 0.58 - 0.82 | 0 | 3 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-IS01-03 09-09-1997 6' - 8' | SWMU303-IS02-03 09-09-1997 6' - 8' | SWMU303-IS03-03 09-09-1997 6' - 8' | SWMU303-IS04-03 09-09-1997 6' - 8' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 6250 (2) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 62500 (2) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 340 J | 110 J | 100 J | 82 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 14 | 1.6 | 5.24 | 2.7 | 5.9 | 1.5 | 3.7 | 3.3 |
| Barium | 47 | 22 | 848 | 100000 | ND | 47.4 | ND | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | 1.5 | ND |
| Chromium | 38 | 16 | 27 | 450 | 13.4 | 6.7 | 33.9 | 15.8 |
| Lead | 15 | 8.2 | 270 | 750 | 6.9 | 3.3 | 21.2 | 7.8 |
| Mercury | 0.07 | 0.08 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 0.86 | 0.69 | 12 | 10000 | 0.66 | ND | ND | **0.79** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU303_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-SB01-04 03-19-2002 7' - 9' | SWMU303-SB02-04 03-19-2002 7' - 9' | SWMU303-TW01-04 03-20-2002 7' - 9' | SWMU303-TW02-04 03-20-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | 150 J | ND |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | ND | ND | 250 J | ND |
| Benzo(b)fluoranthene | NE | NE | 6250 (2) | 2900 | ND | ND | 330 J | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | 180 J | ND |
| Benzo(k)fluoranthene | NE | NE | 62500 (2) | 29000 | ND | ND | 270 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 90 J | 180 J | 72 J | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 200 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | 84 J | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | 240 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | 360 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 220 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 14 | 1.6 | 5.24 | 2.7 | 3 J | **2.1** | 1.3 | 3.6 |
| Barium | 47 | 22 | 848 | 100000 | 12.9 | **49.1** | **41.2** | 17 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | **0.12** J | **0.11** J | **1** | ND |
| Chromium | 38 | 16 | 27 | 450 | 14.2 | 10.1 | 10.3 J | 7.2 J |
| Lead | 15 | 8.2 | 270 | 750 | **9.5** | 4 | **13.4** | 3.7 |
| Mercury | 0.07 | 0.08 | 0.015 | 610 | 0.034 J | 0.027 J | ND | ND |
| Selenium | 0.86 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU303_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU303-TW03-03 03-20-2002 5' - 7' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 39 J |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | 85 J |
| Benzo(b)fluoranthene | NE | NE | 6250 (2) | 2900 | 92 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 68 J |
| Benzo(k)fluoranthene | NE | NE | 62500 (2) | 29000 | 110 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 240 J |
| Chrysene | NE | NE | 39800 | 290000 | 72 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 280 J |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 39 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 130 J |
| Pyrene | NE | NE | 286000 | 54000000 | 55 J |
| **METALS (mg/kg)** | | | | | |
| Arsenic | 14 | 1.6 | 5.24 | 2.7 | ND |
| Barium | 47 | 22 | 848 | 100000 | 11.3 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND |
| Chromium | 38 | 16 | 27 | 450 | 7.5 J |
| Lead | 15 | 8.2 | 270 | 750 | 4.2 |
| Mercury | 0.07 | 0.08 | 0.015 | 610 | ND |
| Selenium | 0.86 | 0.69 | 12 | 10000 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/4/02
SWMU303_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 2/9 | 39 J - 150 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 493 (1) | 290 | 2/9 | 85 J - 250 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 6250 (2) | 2900 | 2/9 | 92 J - 330 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 2/9 | 68 J - 180 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 62500 (2) | 29000 | 22/9 | 110 J - 270 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 8/9 | 72 J - 340 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/9 | 72 J - 200 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/9 | 280 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/9 | 84 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 2/9 | 39 J - 240 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 2/9 | 130 J - 360 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/9 | 55 J - 220 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 14 | 1.6 | 5.24 | 2.7 | 8/9 | 1.3 - 5.9 | 0 | 6 | 1 | 5 |
| Barium | 47 | 22 | 848 | 100000 | 6/9 | 11.3 - 49.1 | 2 | 3 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 4/9 | 0.11 J - 1.5 | 4 | 4 | 0 | 0 |
| Chromium | 38 | 16 | 27 | 450 | 9/9 | 6.7 - 33.9 | 0 | 1 | 1 | 0 |
| Lead | 15 | 8.2 | 270 | 750 | 9/9 | 3.3 - 21.2 | 1 | 3 | 0 | 0 |
| Mercury | 0.07 | 0.08 | 0.015 | 610 | 2/9 | 0.027 J - 0.034 J | 0 | 0 | 2 | 0 |
| Selenium | 0.86 | 0.69 | 12 | 10000 | 2/9 | 0.66 - 0.79 | 0 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 5407 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 5407mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU303-TW01 04-02-2002 | | SWMU303-TW02 04-02-2002 | | SWMU303-TW03 04-02-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 1,1'-Biphenyl | NE | 300 (2) | ND | | ND | | 4 | J |
| 2,4-Dimethylphenol | NE | 140 | ND | | ND | | 29 | |
| 2-Methylnaphthalene | NE | 28 | 1 | J | ND | | 17 | |
| 4-Methylphenol | NE | 3.5 | 2 | J | **4** | J | 9 | J |
| Acenaphthene | NE | 80 | 10 | J | 3 | J | 18 | J |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 2 | J | 1 | J | 2 | J |
| Carbazole | NE | 3.4 (2) | 1 | J | 1 | J | ND | |
| Dibenzofuran | NE | 28 | ND | | 1 | J | ND | |
| Diethyl phthalate | NE | 5000 | ND | | ND | | 38 | J |
| Fluorene | NE | 280 | 0.8 | J | 1 | J | ND | |
| Naphthalene | NE | 21 | 6 | J | ND | | **140** | |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | ND | | 19 | J | 19.6 | J |
| Barium | 145 | 2000 | 271 | J | 837 | J | 552 | J |
| Chromium | 5.8 | 50 | 11.6 | J | 67.2 | J | 43.8 | J |
| Lead | 3.6 | 15 | 4.9 | J | 18.4 | J | 12.9 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

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SWMU303_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 303
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 1,1'-Biphenyl | NE | 300 (2) | 1/3 | 4 J | NA | 0 |
| 2,4-Dimethylphenol | NE | 140 | 1/3 | 29 | NA | 0 |
| 2-Methylnaphthalene | NE | 28 | 2/3 | 1 J - 17 | NA | 0 |
| 4-Methylphenol | NE | 3.5 | 3/3 | 2 J - 9 J | NA | 2 |
| Acenaphthene | NE | 80 | 3/3 | 3 J - 18 J | NA | 0 |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 3/3 | 1 J - 2 J | NA | 0 |
| Carbazole | NE | 3.4 (2) | 2/3 | 1 J | NA | 0 |
| Dibenzofuran | NE | 28 | 1/3 | 1 J | NA | 0 |
| Diethyl phthalate | NE | 5000 | 1/3 | 38 J | NA | 0 |
| Fluorene | NE | 280 | 2/3 | 0.8 J - 1 J | NA | 0 |
| Naphthalene | NE | 21 | 2/3 | 6 J - 140 | NA | 1 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 2/3 | 19 J - 19.6 J | 2 | 2 |
| Barium | 145 | 2000 | 3/3 | 271 J - 837 J | 3 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 11.6 J - 67.2 J | 3 | 1 |
| Lead | 3.6 | 15 | 3/3 | 4.9 J - 18.4 J | 3 | 1 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

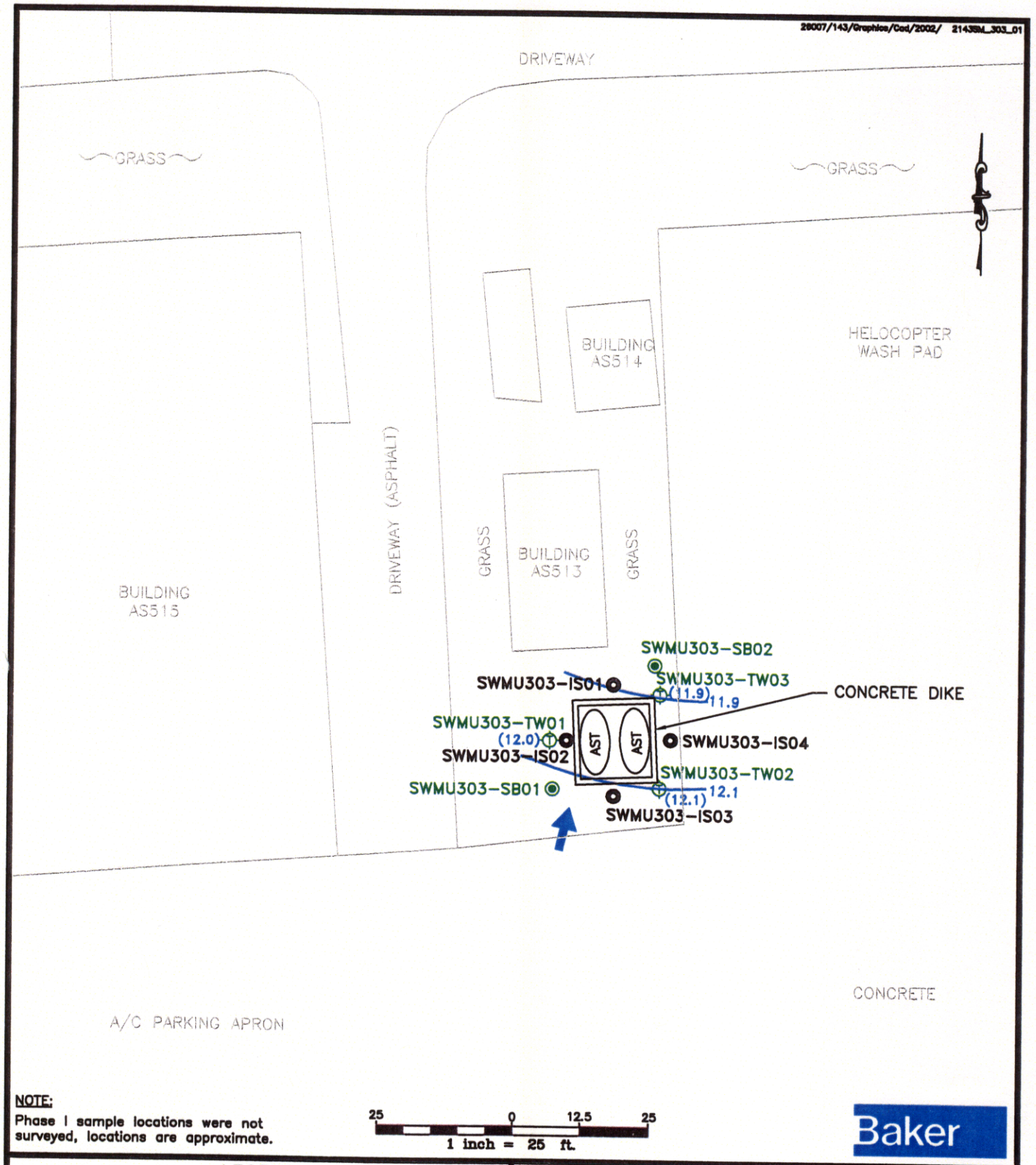
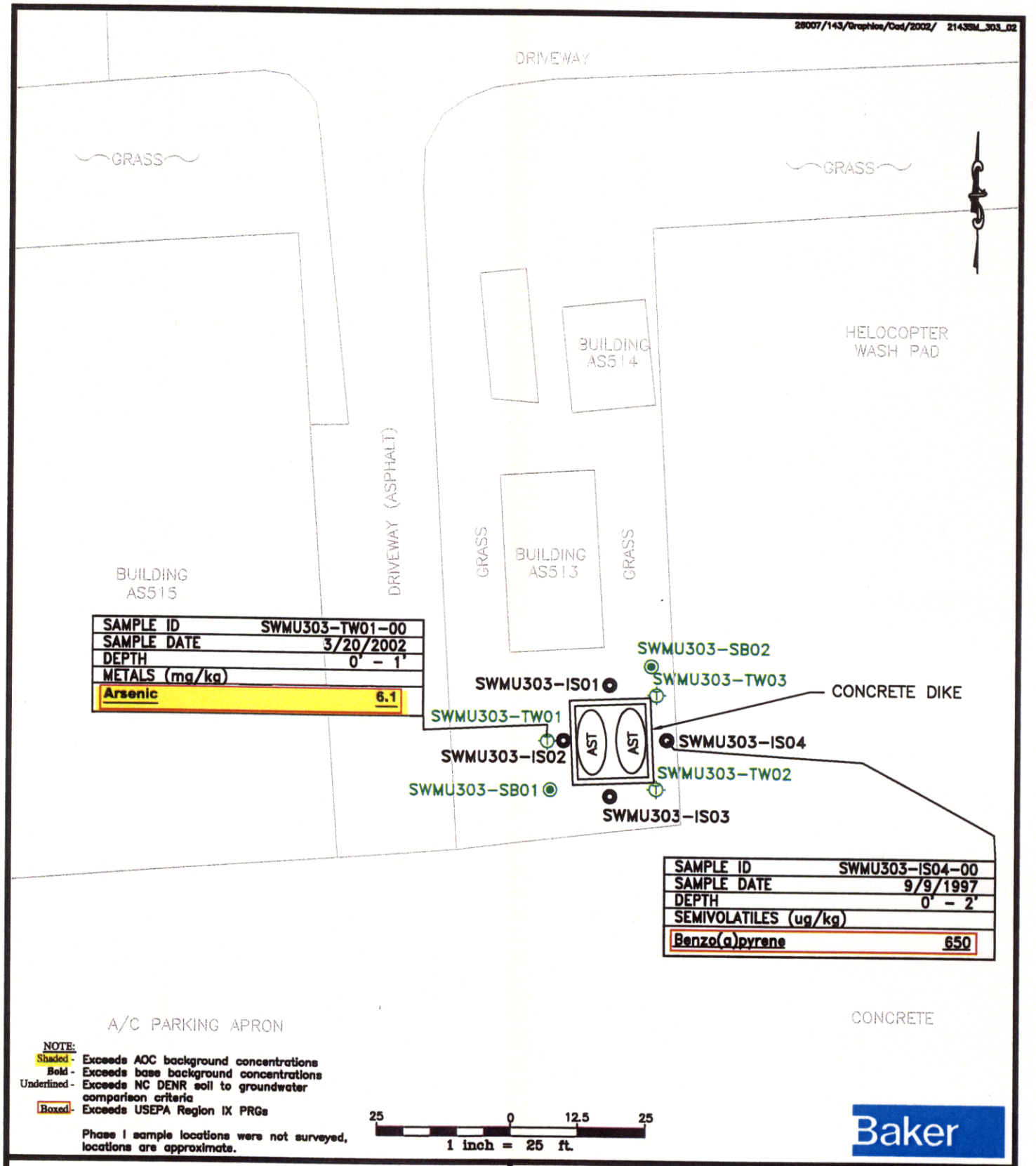



FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 303
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037 5 36B 24V

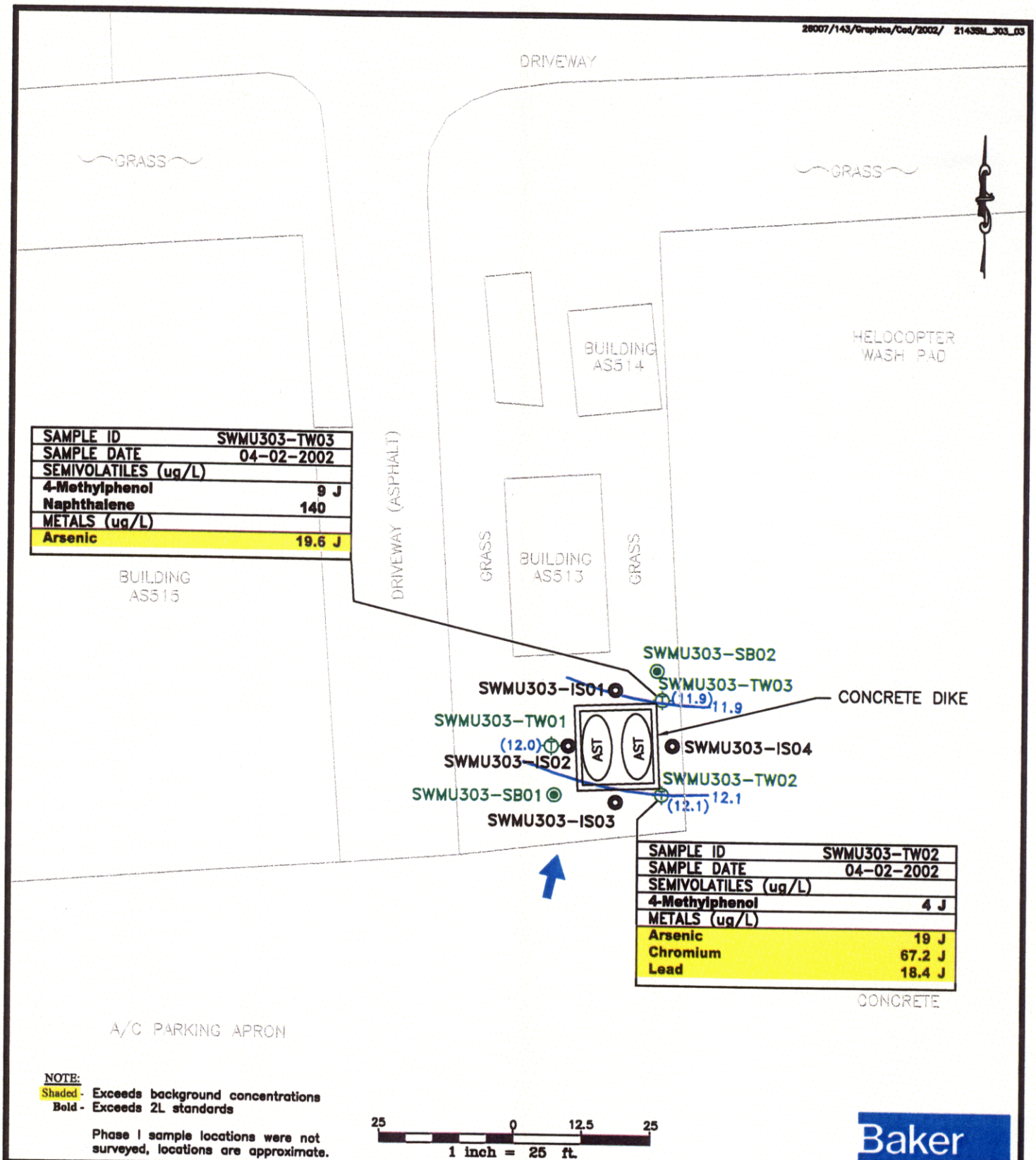



## LEGEND

- TEMPORARY WELL
- SOIL BORING (PHASE II)
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 303
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- SOIL BORING (PHASE II)
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 11.9 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER SWMU 303

CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.23 SWMU 305 - BB224 Pile

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.23.1 SWMU Description and History

SWMU 305 consists of a former soil pile that was located near Jackson Street in the vicinity of Building BB82. The soil pile was removed prior to October 1996 and reportedly contained grease and contaminated soil. Courthouse Bay is located approximately 600 feet west of the SWMU. During the site visit conducted by Baker in 1996, little evidence of the location of the pile was observed. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if any residual soil contamination remained in the area following removal of the soil pile. Surface and subsurface soil samples were collected from three soil borings that were advanced in the area where the soil mound was identified during previous investigations (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, pesticides/PCBs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 305 was recommended in the form of a Phase II CSI.

During the site visit conducted by Baker in March 2002, it was noted that the soils in the vicinity of the SWMU have since been moved/redistributed throughout the area during construction of the new barracks.

### 4.23.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix C.

The water table was measured in the wells at depths ranging from approximately 4.2 to 4.5 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 12.3 to 13.1 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northwest.

### 4.23.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix E.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Five metals were detected in the sample set, as follows: arsenic, barium, chromium, lead, and selenium. Selenium was detected in subsurface soil samples but not any surface soil samples. Lead and selenium were detected at concentrations above the background criteria in a few of the subsurface soil samples, however the concentrations were below the NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Arsenic exceeded the AOC and Base background screening criteria and the USEPA Region IX residential PRG in surface soil sample SWMU305-IS03-00 and subsurface sample SWMU305-IS01-01. None of the other metals detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Three metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, and lead. Lead was detected above the Base background screening criteria in sample SWMU305-GW03. However, the concentration was below the 2L standards. None of the other metals detected in the samples exceeded the established screening criteria.

All of the metals detected in groundwater were also detected in soil samples collected from this SWMU. Arsenic and selenium were the only metals detected in soil samples but not in the groundwater.

### 4.23.4 Conclusions

Arsenic was the only metal detected in soil at concentrations exceeding both the AOC and Base background screening criteria and the USEPA Region IX residential PRG.

None of the metals detected in groundwater exceeded both the Base background criteria and 2L standards.

The soil pile originally investigated as SWMU 305 no longer exists. The arsenic concentrations in surface soil samples collected at the SWMU are not much above background concentrations. With the construction of the new barracks in the area soils have been moved and redistributed throughout the area. Based on this information and the evaluation of the analytical results, additional activities at SWMU 305 are not warranted.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU305-TW01 | 3/24/02 | BAKER | 16.76 | 16.9 | 13 | 13 | 1.5 | 0 | 3 | 4.48 | 12.3 |
| SWMU305-TW02 | 3/24/02 | BAKER | 17.13 | 17.2 | 13 | 13 | 1.5 | 0 | 3 | 4.32 | 12.8 |
| SWMU305-TW03 | 3/24/02 | BAKER | 17.22 | 17.1 | 13 | 13 | 1.5 | 0 | 3 | 4.15 | 13.1 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU305

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU305-IS01-00 09-14-1997 0' - 2' | SWMU305-IS02-00 09-14-1997 0' - 2' | SWMU305-IS03-00 09-14-1997 0' - 2' | SWMU305-TW01-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.32 | 1.3 | 5.24 | 0.39 | ND | ND | 1.4 | ND |
| Barium | 52 | 23 | 848 | 5400 | ND | ND | ND | 8.4 J |
| Chromium | 13 | 12 | 27 | 210 | 3.9 | 3.7 | 5.5 | 3.3 J |
| Lead | 193 | 26 | 270 | 400 | 14.5 | 20.6 | 15.1 | 5.3 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU305-TW02-00 03-24-2002 0' - 1' | SWMU305-TW03-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 0.32 | 1.3 | 5.24 | 0.39 | ND | ND |
| Barium | 52 | 23 | 848 | 5400 | 4.8 J | 4.4 J |
| Chromium | 13 | 12 | 27 | 210 | 1.6 J | 2.3 J |
| Lead | 193 | 26 | 270 | 400 | 3.9 J | 2.8 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 0.32 | 1.3 | 5.24 | 0.39 | 1/6 | 1.4 | 1 | 1 | 0 | 1 |
| Barium | 52 | 23 | 848 | 5400 | 3/6 | 4.4 J - 8.4 J | 0 | 0 | 0 | 0 |
| Chromium | 13 | 12 | 27 | 210 | 6/6 | 1.6 J - 5.5 | 0 | 0 | 0 | 0 |
| Lead | 193 | 26 | 270 | 400 | 6/6 | 2.8 J - 20.6 | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 10 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU305-IS01-01 09-14-1997 2' - 4' | SWMU305-IS02-01 09-14-1997 2' - 4' | SWMU305-IS03-01 09-14-1997 2' - 4' | SWMU305-TW01-02 03-24-2002 3' - 5' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 1.6 | 5.24 | 0.39 | 2.3 | ND | ND | ND |
| Barium | 24 | 22 | 848 | 5400 | ND | ND | ND | 3.4 J |
| Chromium | 14 | 16 | 27 | 210 | 11.4 | 2.8 | 2.4 | 1.7 J |
| Lead | 5 | 8.2 | 270 | 400 | 6.7 | 6.7 | 2.1 | 1.7 J |
| Selenium | 0.64 | 0.69 | 12 | 390 | **0.94** | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU305_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU305-TW02-02 03-24-2002 3' - 5' | SWMU305-TW03-02 03-24-2002 3' - 5' |
|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.7 | 1.6 | 5.24 | 0.39 | ND | ND |
| Barium | 24 | 22 | 848 | 5400 | 5.6 J | 12.3 J |
| Chromium | 14 | 16 | 27 | 210 | 5.7 J | 4.8 J |
| Lead | 5 | 8.2 | 270 | 400 | 4.4 J | 3 J |
| Selenium | 0.64 | 0.69 | 12 | 390 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU305_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.7 | 1.6 | 5.24 | 0.39 | 1/6 | 2.3 | 1 | 1 | 0 | 1 |
| Barium | 24 | 22 | 848 | 5400 | 3/6 | 3.4 J - 12.3 J | 0 | 0 | 0 | 0 |
| Chromium | 14 | 16 | 27 | 210 | 6/6 | 1.7 J - 11.4 | 0 | 0 | 0 | 0 |
| Lead | 5 | 8.2 | 270 | 400 | 6/6 | 1.7 J - 6.7 | 2 | 0 | 0 | 0 |
| Selenium | 0.64 | 0.69 | 12 | 390 | 1/6 | 0.94 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 10 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU305-TW01 04-04-2002 | | SWMU305-TW02 04-04-2002 | SWMU305-TW03 04-04-2002 |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 55.2 | | 18.6 | 52.4 |
| Chromium | 5.8 | 50 | 0.79 | J | ND | 10.6 |
| Lead | 3.6 | 15 | ND | | ND | 3.4 |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

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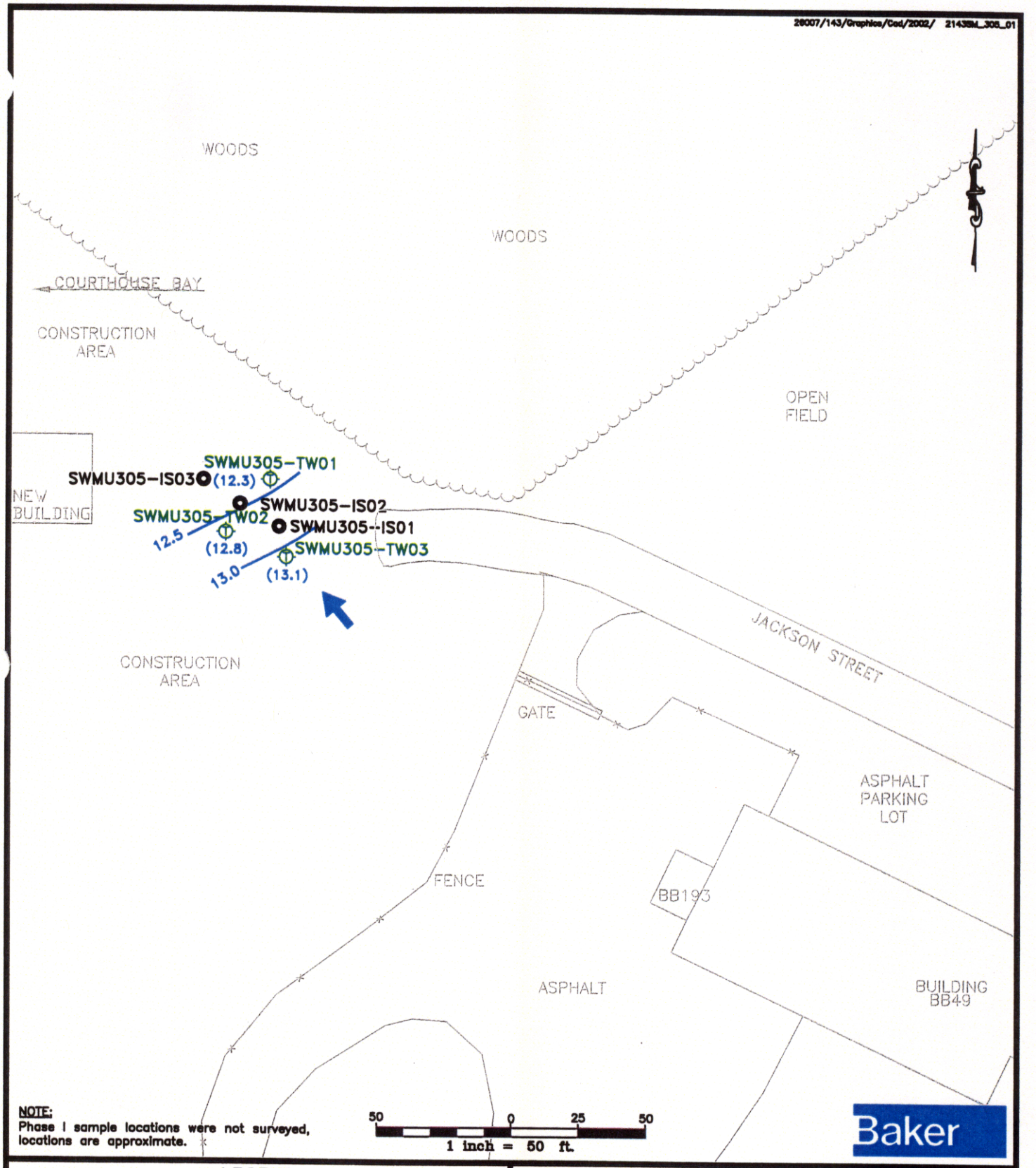
SWMU305_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 305
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 18.6 - 55.2 | 0 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 0.79 J - 10.6 | 1 | 0 |
| Lead | 3.6 | 15 | 1/3 | 3.4 | 0 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

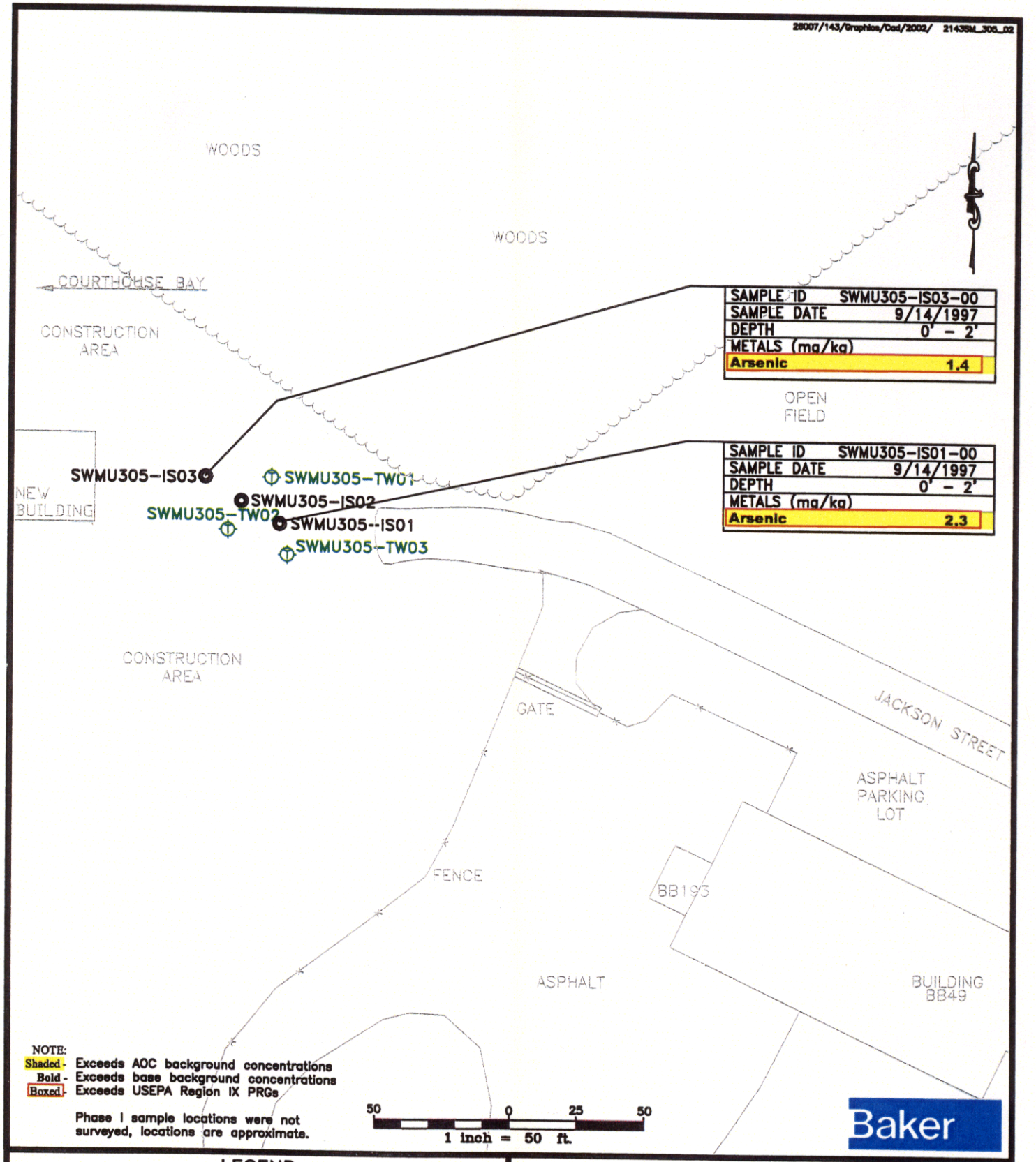
## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 12.5 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 305
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB25Y




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 305
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.24 SWMU 306 - FC230 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.24.1 SWMU Description and History

SWMU 306 consists of an oil/water separator that is associated with a vehicle wash area. The SWMU is located in the Hadnot Point Industrial Area, southeast of the intersection of Daly and Main Service Roads. The oil/water separator and vehicle wash area are situated in a fenced area between Building FC-230 and Daly Road. The ground surface surrounding the oil/water separator and vehicle wash area is covered with asphalt. The separator is a concrete, in-ground unit that was installed in 1988 and is still active. The concrete vault measures 8 feet by 20 feet by 12 feet. Fluids are conveyed from the structure to the wastewater treatment plant. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. At the time of the Investigation, the wash rack pit was filled with water. In addition, petroleum staining was observed in the soils along the fence line and on the inside of the oil/water separator. The purpose of the investigation was to determine if operation of the oil/water separator and wash area has impacted surface and subsurface soils in the vicinity of the SWMU. Soil samples were collected from four soil borings that were advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, silver exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 306 was recommended in the form of a Phase II CSI.

### 4.24.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 8 and 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 14.5 to 16.3 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 9.4 to 9.7 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south.

### 4.24.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results are included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 though 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals were detected in the subsurface soil sample set as follows: arsenic, barium, cadmium, chromium, lead, mercury, and silver. Barium and chromium exceeded the AOC and Base background criteria in one or more of the samples; however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX residential PRGs. Arsenic and mercury exceeded the USEPA Region IX Residential PRGs and NC DENR soil to groundwater criteria, respectively; however the concentrations were below the AOC and Base background criteria. Silver exceeded the AOC and Base background criteria and NC DENR soil to groundwater criteria in sample SWMU306-IS04-02, which was collected during the Phase I CSI conducted in September 1997. None of the other metals detected in the samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 5 on Table 6, and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Four metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, and selenium. None of the metals detected in the samples exceeded the 2L Standards or background criteria.

All of the compounds detected in the groundwater were detected in soils at the SWMU. Arsenic, mercury, and silver were detected in the soil samples and not in the groundwater samples.

### 4.24.4 Conclusions

Silver was the only one metal detected in soil at a concentration exceeding both the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria. There were not any metals that exceeded both the Base background criteria and 2L standards in groundwater.

Based on the single isolated, anomalous detection of silver in subsurface soils and the results of the Phase II CSI, silver is not a widespread problem at the SWMU nor is it associated with SWMU-related activities. Therefore, no additional activities are warranted at this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU306-TW01 | 3/25/02 | BAKER | 25.66 | 25.6 | 19 | 19 | 6.9 | 5 | 9 | 16 | 9.7 |
| SWMU306-TW02 | 3/25/02 | BAKER | 25.80 | 25.8 | 20 | 20 | 8 | 5.9 | 10.2 | 16.3 | 9.5 |
| SWMU306-TW03 | 3/25/02 | BAKER | 23.93 | 23.9 | 20 | 20 | 6.8 | 5 | 9 | 14.5 | 9.4 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU306

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU306-IS01-00 09-12-1997 0' - 2' | SWMU306-IS02-00 09-13-1997 0' - 2' | SWMU306-IS03-00 09-13-1997 0' - 2' | SWMU306-IS04-00 09-12-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 31 | 17 | 848 | 5400 | ND | ND | ND | ND |
| Cadmium | 0.85 | 0.05 | 2.7 | 37 | ND | ND | ND | 1.7 |
| Chromium | 9.4 | 15 | 27 | 210 | 6.8 | 7.9 | 5 | 6.7 |
| Lead | 40 | 21 | 270 | 400 | 7.8 | 6.8 | 7.3 | 10.9 |
| Mercury | 0.12 | 0.1 | 0.015 | 23 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU306-TW01-00 03-25-2002 0' - 1' | SWMU306-TW02-00 03-25-2002 0' - 1' | SWMU306-TW03-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | |
| Barium | 31 | 17 | 848 | 5400 | 6 J | 9.7 J | 13.1 J |
| Cadmium | 0.85 | 0.05 | 2.7 | 37 | ND | ND | ND |
| Chromium | 9.4 | 15 | 27 | 210 | 2.9 J | 2.5 J | 3.1 J |
| Lead | 40 | 21 | 270 | 400 | 2.9 J | 5.9 J | 7.7 J |
| Mercury | 0.12 | 0.1 | 0.015 | 23 | 0.02 J | 0.02 J | 0.02 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 31 | 17 | 848 | 5400 | 3/7 | 6 J - 13.1 J | 0 | 0 | 0 | 0 |
| Cadmium | 0.85 | 0.05 | 2.7 | 37 | 1/7 | 1.7 | 1 | 1 | 0 | 0 |
| Chromium | 9.4 | 15 | 27 | 210 | 7/7 | 2.5 J - 7.9 | 0 | 0 | 0 | 0 |
| Lead | 40 | 21 | 270 | 400 | 7/7 | 2.9 J - 10.9 | 0 | 0 | 0 | 0 |
| Mercury | 0.12 | 0.1 | 0.015 | 23 | 3/7 | 0.02 J | 0 | 0 | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 9 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU306-IS01-02 09-12-1997 4' - 6' | SWMU306-IS02-02 09-13-1997 4' - 6' | SWMU306-IS03-02 09-13-1997 4' - 6' | SWMU306-IS04-02 09-13-1997 4' - 6' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 9 | 1.6 | 5.24 | 0.39 | ND | ND | ND | ND |
| Barium | 19 | 22 | 848 | 5400 | ND | **37.4** | ND | ND |
| Chromium | 16 | 16 | 27 | 210 | 6.4 | 11 | 4.6 | 6.2 |
| Lead | 11 | 8.2 | 270 | 400 | 4 | 5.3 | 6.6 | 4.6 |
| Mercury | 0.05 | 0.08 | 0.015 | 23 | ND | 0.041 | 0.039 | 0.037 |
| Silver | 0.09 | 0.09 | 0.22 | 390 | ND | ND | ND | **1.5** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU306_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU306-TW01-06 03-25-2002 11' - 13' | SWMU306-TW02-03 03-25-2002 5' - 7' | SWMU306-TW02A-07 04-09-2002 13' - 15' | SWMU306-TW03-06 03-25-2002 11' - 13' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 9 | 1.6 | 5.24 | 0.39 | ND | ND | 1.2 J | ND |
| Barium | 19 | 22 | 848 | 5400 | ND | 16.9 J | 5 J | 6.7 J |
| Chromium | 16 | 16 | 27 | 210 | 0.46 J | 5.7 J | 3.8 J | 2.2 J |
| Lead | 11 | 8.2 | 270 | 400 | 1.1 J | 5 J | 2.4 J | 2.9 J |
| Mercury | 0.05 | 0.08 | 0.015 | 23 | ND | ND | ND | ND |
| Silver | 0.09 | 0.09 | 0.22 | 390 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU306_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 9 | 1.6 | 5.24 | 0.39 | 1/8 | 1.2 J | 0 | 0 | 0 | 1 |
| Barium | 19 | 22 | 848 | 5400 | 4/8 | 5 J - 37.4 | 1 | 1 | 0 | 0 |
| Chromium | 16 | 16 | 27 | 210 | 8/8 | 0.46 J - 11 | 0 | 0 | 0 | 0 |
| Lead | 11 | 8.2 | 270 | 400 | 8/8 | 1.1 J - 6.6 | 0 | 0 | 0 | 0 |
| Mercury | 0.05 | 0.08 | 0.015 | 23 | 3/8 | 0.037 - 0.041 | 0 | 0 | 3 | 0 |
| Silver | 0.09 | 0.09 | 0.22 | 390 | 1/8 | 1.5 | 1 | 1 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 9 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU306-TW01 04-08-2002 | | SWMU306-TW02 04-09-2002 | | SWMU306-TW03 04-08-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Barium | 150 | 2000 | 62.1 | | 63.9 | | 50.4 | |
| Chromium | 5.8 | 50 | 1.6 | J | ND | | 0.95 | J |
| Lead | 3.6 | 15 | ND | | 1.8 | J | ND | |
| Selenium | 2.8 | 50 | ND | | 2.3 | J | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

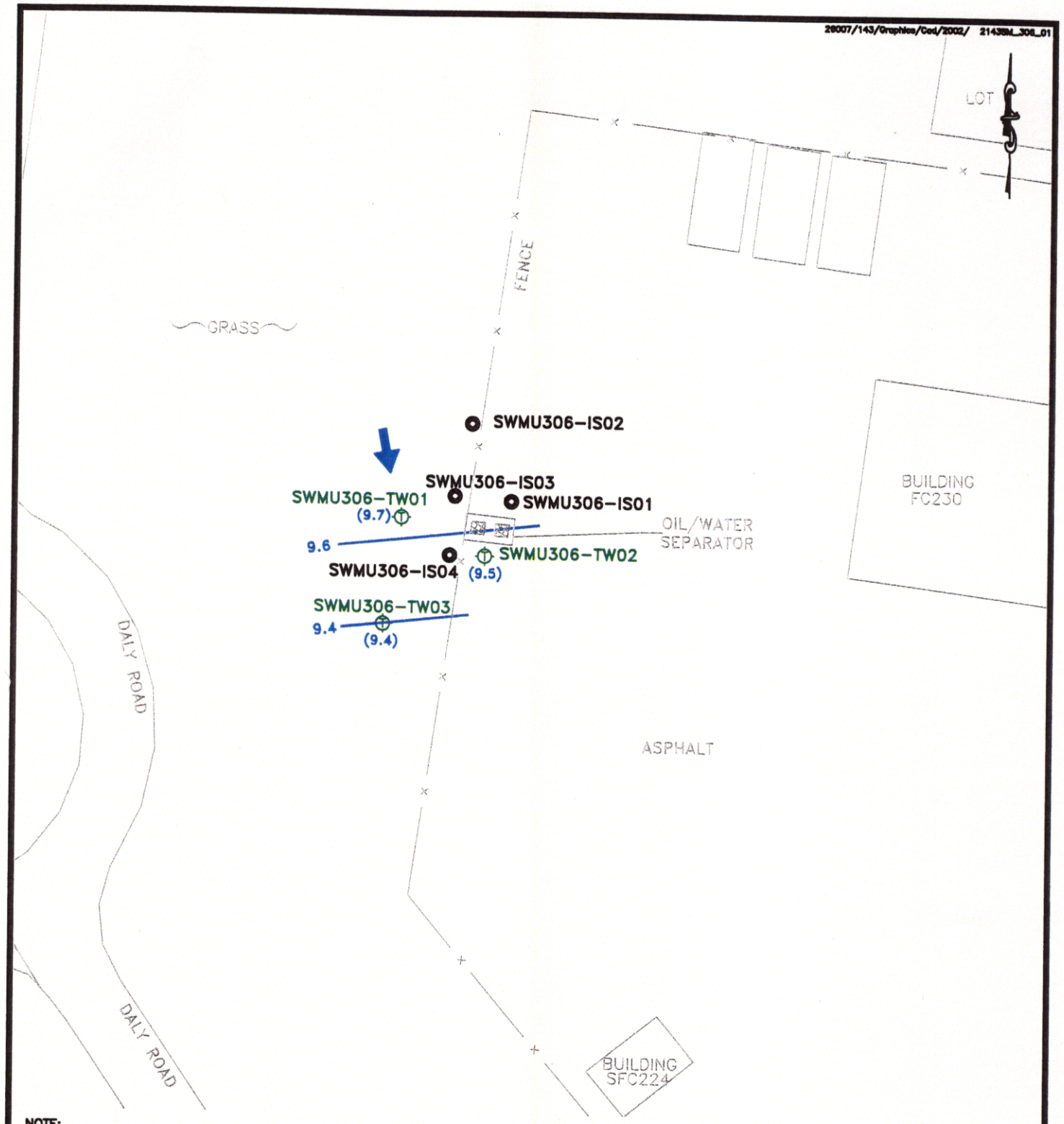
8/30/02
SWMU306_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 306
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 50.4 - 63.9 | 0 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 0.95 J - 1.6 J | 0 | 0 |
| Lead | 3.6 | 15 | 1/3 | 1.8 J | 0 | 0 |
| Selenium | 2.8 | 50 | 1/3 | 2.3 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.



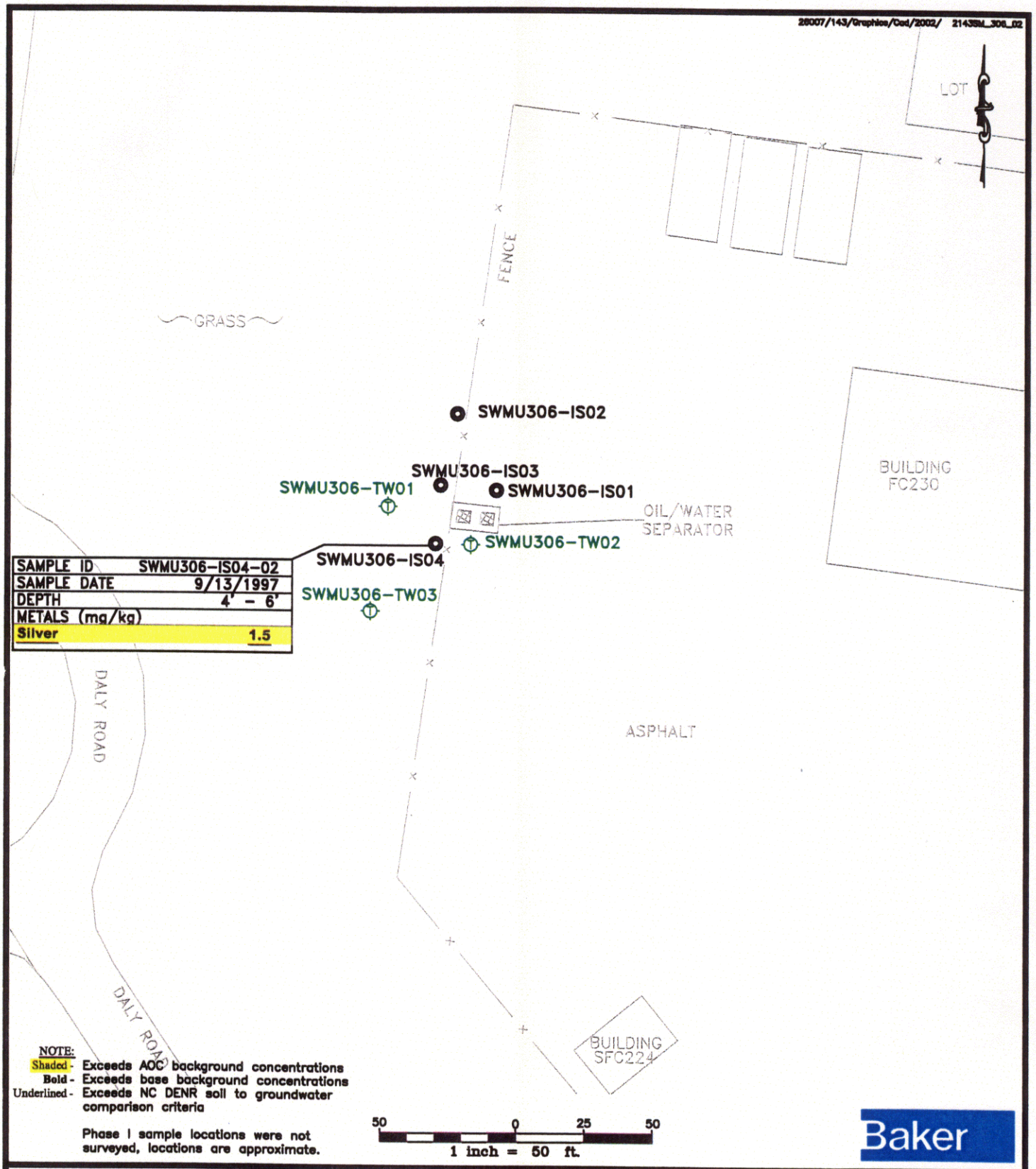

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 9.6 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 306
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037538B26Y




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 306
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.25 SWMU 307 - G649 Wash Rack

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI and additional sampling effort, investigation findings, and conclusions.

### 4.25.1 SWMU Description and History

SWMU 307 is a concrete oil/water separator and associated vehicle wash rack. The oil/water separator measures approximately 10 feet by 25 feet. Water from the wash rack is collected and transported via underground piping to the oil/water separator. The oil/water separator is located west/northwest of the vehicle wash rack. A steam plant building (G-650) is located west/northwest of the oil/water separator and two ASTs are located southwest of the separator. A SWMU investigation plan is presented on Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface soil and subsurface soil samples were collected from four soil borings that were advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria. Based on evaluation of the results, arsenic and mercury exceeded the regulatory driven criteria and established background/secondary criteria and NC DENR soil to groundwater criteria and/or USEPA Region IX residential PRGs. Therefore, additional investigation at SWMU 307 was recommended in the form of a Phase II CSI.

### 4.25.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 3, 2002 in general accordance with the Final Project Plans (Baker, 2002). As a result of the detections of lead in groundwater during the 2002 Phase II sampling, additional groundwater sampling was conducted on June 21 and 24, 2003.

The purpose of these investigations were to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI.

The Phase II field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at seven temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

During the Phase II CSI, the water table was measured in the wells at depths ranging from approximately 3.2 to 4.0 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 11.3 to 12.3 feet above mean MSL. During the additional sampling, the water table was measured in the wells at depths ranging from approximately 5.6 to 7.7 feet

below the ground surface, with corresponding elevations ranging from approximately 11.5 to 12.6 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to have a southeasterly flow direction.

### 4.25.3 Investigation Findings

The soil and groundwater samples from the 2002 Phase II CSI sampling were submitted to CompuChem Laboratories and analyzed for RCRA metals. All samples collected in 2003 were submitted to Chemtech Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the Phase I and Phase II sampling events are presented on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals were detected in the surface soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and silver. Arsenic was the only metal that exceeded the USEPA Region IX residential PRGs. Arsenic and cadmium were detected in one or more of the samples at concentrations exceeding both the AOC and Base background criteria; however, the concentrations were below the NC DENR soil to groundwater criteria. Lead exceeded the Base background criteria and the NC DENR soil to groundwater criteria; however, the concentrations were below the AOC background criteria. In addition, silver exceeded the AOC background criteria and the NC DENR soil to groundwater criteria in one sample; however, the concentration was below the Base background criteria. Barium, chromium, and mercury exceeded both the AOC and Base background criteria and NC DENR soil to groundwater criteria.

Five metals were detected in the subsurface sample set, as follows: barium, cadmium, chromium, lead and mercury. None of the detected metals exceeded the USEPA Region IX residential PRGs. Barium and mercury were detected in one or more of the samples at concentrations exceeding both the AOC and Base background criteria and the NC DENR soil to groundwater criteria. Cadmium and lead exceeded the AOC and/or Base background criteria; however, the concentrations were below the NC DENR soil to groundwater criteria. Chromium exceeded the AOC background criteria and the NC DENR soil to groundwater criteria; however, the concentrations were below the Base background criteria and USEPA Region IX residential PRG.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards
- EPA Region IX Tap Water PRGs

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Four metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, and mercury. Lead was detected in the sample from wells SWMU307-TW03 and SWMU307-TW07 at concentrations above the background criteria and the 2L standard (Figure 3). Chromium and mercury exceeded the background criteria; however, the concentrations were below the 2L standards. Barium did not exceed the applicable screening criteria in any of the groundwater samples.

All of the metals detected in the groundwater were detected in soils at the SWMU.

### 4.25.4 Conclusions

Several metals were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Metals that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria in soil were as follows:

- Arsenic, barium, chromium and mercury

Metals that exceeded the Base background screening criteria and 2L standards in groundwater were as follows:

- Lead

Based on evaluation of the analytical results, additional action at SWMU 307 in the form of an RFI is warranted. The additional activities are presented in Section 5.0. These activities would primarily include addressing the extent of lead in groundwater. Further delineation of surface and shallow subsurface soil contamination is also warranted.

TA 1

SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (ft, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU307-TW01 | 3/21/2002 | BAKER | 15.45 | 15.67 | 12 | 12 | 1 | 0 | 2 | 3.17 | 12.28 |
| SWMU307-TW02 | 3/21/2002 | BAKER | 15.54 | 15.67 | 15 | 15 | 3 | 1.5 | 5 | 3.69 | 11.85 |
| SWMU307-TW03 | 3/21/2002 | BAKER | 15.27 | 15.54 | 16 | 16 | 4 | 2.5 | 6 | 3.99 | 11.28 |
| SWMU307-TW04 | 6/21/2003 | BAKER | 17.58 | 16.00 | 13 | 13 | 2 | 1 | 3 | 5.57 | 12.01 |
| SWMU307-TW05 | 6/21/2003 | BAKER | 18.03 | 15.46 | 13 | 13 | 2 | 0 | 3 | 5.98 | 12.05 |
| SWMU307-TW06 | 6/21/2003 | BAKER | 20.24 | 18.04 | 14 | 14 | 3 | 2 | 4 | 7.66 | 12.58 |
| SWMU307-TW07 | 6/21/2003 | BAKER | 17.19 | 14.73 | 13 | 13 | 2 | 0 | 3 | 5.71 | 11.48 |

Notes: msl - Mean Sea Level
bgs - Below Ground Surface
PVC - Polyvinyl Chloride
N/A - Not Applicable

T

DETECTION SUMMARY
SURFACE SOIL - SWMU 307
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU307-IS01-00 09-09-1997 0' - 2' | SWMU307-IS02-00 09-09-1997 0' - 2' | SWMU307-IS03-00 09-09-1997 0' - 2' | SWMU307-IS04-00 09-09-1997 0' - 2' | SWMU307-TW01-00 03-21-2002 0' - 1' | SWMU307-TW02-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.4 | 1.3 | 5.24 | 0.39 | ND | ND | 2.3 | ND | ND | ND |
| Barium | 20 | 23 | 19 | 848 | 28.9 | ND | ND | ND | 20.6 | 59.8 |
| Cadmium | 0.16 | 0.04 | 2.7 | 37 | ND | ND | ND | ND | 0.25 J | **0.12** |
| Chromium | 12 | 12 | 8.9 | 27 | 14.1 | 22.8 | 11 | 1.8 | 7.2 | 6.1 |
| Lead | 115 | 26 | 26 | 270 | 25.8 | **86.2** | 11.9 | 1.9 | **31.2** J | **68.1** |
| Mercury | 0.05 | 0.13 | 0.015 | 23 | ND | ND | ND | ND | 0.11 | 1.4 |
| Silver | 0.07 | 0.79 | 0.22 | 390 | ND | ND | ND | ND | 0.43 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

DETECTION SUMMARY
SURFACE SOIL - SWMU 307
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU307-TW03-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Arsenic | 1.4 | 1.3 | 5.24 | 0.39 | ND |
| Barium | 20 | 23 | 19 | 848 | 13.2 |
| Cadmium | 0.16 | 0.04 | 2.7 | 37 J | ND |
| Chromium | 12 | 12 | 8.9 | 27 | 4.8 |
| Lead | 115 | 26 | 26 | 270 J | 4.6 J |
| Mercury | 0.05 | 0.13 | 0.015 | 23 | 0.04 |
| Silver | 0.07 | 0.79 | 0.22 | 390 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criter
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

T. 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 307
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.4 | 1.3 | 5.24 | 0.39 | 1/7 | 2.3 | 1 | 1 | 0 | 1 |
| Barium | 20 | 23 | 19 | 848 | 4/7 | 13.2 - 59.8 | 3 | 2 | 3 | 0 |
| Cadmium | 0.16 | 0.04 | 2.7 | 37 | 2/7 | 0.12 J - 0.25 J | 1 | 2 | 0 | 0 |
| Chromium | 12 | 12 | 8.9 | 27 | 7/7 | 1.8 - 22.8 | 2 | 2 | 3 | 0 |
| Lead | 115 | 26 | 26 | 270 | 7/7 | 1.9 - 86.2 | 0 | 3 | 3 | 0 |
| Mercury | 0.05 | 0.13 | 0.015 | 23 | 3/7 | 0.04 - 1.4 | 2 | 1 | 3 | 0 |
| Silver | 0.07 | 0.79 | 0.22 | 390 | 1/7 | 0.43 J | 1 | 0 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 1 Surface Soil
Base comparison - Loam-Silt Surface Soil

4/14/2004
SWMU307_SOIL.xls

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 307
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU307-IS01-03 09-09-1997 6' - 8' | SWMU307-IS02-02 09-09-1997 4' - 6' | SWMU307-IS03-02 09-09-1997 4' - 6' | SWMU307-IS04-02 09-09-1997 4' - 6' | SWMU307-TW01-02 03-21-2002 3' - 5' | SWMU307-TW02-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 16 | 23 | 19 | 848 | 31.1 | ND | ND | ND | 23.6 | 17.2 |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND | ND | ND | ND | 0.04 J | ND |
| Chromium | 12 | 25 | 8.9 | 27 | 13.5 | 6.8 | 6.4 | 4.7 | 8.5 | 7.3 |
| Lead | 15 | 9.2 | 26 | 270 | 9 | **12.5** | **10.5** | 3.9 | **12.5** J | 6 J |
| Mercury | 0.08 | 0.13 | 0.015 | 23 | ND | 0.14 | ND | ND | 0.09 | 0.04 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

4/14/2004
SWMU307_SOIL.xls

T.

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 307
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU307-TW03-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Barium | 16 | 23 | 19 | 848 | 17.2 |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND |
| Chromium | 12 | 25 | 8.9 | 27 | 7.4 |
| Lead | 15 | 9.2 | 26 | 270 | 7.2 J |
| Mercury | 0.08 | 0.13 | 0.015 | 23 | 0.08 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criter
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

4/14/2004
SWMU307_SOIL.xls

T

# STATISTICAL SUMMARY
## SUBSURFACE SOIL - SWMU 307
## SWMU CONFIRMATORY SAMPLING (CTO-0143)
## MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 16 | 23 | 19 | 848 | 4/7 | 17.2 - 31.1 | 4 | 2 | 2 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | 1/7 | 0.04 J | 1 | 1 | 0 | 0 |
| Chromium | 12 | 25 | 8.9 | 27 | 7/7 | 4.7 - 13.5 | 1 | 0 | 1 | 0 |
| Lead | 15 | 9.2 | 26 | 270 | 7/7 | 3.9 - 12.5 J | 0 | 3 | 0 | 0 |
| Mercury | 0.08 | 0.13 | 0.12 | 0.015 | 4/7 | 0.04 - 0.14 | 2 | 1 | 4 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 1 Subsurface Soil
Base comparison - Silt Subsurface Soil

TA 6

**DETECTION SUMMARY GROUNDWATER - SWMU 307**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID | Base Background Criteria | North Carolina 2L | USEPA Region IX | SWMU307-GW01 | SWMU307-GW02 | SWMU307-GW03 | SWMU307-TW04 | SWMU307-TW04D | SWMU307-TW05 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | Groundwater-Shallow | **Groundwater Protection Stds** | PRGs TAP Water | 04-03-2002 | 04-03-2002 | 04-03-2002 | 07-13-2003 | 07-13-2003 | 07-13-2003 |
| **METALS (ug/L)** | | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 2.4 U | 2.4 U | 2.4 U | 3.6 U | 3.6 U | 3.6 U |
| Barium | 37.31 | 2000 | 2600 | 49 J | 72.8 J | 106 J | 71.8 J | 74.9 J | 145 J |
| Chromium | 5.76 | 50 | NE | 2.2 J | 7.1 J | 42.3 J | 1 J | 1.2 J | 3.7 J |
| Lead | 3.61 | 15 | NE | 1.8 U | 7.7 J | 27.7 J | 2.5 J | 1.7 J | 2.4 J |
| Mercury | NE | 1.1 | 11 | 0.1 U | 0.1 U | 0.12 J | 0.2 U | 0.2 U | 0.2 U |

Notes:

**No SVOCs were detected in the samples**

Shaded - Exceeds Base Background Criteria Groundwater-Shallow

Bold - Exceeds North Carolina 2L Groundwater Protection Standards

Underline - Exceeds USEPA Region IX PRGs Tap Water

J - Analyte detected. Report value is estimated.

ND - Not Detected

NE - Not established

TA 5

**DETECTION SUMMARY GROUNDWATER - SWMU 307**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID | Base Background Criteria | **North Carolina 2L** | USEPA Region IX | SWMU307-TW06 | | SWMU307-TW07 | |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | Groundwater-Shallow | **Groundwater** | PRGs | 07-13-2003 | | 07-13-2003 | |
| | | **Protection Stds** | TAP Water | | | | |
| **METALS (ug/L)** | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 3.6 | U | 5.6 | J |
| Barium | 37.31 | 2000 | 2600 | 31.2 | J | 107 | J |
| Chromium | 5.76 | 50 | NE | 0.8 | U | 5.4 | J |
| Lead | 3.61 | 15 | NE | 1.6 | U | 24.4 | |
| Mercury | NE | 1.1 | 11 | 0.2 | U | 0.2 | U |

Notes:

**No SVOCs were detected in the samples**

Shaded - Exceeds Base Background Criteria Groundwater-Shallow

Bold - Exceeds North Carolina 2L Groundwater Protection Standards

Underline - Exceeds USEPA Region IX PRGs Tap Water

J - Analyte detected. Report value is estimated.

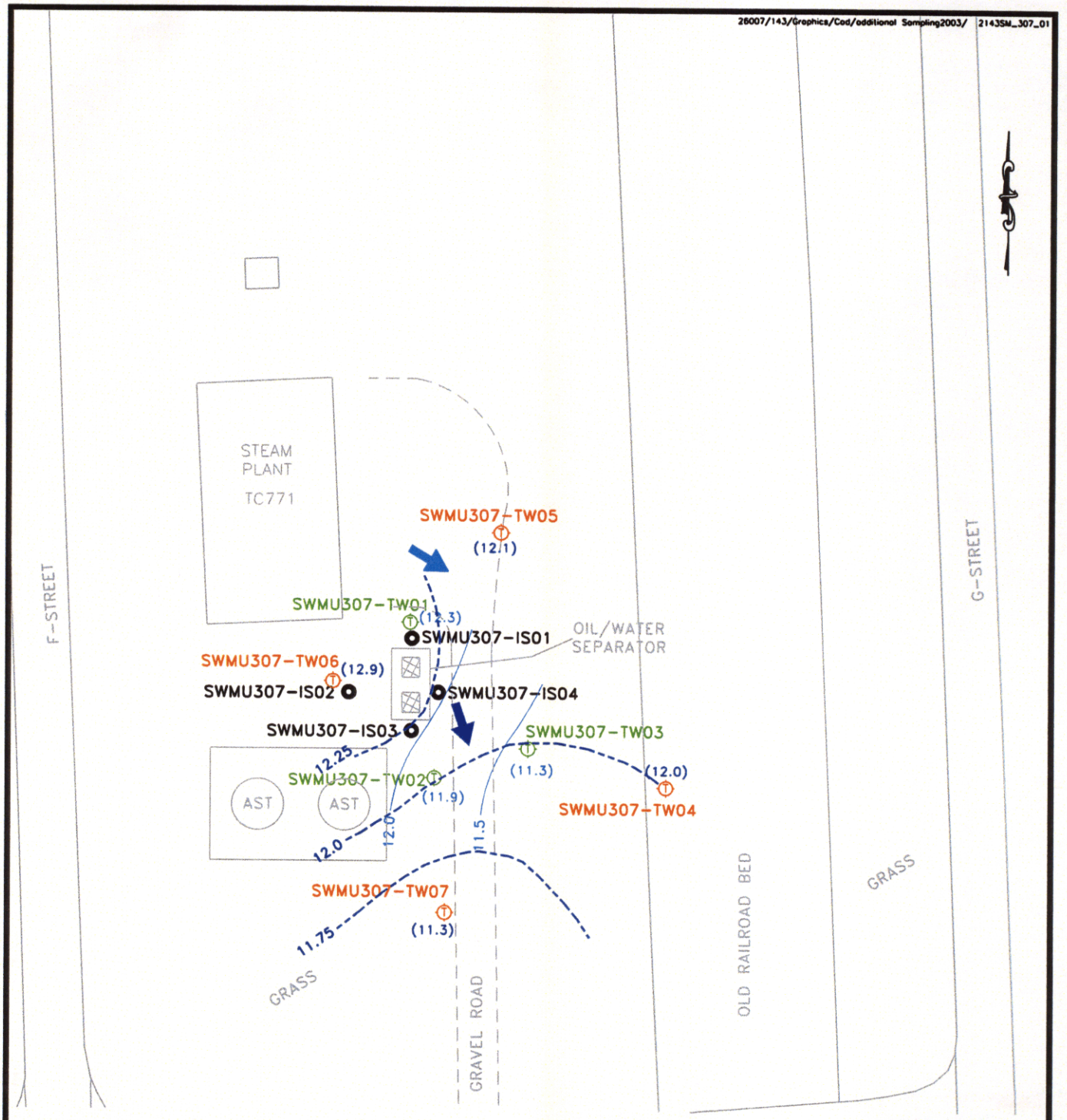
ND - Not Detected

NE - Not established

**STATISTICAL SUMMARY**
**GROUNDWATER - SWMU 307**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water | Minimum Detected | Maximum Detected | Frequency of Detection | Base Background Criteria Groundwater Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs TAP Water |
|---|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 5.6 J | 5.6 J | 1/8 | 0 | 0 | 1 |
| Barium | 37.31 | 2000 | 2600 | 31.2 J | 145 J | 8/8 | 7 | 0 | 0 |
| Chromium | 5.76 | 50 | NE | 1 J | 42.3 J | 7/8 | 2 | 0 | 0 |
| Lead | 3.61 | 15 | NE | 1.7 J | 27.7 J | 6/8 | 3 | 2 | 0 |
| Mercury | NE | 1.1 | 11 | 0.12 J | 0.12 J | 1/8 | 0 | 0 | 0 |

Notes:
**No SVOCs were detected in the samples**
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established

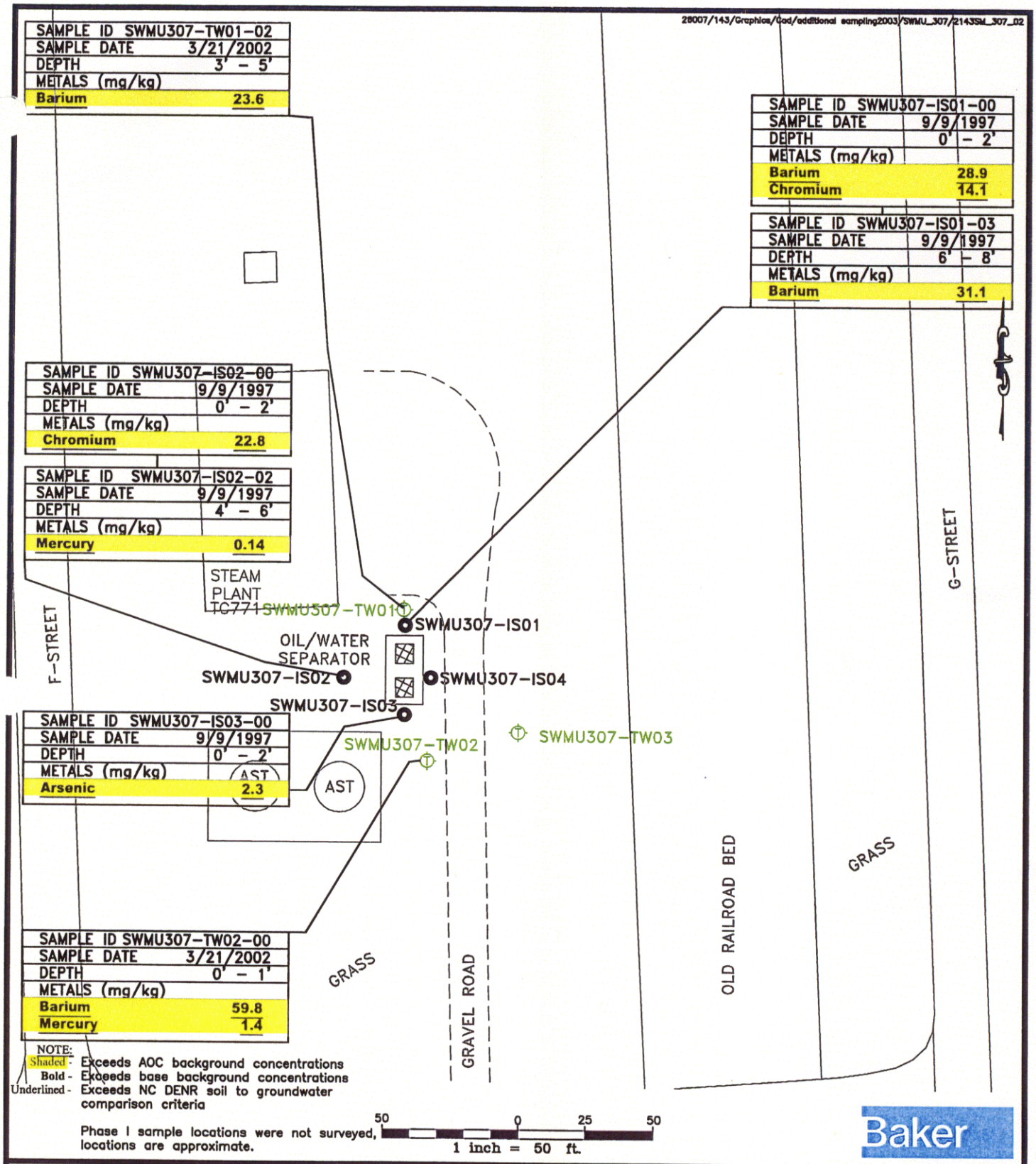



## LEGEND

- ⓣ – PHASE II CSI TEMPORARY WELLS
- ⊙ – PHASE I CSI SOIL BORING
- ⓣ – ADDITIONAL PHASE II CSI TEMPORARY WELLS
- → – GROUNDWATER FLOW DIRECTION (APRIL 2002)
- —12.0— – GROUNDWATER CONTOUR (APRIL 2002)
- → – GROUNDWATER FLOW DIRECTION (JULY 2003)
- ---12.0--- – GROUNDWATER CONTOUR (JULY 2003)

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 307
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

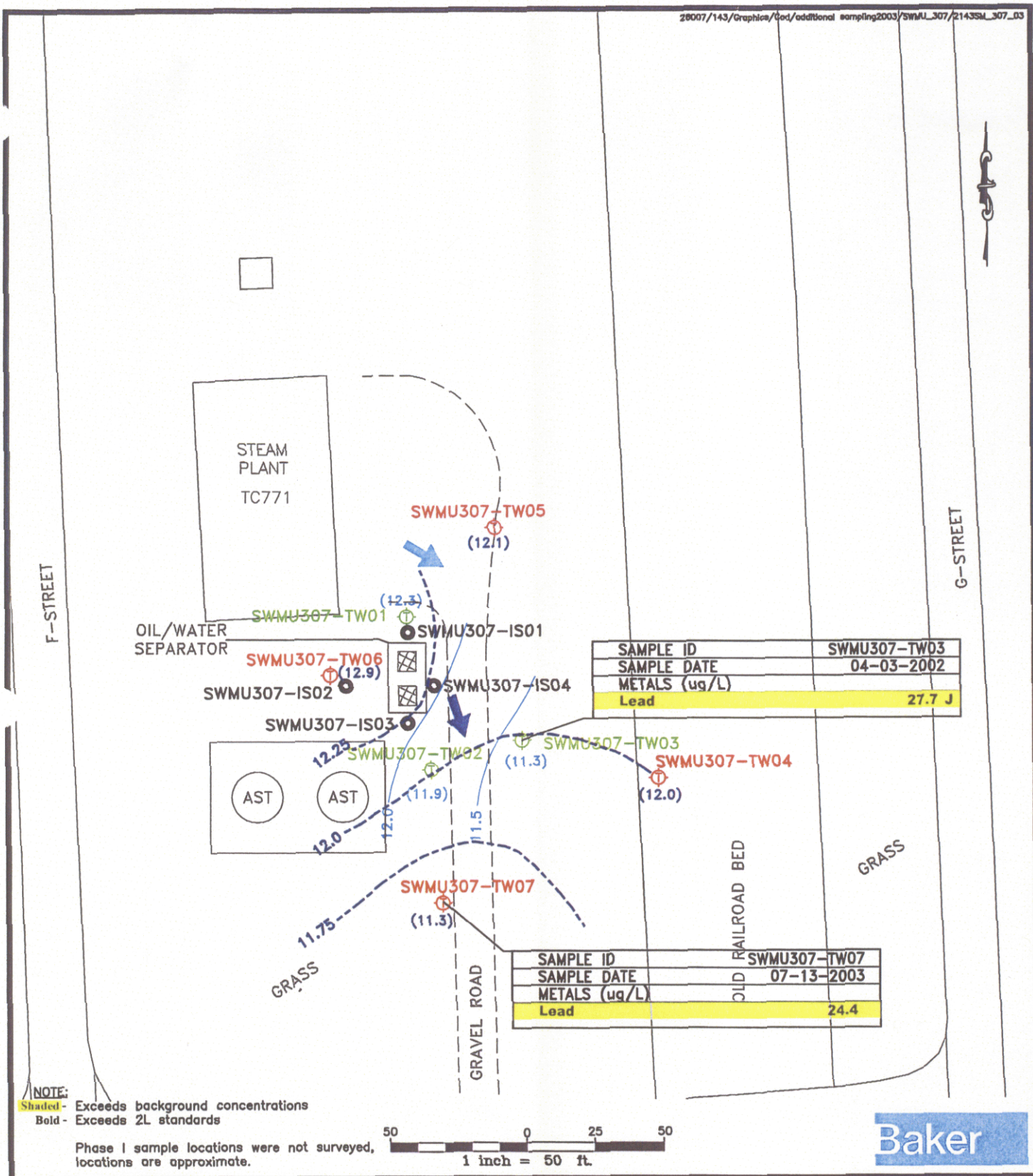



LEGEND

- PHASE II CSI TEMPORARY WELL
- PHASE I CSI SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 307
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standards

Phase I sample locations were not surveyed, locations are approximate.

Baker

## LEGEND

- PHASE II CSI TEMPORARY WELLS
- PHASE I CSI SOIL BORING
- ADDITIONAL PHASE II CSI TEMPORARY WELLS
- GROUNDWATER FLOW DIRECTION (APRIL 2002)
- —12.0— GROUNDWATER CONTOUR (APRIL 2002)
- GROUNDWATER FLOW DIRECTION (JULY 2003)
- —12.0— GROUNDWATER CONTOUR (JULY 2003)

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
## SWMU 307
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.26 SWMU 308 - GP19 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.26.1 SWMU Description and History

SWMU 308 consists of an oil/water separator (GP-19) that is associated with a vehicle wash rack. The SWMU is located in the Hadnot Point Industrial Area, just southwest of the intersection of Main Service and Daly Roads, adjacent to the former location of Building GP-19. The separator was installed in 1982 and is currently active. The separator consists of an in-ground concrete structure that measures 4 feet by 6 feet by 6 feet and discharges to a sanitary sewer. A potential overflow area exists in a low-lying area adjacent to (approximately 10 feet away from) the separator. During the October 1996 site visit conducted by Baker, tree debris was noted in the vehicle wash area, and the drain for the wash rack was clogged. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if overflow/runoff from the wash rack or oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced adjacent to the vehicle wash rack, the oil/water separator, and within the overflow area (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, bis(2-chloroethyl)ether exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 308 was recommended in the form of a Phase II CSI.

### 4.26.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 7, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 16.3 to 17 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 7.4 to 8.3 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northeast.

### 4.26.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 through 5 and were compared to the following screening criteria:

- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Four SVOCs were detected in the soil sample set, as follows: bis(2-chloroethyl)ether, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and di-n-octyl phthalate. Bis(2-chloroethyl)ether exceeded the NC DENR soil to groundwater screening criteria and the USEPA Region IX residential PRG in surface soil sample SWMU308-IS04-00, which was collected in September 1997 during the Phase I CSI. None of the other SVOCs detected in the samples exceeded established screening criteria.

Groundwater

The analytical results and a statistical summary for positive detections is presented on Tables 6 and 7 and were compared to the North Carolina 2L standards.

One SVOC (4-methylphenol) was detected in the groundwater sample from well SWMU308-TW01. The concentration was below the 2L standard. No other SVOCs were detected in the groundwater samples from the remaining two wells.

### 4.26.4 Conclusions

Bis(2-chloroethyl)ether was detected in the soil at a concentration exceeding the NC DENR soil to groundwater screening criteria and the USEPA Region IX residential PRG. None of the SVOCs detected in groundwater exceeded the applicable screening criteria. Phase II CSI samples locations did not detect additional bis(2-chloroethyl)ether at this site. Additionally, groundwater samples did not contain this compound. Based on these results, it is assumed that the surface soil sample result was indicative of an isolated, anomalous detection and not related to the SWMU. Therefore, no further action is warranted.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU308-TW01 | 3/25/02 | BAKER | 23.81 | 23.6 | 22 | 22 | 10 | 8 | 12 | 16.4 | 7.4 |
| SWMU308-TW02 | 3/25/02 | BAKER | 25.04 | 24.9 | 21 | 21 | 9 | 7 | 11 | 17 | 8.0 |
| SWMU308-TW03 | 3/25/02 | BAKER | 24.61 | 24.4 | 20 | 20 | 8 | 6 | 10 | 16.3 | 8.3 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU308

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU308-IS01-00 09-13-1997 0' - 2' | SWMU308-IS02-00 09-13-1997 0' - 2' | SWMU308-IS03-00 09-13-1997 0' - 2' | SWMU308-IS04-00 09-13-1997 0' - 2' | SWMU308-TW01-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Chloroethyl) ether | 0.19 (1) | 210 | ND | ND | ND | 260 J | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 120 J | 450 J | 190 J | 310 J | 150 J |
| Di-n-butyl phthalate | 24800 | 6100000 | ND | ND | ND | 27 J | ND |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | 170 J | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1441 mg/kg.

ND - Analyte not detected.

NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU308-TW02-00 03-25-2002 0' - 1' | SWMU308-TW03-00 03-25-2002 0' - 1' |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | |
| bis(2-Chloroethyl) ether | 0.19 (1) | 210 | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 200 J | 120 J |
| Di-n-butyl phthalate | 24800 | 6100000 | ND | ND |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1441 mg/kg.

ND - Analyte not detected.

NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Chloroethyl) ether | 0.19 (1) | 210 | 1/7 | 260 J | NA | NA | 1 | 1 |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 7/7 | 120 J - 450 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | 24800 | 6100000 | 1/7 | 27 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 1200000 | 1/7 | 170 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1441 mg/kg.

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU308-IS01-06 09-13-1997 12' - 14' | SWMU308-IS02-06 09-13-1997 12' - 14' | SWMU308-IS03-06 09-13-1997 12' - 14' | SWMU308-IS04-06 09-13-1997 12' - 14' | SWMU308-TW01-07 03-25-2002 13' - 15' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 130 J | 150 J | 1600 J | 140 J | 52 J |
| Di-n-octyl phthalate | 10000000 | 1200000 | ND | ND | ND | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/12/02
SWMU308_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU308-TW02-07 03-25-2002 13' - 15' | SWMU308-TW03-07 03-25-2002 13' - 15' |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 57 J | 110 J |
| Di-n-octyl phthalate | 10000000 | 1200000 | 43 J | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/12/02
SWMU308_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 35000 | 7/7 | 52 J - 1600 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 1200000 | 1/7 | 43 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | SWMU308-TW01 04-07-2002 | SWMU308-TW02 04-07-2002 | SWMU308-TW03 04-07-2002 |
|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | |
| 4-Methylphenol | 3.5 | 1.3 J | ND | ND |

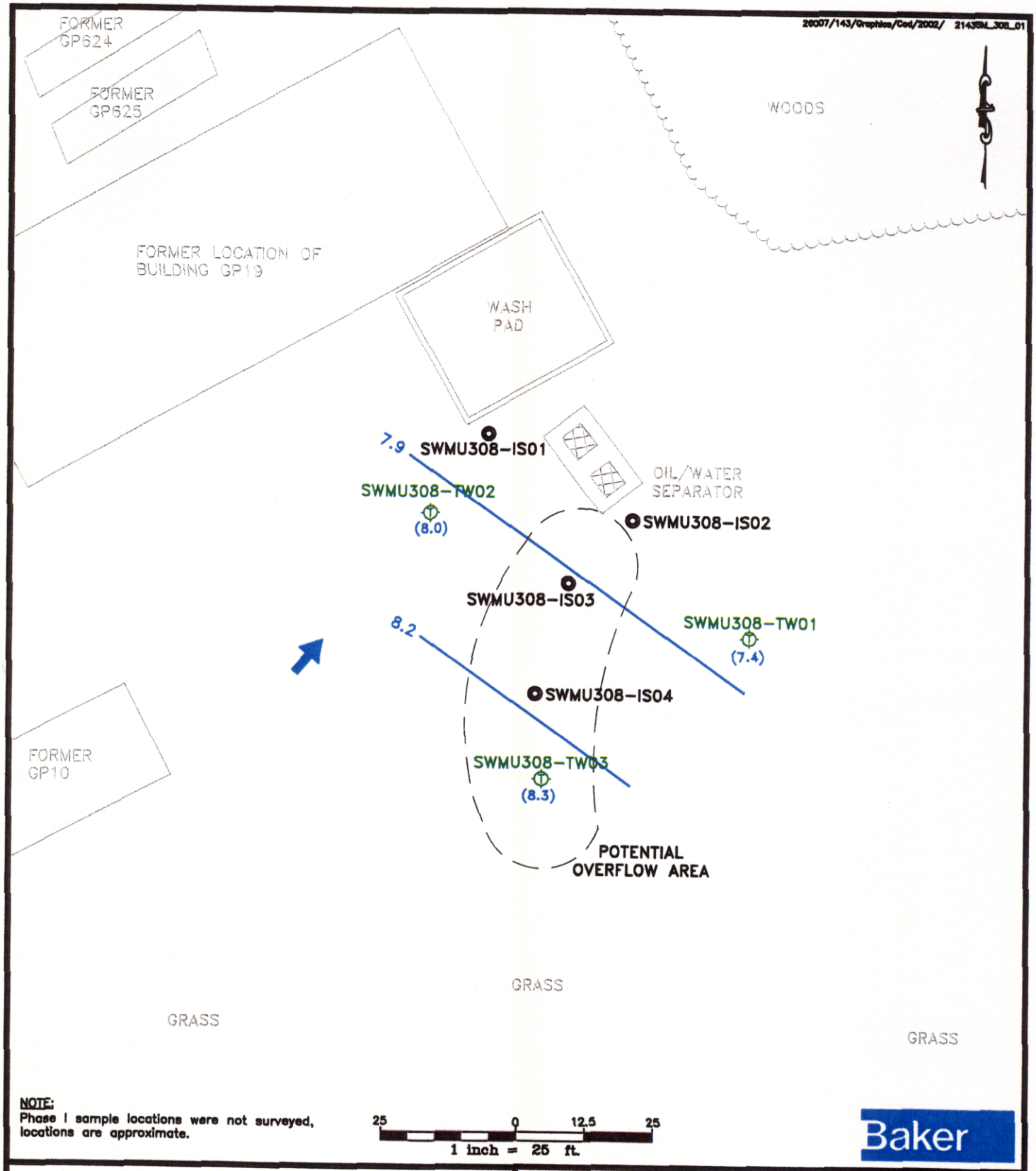
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 308
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| 4-Methylphenol | 3.5 | 1/3 | 1.3 J | NA | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
(1) - If NC 2L Standard not available, Interim Standard was used.




LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 8.2 — GROUNDWATER CONTOUR
- ESTIMATED EXTENT OF RELEASE AREA

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 308
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB28Y

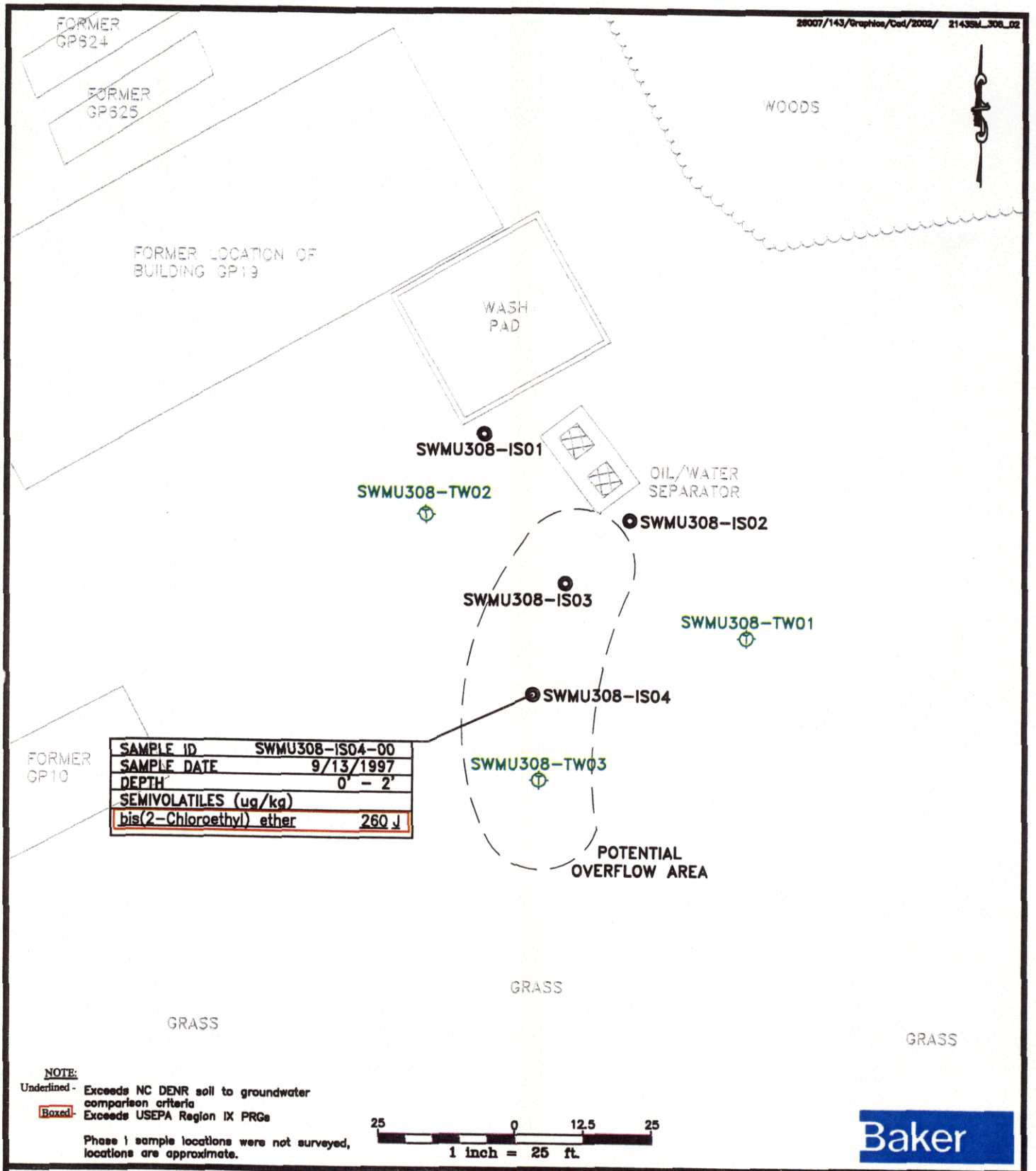



FIGURE 2
PHASE II CONFIRMATORY INVESTIGATIO
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 308
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.27 SWMU 311 - S1619 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.27.1 SWMU Description and History

SWMU 311 consists of an oil/water separator that is associated with a vehicle wash rack. The SWMU is located in the Hadnot Point Industrial Area just north of Michael Road between Gum and Fir Streets. The vehicle wash rack is situated between Buildings 1604 and 1605 in a fenced-in and paved area. The oil/water separator is situated in a grassy area adjacent to the paved area and outside of the fence line. The separator was installed in 1984 and is currently used. The structure is a concrete, in-ground unit that discharges to a wastewater treatment plant. A drainage swale runs parallel to Michael Road and flows into a culvert that leads to Cogdels Creek. The interception of the drainage swale and culvert is approximately 2,250 feet northwest of Cogdels Creek. The drain from the wash rack to the oil/water separator showed evidence of overflow (i.e., eroded soils) during the October 1996 site visit conducted by Baker. Overflow from the earthen drainage way could potentially reach Cogdels Creek. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator and wash rack has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected at three soil borings advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, one VOC chlorobenzene and several metals exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 311 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.27.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and 25 and April 4 through 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three soil borings and three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 7.6 to 13.9 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 14.3 to 19.4 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow north.

### 4.27.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Twenty VOCs were detected in the soil sample set. Benzene, bromoform, chlorobenzene, chloroform, methylene chloride, tetracholoethene, and/or trichloroethene exceeded the NC DENR soil to groundwater criteria in surface and subsurface soil samples from borings SWMU 311-IS01, SWMU 311-SB01, and SWMU 311-TW01 through SWMU 311-TW03. None of the other VOCs in the samples exceed the applicable screening criteria.

Seven metals were detected in the soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. These seven metals exceeded the AOC and/or Base background criteria in one or more of the samples. Mercury exceeded the AOC background criteria and the NC DENR soil to groundwater criteria; however, the concentrations were below the Base background criteria and USEPA Region IX industrial PRG. Cadmium, chromium, and lead exceeded both the AOC and Base background screening criteria and the NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs in one or more of the surface soil samples. None of the metals detected in the subsurface soil samples exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria or USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Five VOCs were detected in the groundwater samples from SWMU311-TW01, as follows: cyclohexane, ethylbenzene, ispropylbenzene, methylcyclohexane, and xylenes (total). None of these

five VOCs exceeded associated screening criteria. No VOCs were detected above the laboratory reporting limits in samples from the remaining two wells.

Four metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, and lead. Chromium and lead were detected in the sample from well SWMU 311-TW01 at concentrations above the background criteria; however, the concentrations were below the 2L standards. None of the other metals detected in the samples exceeded the established screening criteria.

Most of the compounds detected in groundwater (except for isopropylbenzene) were detected in the soils at SWMU 311.

### 4.27.4 Conclusions

Several VOCs and metals were detected in soil at concentrations exceeding applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- VOCs - benzene, bromoform, chlorobenzene, chloroform, methylene chloride, tetrachloroethene, and trichloroethene
- Metals - cadmium, chromium, and lead

None of the compounds detected in groundwater exceeded both the background criteria and 2L standards.

Based on evaluation of the results, additional investigation at SWMU 311 is warranted to further investigate VOCs and SVOCs in soil. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU311-TW01 | 3/24/02 | BAKER | 26.99 | 26.8 | 12 | 12 | 0.9 | 0 | 2 | 7.61 | 19.4 |
| SWMU311-TW02 | 3/24/02 | BAKER | 26.61 | 26.5 | 13 | 13 | 1 | 0 | 3.2 | 11.51 | 15.1 |
| SWMU311-TW03 | 3/25/02 | BAKER | 28.12 | 28.1 | 20 | 20 | 8 | 6 | 10 | 13.85 | 14.3 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU311

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU311-IS02-00 09-13-1997 0' - 2' | SWMU311-IS03-00 09-13-1997 0' - 2' | SWMU311-IS04-00 09-13-1997 0' - 2' | SWMU311-SB01-00 03-24-2002 0' - 1' | SWMU311-SB02-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | NA | NA | NA | ND | ND |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | NA | NA | NA | ND | ND |
| Acetone | NE | NE | 2810 | 6200000 | NA | NA | NA | 14 J | 4 J |
| Benzene | NE | NE | 5.6 | 1500 | ND | ND | ND | ND | ND |
| Bromoform | NE | NE | 1.4 (1) | 310000 | NA | NA | NA | 14 | ND |
| Carbon disulfide | NE | NE | 4940 | 720000 | NA | NA | NA | ND | ND |
| Chloroform | NE | NE | 1.1 (1) | 520 | NA | NA | NA | ND | ND |
| Cyclohexane | NE | NE | NE | 140000 | NA | NA | NA | ND | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | ND | ND | ND | ND |
| Methylcyclohexane | NE | NE | NE | 8800000 | NA | NA | NA | ND | ND |
| Methylene chloride | NE | NE | 23 (1) | 21000 | NA | NA | NA | 21 | 13 |
| **METALS (mg/kg)** | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | ND | ND | ND | ND |
| Barium | 39 | 17 | 848 | 100000 | ND | ND | ND | 8.5 | 12.8 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 5.2 | 0.74 | ND | 0.096 J | ND |
| Chromium | 16 | 15 | 27 | 450 | 28.8 | 6.1 | 6.4 | 5.4 | 4.8 |
| Lead | 69 | 21 | 270 | 750 | 211 | 15.6 | 1110 | 5.3 J | 4.4 J |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.09 | ND | ND | 0.041 | 0.02 J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | ND | ND | ND | **0.56** |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
(2) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU311-SB03-00 03-25-2002 0' - 1' | SWMU311-TW01-00 03-24-2002 0' - 1' | SWMU311-TW02-00 03-24-2002 0' - 1' | SWMU311-TW03-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | 6 J | 11 J | ND |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | 2 J | ND | ND | ND |
| Acetone | NE | NE | 2810 | 6200000 | 8 J | 17 J | 34 J | 12 J |
| Benzene | NE | NE | 5.6 | 1500 | ND | ND | 2 J | ND |
| Bromoform | NE | NE | 1.4 (1) | 310000 | ND | 12 | 19 | 11 J |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | ND | 2 J | ND |
| Chloroform | NE | NE | 1.1 (1) | 520 | ND | 2 J | ND | 2 J |
| Cyclohexane | NE | NE | NE | 140000 | ND | ND | 1 J | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | ND | 2 J | ND |
| Methylcyclohexane | NE | NE | NE | 8800000 | ND | ND | 1 J | ND |
| Methylene chloride | NE | NE | 23 (1) | 21000 | 13 | 30 | 18 | 24 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | ND | 0.31 J | ND | ND |
| Barium | 39 | 17 | 848 | 100000 | 9.3 | 11.6 | 10 | **17.8** J |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 0.041 J | **0.056** J | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 3.3 | 10.4 | 4.8 | 4.5 |
| Lead | 69 | 21 | 270 | 750 | 17.2 J | 5.2 J | 6.4 J | 8.2 J |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.021 J | 0.053 | 0.034 J | 0.019 J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | **0.91** | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
(2) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Butanone | NE | NE | 692 | 28000000 | 2/6 | 6 J - 11 J | NA | NA | 0 | 0 |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | 1/6 | 2 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 6200000 | 6/6 | 4 J - 34 J | NA | NA | 0 | 0 |
| Benzene | NE | NE | 5.6 | 1500 | 1/9 | 2 J | NA | NA | 0 | 0 |
| Bromoform | NE | NE | 1.4 (1) | 310000 | 4/6 | 11 J - 19 | NA | NA | 4 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/6 | 2 J | NA | NA | 0 | 0 |
| Chloroform | NE | NE | 1.1 (1) | 520 | 2/6 | 2 J | NA | NA | 2 | 0 |
| Cyclohexane | NE | NE | NE | 140000 | 1/6 | 1 J | NA | NA | 0 | 0 |
| Ethylbenzene | NE | NE | 241 | 230000 | 1/9 | 2 J | NA | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | NE | 8800000 | 1/6 | 1 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 23 (1) | 21000 | 6/6 | 13 - 30 | NA | NA | 2 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 1/9 | 0.31 J | 0 | 0 | 0 | 0 |
| Barium | 39 | 17 | 848 | 100000 | 6/9 | 8.5 - 17.8 | 0 | 1 | 0 | 0 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 5/9 | 0.041 J - 5.2 | 3 | 4 | 1 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 9/9 | 3.3 - 28.8 | 1 | 1 | 1 | 0 |
| Lead | 69 | 21 | 270 | 750 | 9/9 | 4.4 J - 1110 | 2 | 2 | 1 | 1 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 7/9 | 0.019 J - 0.09 | 1 | 0 | 7 | 0 |
| Selenium | 1 | 0.46 | 12 | 10000 | 2/9 | 0.56 - 0.91 | 0 | 2 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU311-IS02-03 09-13-1997 6' - 8' | SWMU311-IS03-03 09-13-1997 6' - 8' | SWMU311-IS04-06 09-13-1997 12' - 14' | SWMU311-SB01-03 03-24-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | 530 | ND | ND | ND |
| 1,3-Dichlorobenzene | NE | NE | 23700 | 52000 | 140 | ND | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | 220 | ND | ND | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | NA | NA | NA | ND |
| Acetone | NE | NE | 2810 | 6200000 | NA | NA | NA | 3 J |
| Benzene | NE | NE | 6.1 (1) | 1500 | ND | ND | ND | ND |
| Bromoform | NE | NE | 1.4 (1) | 310000 | NA | NA | NA | 23 |
| Carbon disulfide | NE | NE | 4940 | 720000 | NA | NA | NA | ND |
| Chlorobenzene | NE | NE | 520 (1) | 9100 | 530 | ND | ND | ND |
| Chloroform | NE | NE | 1.1 (1) | 520 | NA | NA | NA | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 150000 | NA | NA | NA | ND |
| Cyclohexane | NE | NE | NE | 140000 | NA | NA | NA | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | ND | ND | ND |
| Methylcyclohexane | NE | NE | NE | 8800000 | NA | NA | NA | ND |
| Methylene chloride | NE | NE | 23 (1) | 21000 | NA | NA | NA | 27 |
| Tetrachloroethene | NE | NE | 9 (1) | 19000 | NA | NA | NA | ND |
| Toluene | NE | NE | 7270 | 520000 | 200 | ND | ND | ND |
| Trichloroethene | NE | NE | 20 (1) | 6100 | NA | NA | NA | ND |
| Xylenes (total) | NE | NE | 4960 | 210000 | 2000 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | **1.9** | ND | 2.6 | 0.55 J |
| Barium | 26 | 22 | 848 | 100000 | ND | ND | ND | 9 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 0.61 | ND | ND | 0.044 J |
| Chromium | 12 | 16 | 27 | 450 | 21 | 4.5 | 17 | 8.7 |
| Lead | 8.6 | 8.2 | 270 | 750 | 42.1 | 2.8 | 5.1 | 3.5 J |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 0.057 | ND | ND | ND |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
(2) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU311_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU311-SB02-03 03-25-2002 5' - 7' | SWMU311-SB03-03 03-25-2002 5' - 7' | SWMU311-TW01-03 03-24-2002 5' - 7' | SWMU311-TW02-03 03-24-2002 5' - 7' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | ND | ND | ND |
| 1,3-Dichlorobenzene | NE | NE | 23700 | 52000 | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | ND | ND | ND | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | ND | ND | ND |
| Acetone | NE | NE | 2810 | 6200000 | 4 J | 2 J | 2 J | 6 J |
| Benzene | NE | NE | 6.1 (1) | 1500 | ND | ND | ND | ND |
| Bromoform | NE | NE | 1.4 (1) | 310000 | ND | ND | 22 | 28 |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | ND | ND | ND |
| Chlorobenzene | NE | NE | 520 (1) | 9100 | ND | ND | ND | ND |
| Chloroform | NE | NE | 1.1 (1) | 520 | ND | ND | 1 J | 2 J |
| cis-1,2-Dichloroethene | NE | NE | 350 | 150000 | ND | ND | ND | ND |
| Cyclohexane | NE | NE | NE | 140000 | ND | ND | ND | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | ND | ND | ND |
| Methylcyclohexane | NE | NE | NE | 8800000 | ND | ND | ND | ND |
| Methylene chloride | NE | NE | 23 (1) | 21000 | ND | 19 | 27 | 32 |
| Tetrachloroethene | NE | NE | 9 (1) | 19000 | ND | ND | ND | ND |
| Toluene | NE | NE | 7270 | 520000 | ND | ND | ND | ND |
| Trichloroethene | NE | NE | 20 (1) | 6100 | ND | ND | ND | ND |
| Xylenes (total) | NE | NE | 4960 | 210000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 0.97 J | ND | ND | 0.69 J |
| Barium | 26 | 22 | 848 | 100000 | 5.4 | 8.8 | 45 | 20.1 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 0.045 J | ND | 0.27 J | 0.052 J |
| Chromium | 12 | 16 | 27 | 450 | 8.5 | 4.2 | 12.1 | 13.9 |
| Lead | 8.6 | 8.2 | 270 | 750 | 3.3 J | 2.5 J | 28.5 J | 4.7 J |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 0.029 J | ND | 0.023 J | 0.027 J |
| Selenium | 0.43 | 0.69 | 12 | 10000 | 0.67 | ND | 0.84 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
(2) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU311_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU311-TW03-03 03-25-2002 5' - 7' | SWMU311-TW03A-08 04-08-2002 15' - 17' |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (2)** | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | ND | ND |
| 1,3-Dichlorobenzene | NE | NE | 23700 | 52000 | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | ND | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | ND | 12 J |
| Acetone | NE | NE | 2810 | 6200000 | ND | 40 |
| Benzene | NE | NE | 6.1 (1) | 1500 | ND | 10 |
| Bromoform | NE | NE | 1.4 (1) | 310000 | ND | 25 |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | 11 |
| Chlorobenzene | NE | NE | 520 (1) | 9100 | ND | ND |
| Chloroform | NE | NE | 1.1 (1) | 520 | ND | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 150000 | ND | 49 |
| Cyclohexane | NE | NE | NE | 140000 | ND | 7 |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | 2 J |
| Methylcyclohexane | NE | NE | NE | 8800000 | ND | 6 J |
| Methylene chloride | NE | NE | 23 (1) | 21000 | 34 | 30 |
| Tetrachloroethene | NE | NE | 9 (1) | 19000 | ND | 400 J |
| Toluene | NE | NE | 7270 | 520000 | ND | 5 J |
| Trichloroethene | NE | NE | 20 (1) | 6100 | ND | 24 |
| Xylenes (total) | NE | NE | 4960 | 210000 | ND | ND |
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | 0.78 J |
| Barium | 26 | 22 | 848 | 100000 | 4 | 10.2 J |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 2.3 | 16.1 J |
| Lead | 8.6 | 8.2 | 270 | 750 | 1.7 J | 5.6 J |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | ND | ND |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
(2) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 7270 | 370000 | 1/10 | 530 | NA | NA | 0 | 0 |
| 1,3-Dichlorobenzene | NE | NE | 23700 | 52000 | 1/10 | 140 | NA | NA | 0 | 0 |
| 1,4-Dichlorobenzene | NE | NE | 1240 | 8100 | 1/10 | 220 | NA | NA | 0 | 0 |
| 2-Butanone | NE | NE | 692 | 28000000 | 1/7 | 12 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 6200000 | 6/7 | 2 J - 40 | NA | NA | 0 | 0 |
| Benzene | NE | NE | 6.1 (1) | 1500 | 1/10 | 10 | NA | NA | 1 | 0 |
| Bromoform | NE | NE | 1.4 (1) | 310000 | 4/7 | 22 - 28 | NA | NA | 4 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/7 | 11 | NA | NA | 0 | 0 |
| Chlorobenzene | NE | NE | 520 (1) | 9100 | 1/10 | 530 | NA | NA | 1 | 0 |
| Chloroform | NE | NE | 1.1 (1) | 520 | 2/7 | 1 J - 2 J | NA | NA | 1 | 0 |
| cis-1,2-Dichloroethene | NE | NE | 350 | 150000 | 1/7 | 49 | NA | NA | 0 | 0 |
| Cyclohexane | NE | NE | NE | 140000 | 1/7 | 7 | NA | NA | 0 | 0 |
| Ethylbenzene | NE | NE | 241 | 230000 | 1/10 | 2 J | NA | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | NE | 8800000 | 1/7 | 6 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 23 (1) | 21000 | 6/7 | 19 - 34 | NA | NA | 5 | 0 |
| Tetrachloroethene | NE | NE | 9 (1) | 19000 | 1/7 | 400 J | NA | NA | 1 | 0 |
| Toluene | NE | NE | 7270 | 520000 | 2/10 | 5 J - 200 | NA | NA | 0 | 0 |
| Trichloroethene | NE | NE | 20 (1) | 6100 | 1/7 | 24 | NA | NA | 1 | 0 |
| Xylenes (total) | NE | NE | 4960 | 210000 | 1/10 | 2000 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 6/10 | 0.55 J - 2.6 | 1 | 2 | 0 | 0 |
| Barium | 26 | 22 | 848 | 100000 | 7/10 | 4 - 45 | 1 | 1 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 5/10 | 0.044 J - 0.61 | 5 | 5 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 10/10 | 2.3 - 21 | 5 | 3 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 10/10 | 1.7 J - 42.1 | 2 | 2 | 0 | 0 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 4/10 | 0.023 J - 0.057 | 1 | 0 | 4 | 0 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | 2/10 | 0.67 - 0.84 | 2 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1364 mg/kg.
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU311-GW01 04-04-2002 | | SWMU311-GW02 04-04-2002 | SWMU311-GW03 04-09-2002 | |
|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | |
| Cyclohexane | NE | 35000 (2) | 3 | J | ND | ND | |
| Ethylbenzene | NE | 29 | 2 | J | ND | ND | |
| Isopropylbenzene | NE | 70 | 3 | J | ND | ND | |
| Methylcyclohexane | NE | 5200 (2) | 3 | J | ND | ND | |
| Xylene (Total) | NE | 530 | 3 | J | ND | ND | |
| **METALS (ug/L)** | | | | | | | |
| Arsenic | 12 | 10 | ND | | ND | 3.4 | J |
| Barium | 145 | 2000 | 54.5 | | 24.7 | ND | |
| Chromium | 5.8 | 50 | 11.4 | | ND | ND | |
| Lead | 3.6 | 15 | 9.4 | | ND | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

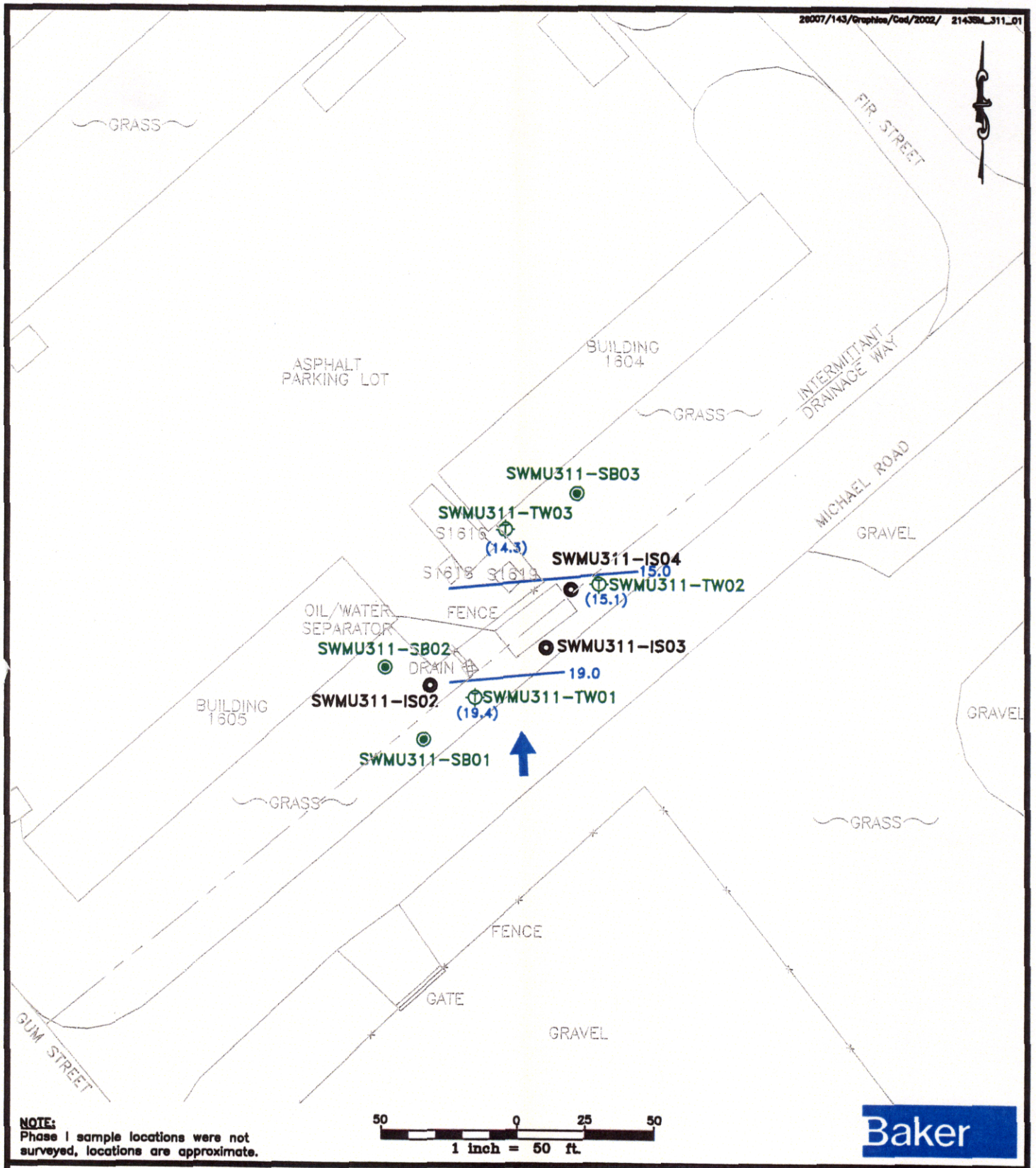
9/12/02
SWMU311_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 311
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| Cyclohexane | NE | 35000 (2) | 1/3 | 3 J | NA | 0 |
| Ethylbenzene | NE | 29 | 1/3 | 2 J | NA | 0 |
| Isopropylbenzene | NE | 70 | 1/3 | 3 J | NA | 0 |
| Methylcyclohexane | NE | 5200 (2) | 1/3 | 3 J | NA | 0 |
| Xylene (Total) | NE | 530 | 1/3 | 3 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 1/3 | 3.4 J | 0 | 0 |
| Barium | 145 | 2000 | 2/3 | 24.7 - 54.5 | 0 | 0 |
| Chromium | 5.8 | 50 | 1/3 | 11.4 | 1 | 0 |
| Lead | 3.6 | 15 | 1/3 | 9.4 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

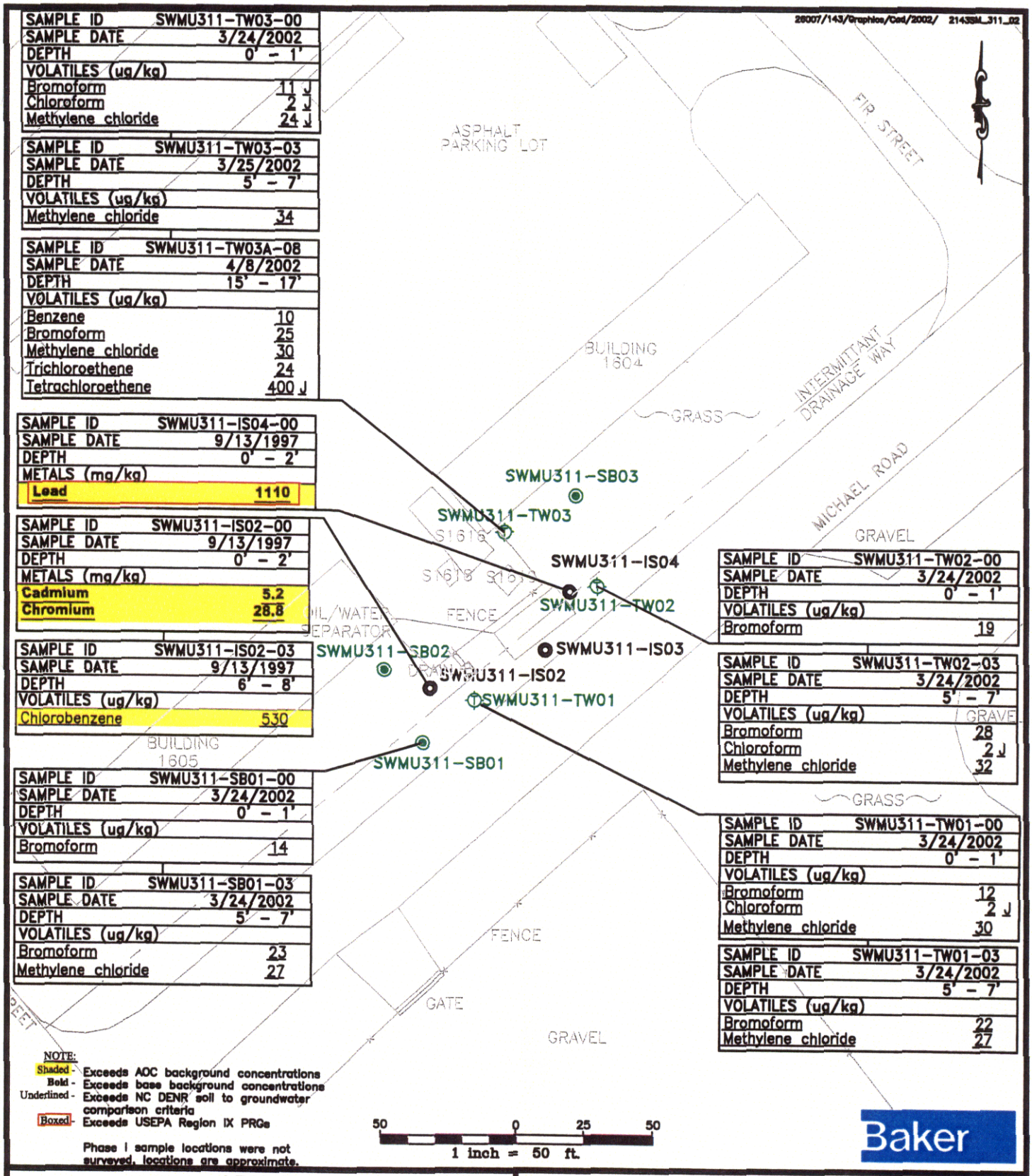



## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 19.0 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 311
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU311-TW03-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 11 J |
| Chloroform | 2 J |
| Methylene chloride | 24 J |

| SAMPLE ID | SWMU311-TW03-03 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 5' - 7' |
| VOLATILES (ug/kg) | |
| Methylene chloride | 34 |

| SAMPLE ID | SWMU311-TW03A-08 |
|---|---|
| SAMPLE DATE | 4/8/2002 |
| DEPTH | 15' - 17' |
| VOLATILES (ug/kg) | |
| Benzene | 10 |
| Bromoform | 25 |
| Methylene chloride | 30 |
| Trichloroethene | 24 |
| Tetrachloroethene | 400 J |

| SAMPLE ID | SWMU311-IS04-00 |
|---|---|
| SAMPLE DATE | 9/13/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Lead** | **1110** |

| SAMPLE ID | SWMU311-IS02-00 |
|---|---|
| SAMPLE DATE | 9/13/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Cadmium** | **5.2** |
| **Chromium** | **28.8** |

| SAMPLE ID | SWMU311-IS02-03 |
|---|---|
| SAMPLE DATE | 9/13/1997 |
| DEPTH | 6' - 8' |
| VOLATILES (ug/kg) | |
| Chlorobenzene | 530 |

| SAMPLE ID | SWMU311-SB01-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 14 |

| SAMPLE ID | SWMU311-SB01-03 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 5' - 7' |
| VOLATILES (ug/kg) | |
| Bromoform | 23 |
| Methylene chloride | 27 |

| SAMPLE ID | SWMU311-TW02-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 19 |

| SAMPLE ID | SWMU311-TW02-03 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 5' - 7' |
| VOLATILES (ug/kg) | |
| Bromoform | 28 |
| Chloroform | 2 J |
| Methylene chloride | 32 |

| SAMPLE ID | SWMU311-TW01-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 12 |
| Chloroform | 2 J |
| Methylene chloride | 30 |

| SAMPLE ID | SWMU311-TW01-03 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 5' - 7' |
| VOLATILES (ug/kg) | |
| Bromoform | 22 |
| Methylene chloride | 27 |

## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 311
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.28 SWMU 312 - Oil/Water Separator S-1735 (S-1698)

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.28.1 SWMU Description and History

SWMU 312 is located within the central portion of the Hadnot Point Industrial Area southwest of Gum Street and behind the Steam Plant (Building 1700). The SWMU consists of a concrete in-ground oil/water separator that receives steam condensate from the Steam Plant. During the 1996 site visit conducted by Baker, petroleum stains were observed on the concrete and a hydrocarbon sheen was noted within the unit. The oil/water separator was installed in 1984 and is still in use. The area surrounding the SWMU is grass covered. A SWMU investigation plan is presented in Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the SWMU (see Figure 1). The soil samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 312 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.28.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two soil borings and three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 5 to 6.7 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 22.2 to 22.8 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northeast.

### 4.28.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix D.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Twenty-one SVOCs (mostly PAHs) were detected in the soil sample set. Most of the SVOCs were detected in the surface and subsurface soil samples from boring SWMU312-IS01 and the surface soil sample from boring SWMU312-SB02. Benzo(a)pyrene exceeded the NC DENR soil to groundwater criteria in surface soil sample SWMU312-SB02-00. None of the other SVOCs detected in the surface and subsurface soil samples exceeded the applicable screening criteria.

Seven metals were detected in the soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Of these seven metals, cadmium and selenium were not detected in the subsurface soil samples. Barium, cadmium, and selenium were detected above the AOC and Base background criteria, however the concentrations were below the NC DENR soil to groundwater screening criteria and the USEPA Region IX industrial PRGs. Arsenic and chromium exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria or the USEPA Region IX industrial PRG in surface soil sample SWMU312-SB01-00. These two metals did not exceed the soil to groundwater criteria or the USEPA Region IX PRG in the subsurface soil sample from this boring. Mercury exceeded the NC DENR soil to groundwater criteria, however, the concentrations were below the AOC and Base background criteria and the USEPA Region IX industrial PRG. None of the other metals detected in the samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

No SVOCs were detected above the laboratory reporting limits in the groundwater samples.

Three metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, and lead. Chromium and lead exceeded the Base background screening criteria. However, the concentrations were below the 2L standards.

All of the metals detected in the groundwater were detected in soil samples collected at SWMU 312.

### 4.28.4 Conclusions

One SVOC [benzo(a)pyrene] and two metals (arsenic and chromium) exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria or USEPA Region IX industrial PRGs in soil.

None of the compounds detected in groundwater exceeded both the Base background criteria and the 2L standards.

Based on evaluation of the results, no further action is warranted at SWMU 312 because COPCs were only detected in surface soils and are not indicative of SWMU failure or release. The detections of benzo(a)pyrene are likely related to coal residue or asphalt paving operations. Arsenic and chromium detections are similar to concentrations detected at SWMU 53 and are likely related to the operations of the plant and not associated with this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU312-TW01 | 3/21/02 | BAKER | 27.23 | 27.6 | 16 | 15.1 | 3.2 | 1.5 | 5 | 5 | 22.2 |
| SWMU312-TW02 | 3/21/02 | BAKER | 28.52 | 28.8 | 16 | 15.1 | 3 | 2 | 5 | 5.68 | 22.8 |
| SWMU312-TW03 | 3/21/02 | BAKER | 29.38 | 29.3 | 16 | 16 | 4 | 3 | 6 | 6.68 | 22.7 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU312

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-IS01-00 09-12-1997 0' - 2' | SWMU312-IS02-00 09-11-1997 0' - 2' | SWMU312-IS03-00 09-11-1997 0' - 2' | SWMU312-IS04-00 09-11-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | 83 J | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | 41 J | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 100000000 | 78 J | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 93 J | ND | 35 J | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | 100 J | ND | 82 J | 55 J |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | 170 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 81 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | 140 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 100 J | 110 J | 100 J | 120 J |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 160 J | ND | 43 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 45 J | ND | ND | ND |
| Dibenzofuran | NE | NE | 9240 (3) | 5100000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 120 J | ND | 63 J | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 76 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 95 J | ND | 43 J | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 130 J | ND | 49 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.88 | 5.24 | 2.7 | **1.1** | **1.4** | ND | ND |
| Barium | 39 | 19 | 848 | 100000 | **760** | ND | ND | ND |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 16 | 8.9 | 27 | 450 | **10.5** | **10.1** | 5.4 | 7.7 |
| Lead | 69 | 26 | 270 | 750 | 8.2 | 18.8 | 16.8 | 10.6 |
| Mercury | 0.07 | 0.12 | 0.015 | 610 | ND | 0.04 | 0.05 | ND |
| Selenium | 1 | 1.3 | 12 | 10000 | ND | 0.56 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-SB01-00 03-21-2002 0' - 1' | SWMU312-SB02-00 03-21-2002 0' - 1' | SWMU312-TW01-00 03-21-2002 0' - 1' | SWMU312-TW02-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | ND | ND | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | 68 J | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | 96 J | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | 250 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | ND | 190 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | ND | 180 J | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | 92 J | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | ND | 220 J | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | ND |
| Carbazole | NE | NE | NE | 120000 | ND | 65 J | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | 230 J | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | 26 J |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | 51 J | ND | ND |
| Dibenzofuran | NE | NE | 9240 (3) | 5100000 | ND | 40 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | 640 | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | 43 J | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | 180 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | 450 | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | 480 | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 0.88 | 5.24 | 2.7 | 5.2 | ND | ND | ND |
| Barium | 39 | 19 | 848 | 100000 | 9.4 | ND | 8.2 | ND |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 0.29 J | ND | ND | ND |
| Chromium | 16 | 8.9 | 27 | 450 | 33.3 | 1.9 | 7.3 | 1 |
| Lead | 69 | 26 | 270 | 750 | 7.2 | 11.7 | 4.5 J | 1.2 J |
| Mercury | 0.07 | 0.12 | 0.015 | 610 | ND | ND | ND | ND |
| Selenium | 1 | 1.3 | 12 | 10000 | 2.5 | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-TW03-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND |
| Carbazole | NE | NE | NE | 120000 | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 120 J |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND |
| Dibenzofuran | NE | NE | 9240 (3) | 5100000 | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND |
| **METALS (mg/kg)** | | | | | |
| Arsenic | 1.8 | 0.88 | 5.24 | 2.7 | ND |
| Barium | 39 | 19 | 848 | 100000 | 12.3 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | ND |
| Chromium | 16 | 8.9 | 27 | 450 | 5.1 |
| Lead | 69 | 26 | 270 | 750 | 9.6 J |
| Mercury | 0.07 | 0.12 | 0.015 | 610 | ND |
| Selenium | 1 | 1.3 | 12 | 10000 | 0.68 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | 1/9 | 83 J | NA | NA | 0 | 0 |
| Acenaphthene | NE | NE | 8160 | 38000000 | 1/9 | 68 J | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 1/9 | 41 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 100000000 | 2/9 | 78 J - 96 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 3/9 | 35 J - 250 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | 4/9 | 55 J - 190 J | NA | NA | 1 | 0 |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | 2/9 | 170 J - 180 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 2/9 | 81 J - 92 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | 2/9 | 140 J - 220 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 4/9 | 100 J - 120 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/9 | 65 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 3/9 | 43 J - 230 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 2/9 | 26 J - 120 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 2/9 | 45 J - 51 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 9240 (3) | 5100000 | 1/9 | 40 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 3/9 | 63 J - 640 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/9 | 43 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 2/9 | 76 J - 180 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 3/9 | 43 J - 450 | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 3/9 | 49 J - 480 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.88 | 5.24 | 2.7 | 3/9 | 1.1 - 5.2 | 1 | 3 | 0 | 1 |
| Barium | 39 | 19 | 848 | 100000 | 4/9 | 8.2 - 760 | 1 | 1 | 0 | 0 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 1/9 | 0.29 J | 1 | 1 | 0 | 0 |
| Chromium | 16 | 8.9 | 27 | 450 | 9/9 | 1 - 33.3 | 1 | 3 | 1 | 0 |
| Lead | 69 | 26 | 270 | 750 | 9/9 | 1.2 J - 18.8 | 0 | 0 | 0 | 0 |
| Mercury | 0.07 | 0.12 | 0.015 | 610 | 2/9 | 0.04 - 0.05 | 0 | 0 | 2 | 0 |
| Selenium | 1 | 1.3 | 12 | 10000 | 3/9 | 0.56 - 2.5 | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
AOC comparison - AOC 5 Surface Soil
Base comparison - Combined Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-IS01-01 09-12-1997 2' - 4' | SWMU312-IS02-01 09-11-1997 2' - 4' | SWMU312-IS03-01 09-11-1997 2' - 4' | SWMU312-IS04-01 09-11-1997 2' - 4' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | 94 J | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | 45 J | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | NA | NA | NA | NA |
| Anthracene | NE | NE | 995000 | 100000000 | 83 J | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 75 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | 96 J | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | 180 J | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 78 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | 100 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 120 J | 110 J | 1700 J | 70 J |
| Chrysene | NE | NE | 39800 | 290000 | 150 J | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 38 J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 130 J | ND | ND | 54 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 72 J | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | 42 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 120 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 150 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 2.7 | 1.2 | ND | ND |
| Barium | 26 | 22 | 848 | 100000 | 62.4 | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 10.5 | 10 | 7.8 | 6.4 |
| Lead | 8.6 | 8.2 | 270 | 750 | 12.6 | 15.3 | 14.7 | 14.7 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU312_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-SB01-02 03-21-2002 3' - 5' | SWMU312-SB02-04 03-21-2002 7' - 9' | SWMU312-TW01-02 03-21-2002 3' - 5' | SWMU312-TW02-04 03-21-2002 7' - 9' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | 76 J | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | 290 J | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | ND | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 38 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 190000 | 77 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 63 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 34 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | ND | ND | ND |
| Barium | 26 | 22 | 848 | 100000 | 12.2 | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 6.9 | 1.8 | 3.3 | 1.4 |
| Lead | 8.6 | 8.2 | 270 | 750 | 5.5 | 2.4 | 2.4 J | 1.3 J |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 0.04 J | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

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SWMU312_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU312-TW03-03 03-21-2002 5' - 7' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND |
| Acetophenone | NE | NE | NE | 1600 | ND |
| Anthracene | NE | NE | 995000 | 100000000 | ND |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | ND |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 29 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND |
| Naphthalene | NE | NE | 585 | 190000 | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND |
| **METALS (mg/kg)** | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND |
| Barium | 26 | 22 | 848 | 100000 | 11.2 |
| Chromium | 12 | 16 | 27 | 450 | 6 |
| Lead | 8.6 | 8.2 | 270 | 750 | 7.5 J |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

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SWMU312_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 2630 (3) | 41000000 (1) | 2/9 | 76 J - 94 J | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 1/9 | 45 J | NA | NA | 0 | 0 |
| Acetophenone | NE | NE | NE | 1600 | 1/5 | 290 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 100000000 | 1/9 | 83 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/9 | 75 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 183 (2) | 290 | 1/9 | 96 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 2320 (3) | 2900 | 1/9 | 180 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/9 | 78 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 23200 (3) | 29000 | 1/9 | 100 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 4/9 | 70 J - 1700 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/9 | 150 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/9 | 38 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 4/9 | 29 J - 130 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/9 | 72 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 585 | 190000 | 2/9 | 42 J - 77 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 2/9 | 63 J - 120 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/9 | 34 J - 150 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 2/9 | 1.2 - 2.7 | 1 | 1 | 0 | 0 |
| Barium | 26 | 22 | 848 | 100000 | 3/9 | 11.2 - 62.4 | 1 | 1 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 9/9 | 1.4 - 10.5 | 0 | 0 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 9/9 | 1.3 J - 15.3 | 4 | 4 | 0 | 0 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 1/9 | 0.04 J | 0 | 0 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2005 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 2005mg/kg.
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU312-TW01 04-04-2002 | SWMU312-TW02 04-04-2002 | SWMU312-TW03 04-04-2002 |
|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | |
| Barium | 145 | 2000 | 137 | 102 | 93.5 |
| Chromium | 5.8 | 50 | 5.4 | 9.5 | 1.7 J |
| Lead | 3.6 | 15 | 4.3 | 6.6 | 4 |

**No SVOCs were detected in the samples**

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.

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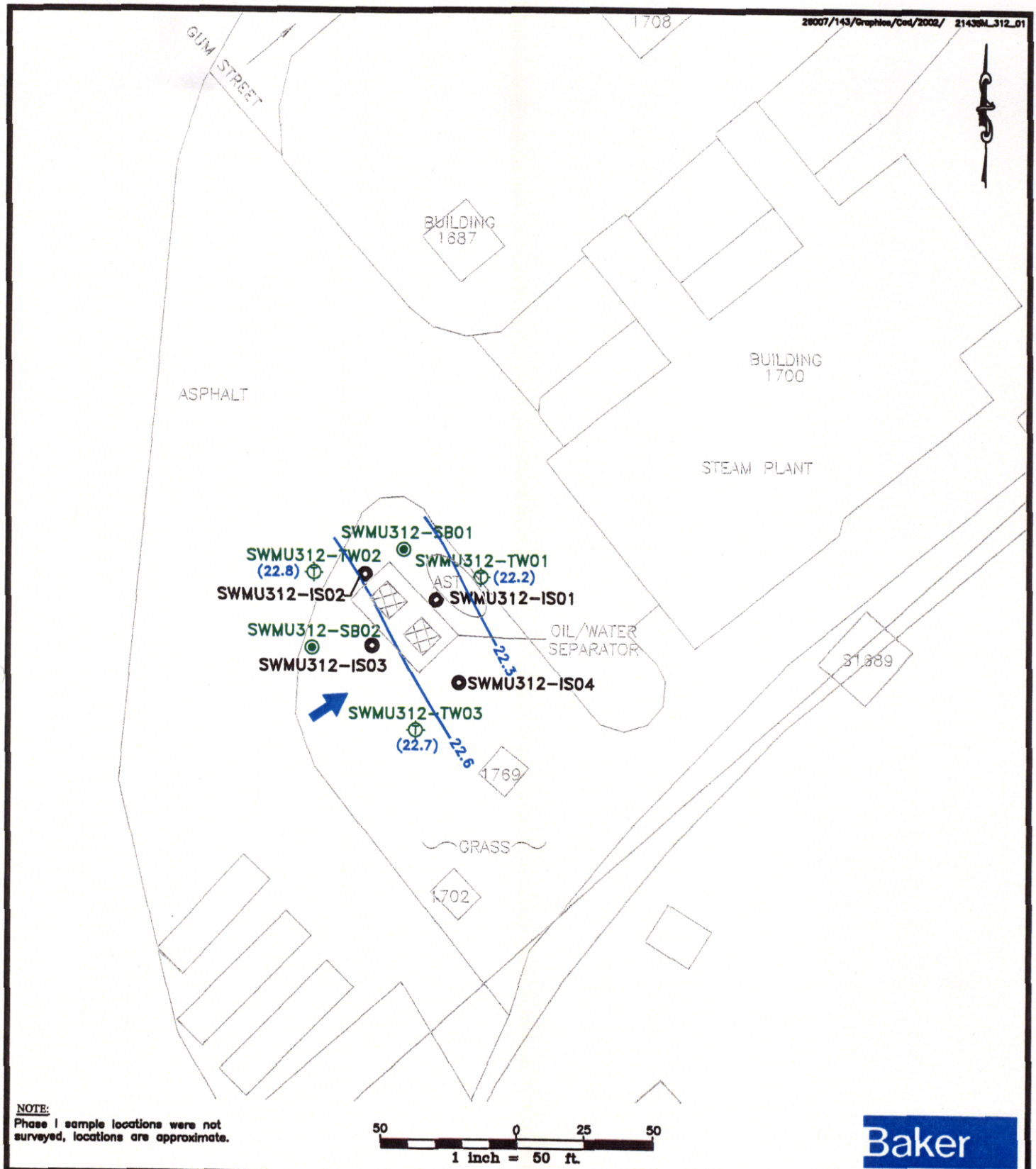
SWMU312_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 312
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 93.5 - 137 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 1.7 J - 9.5 | 1 | 0 |
| Lead | 3.6 | 15 | 3/3 | 4 - 6.6 | 3 | 0 |

**No SVOCs were detected in the samples**
J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.



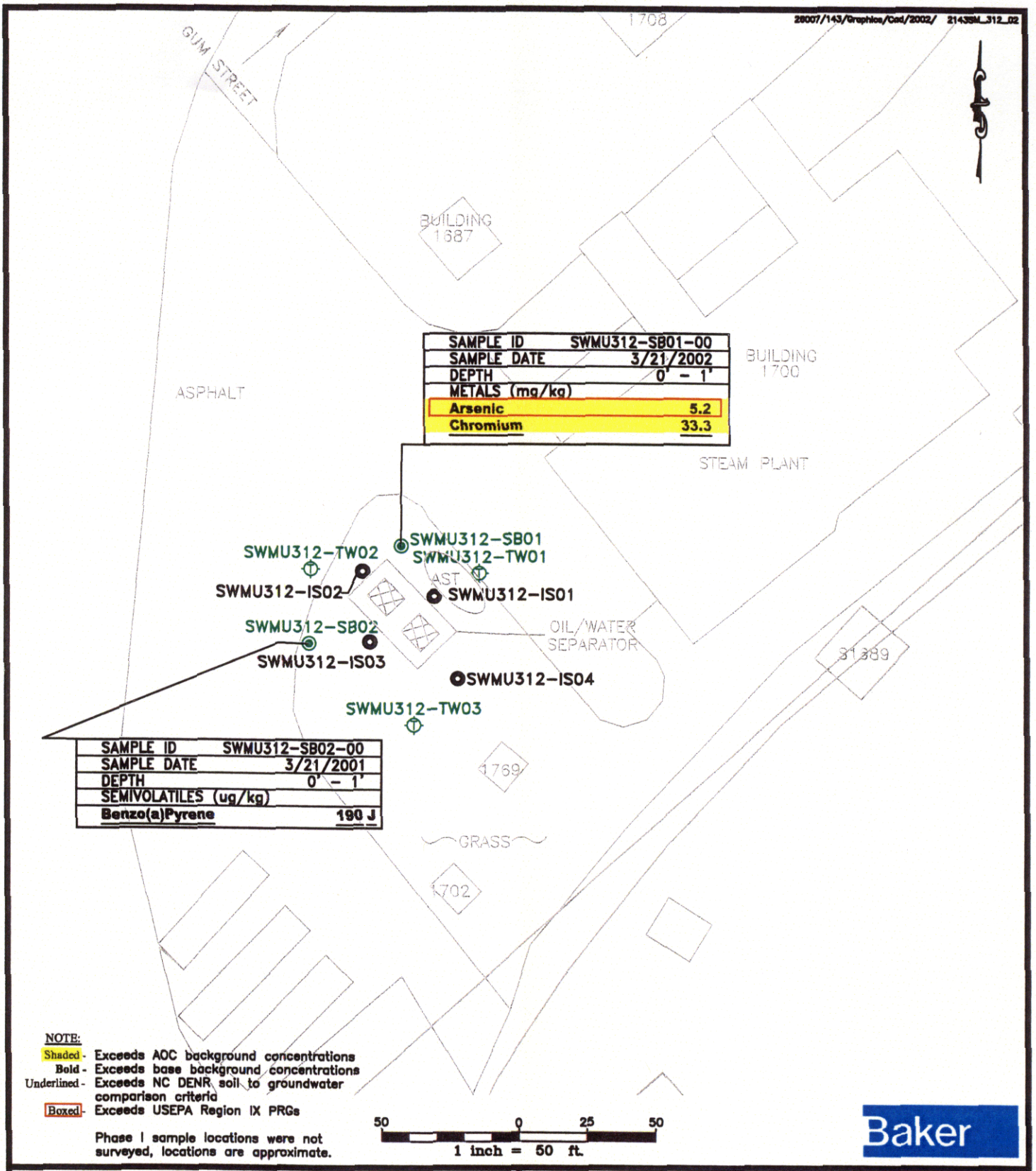

## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 22.3 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 312
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753ER30Y




## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 312
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.29 SWMU 313 - S1753 Oil/Water Separator and Aboveground Storage Tank

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.29.1 SWMU Description and History

SWMU 313 consists of an oil/water separator associated with a vehicle/equipment wash area and a used oil AST. The SWMU is located in the Hadnot Point Industrial Area, southwest of the intersection of Hammond Street and Gum Street. The oil/water separator is an in-ground concrete structure with dimensions of 5 feet by 10 feet by 8 feet. The wash area is paved with concrete and is used for maintenance of small crafts. Baker noted cracks in the concrete wash pad during the October 1996 site visit. In addition, petroleum stains were noted on the outside walls of the used oil AST. Reportedly, the oil/water separator unit was recently constructed. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the oil/water separator (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, silver and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 313 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.29.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 22 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two soil borings and three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 1.5 to 6.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 22.2 to 28.4 feet

above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northeast.

### 4.29.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

All eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) were detected in the soil sample set. None of these metals exceeded the USEPA Region IX industrial PRGs. Arsenic, cadmium, lead, and selenium exceeded the AOC and/or Base background criteria in one or more of the samples; however, the concentrations were below the NC DENR soil to groundwater screening criteria and USEPA Region IX industrial PRGs. Silver was detected above the AOC and Base background concentrations, as well as the NC DENR soil to groundwater screening criteria in surface soil sample SWMU313-IS02-00, which was collected in September 1997 during the Phase I CSI. Mercury exceeded the NC DENR soil to groundwater criteria; however, the concentrations were below the AOC and Base background criteria and the USEPA Region IX industrial PRG. None of the other metals detected in the samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Three metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, and lead. Chromium and lead concentrations in the sample from well SWMU313-TW02 exceeded the Base background screening criteria. However, the concentrations were below the 2L standards. None of the other metals detected in the groundwater samples exceeded the applicable screening criteria.

All of the metals detected in groundwater were also detected in soils at the SWMU.

### 4.29.4 Conclusions

One metal (silver) was detected in soil at concentrations exceeding both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria.

None of the metals detected in groundwater exceeded both the background criteria and 2L Standards.

Based on the evaluation of the analytical results, the isolated detection of silver in the surface soil sample from SWMU313-IS02 was considered anomalous. Therefore, additional activities are not warranted at this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU313-TW01 | 3/22/02 | BAKER | 29.87 | 30.1 | 12 | 12 | 1 | 0 | 2 | 1.52 | 28.4 |
| SWMU313-TW02 | 3/22/02 | BAKER | 28.70 | 28.9 | 12 | 12 | 1.1 | 0 | 2 | 6.55 | 22.2 |
| SWMU313-TW03 | 3/22/02 | BAKER | 28.71 | 28.9 | 12 | 12 | 1 | 0 | 2 | 3.5 | 25.2 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU313-IS01-00 09-13-1997 0' - 2' | SWMU313-IS02-00 09-13-1997 0' - 2' | SWMU313-IS03-00 09-13-1997 0' - 2' | SWMU313-IS04-00 09-13-1997 0' - 2' | SWMU313-SB01-00 03-22-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | **1.1** | **1.6** | **1.3** | **1.6** | ND |
| Barium | 39 | 17 | 848 | 100000 | ND | ND | ND | ND | ND |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | ND | ND | ND | ND | ND |
| Chromium | 16 | 15 | 27 | 450 | 10.9 | 8 | 6.9 | 8.4 | 6.7 J |
| Lead | 69 | 21 | 270 | 750 | 15.2 | 8.3 | 4 | 5.5 | 4.1 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | ND | ND | ND | 0.039 | 0.06 J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | ND | ND | **0.62** | **0.73** |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | ND | 1.8 | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU313-SB02-00 03-22-2002 0' - 1' | | SWMU313-TW01-00 03-22-2002 0' - 1' | | SWMU313-TW02-00 03-22-2002 0' - 1' | | SWMU313-TW03-00 03-22-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 0.36 | J | ND | | 0.36 | J | ND | |
| Barium | 39 | 17 | 848 | 100000 | 11.8 | | ND | | ND | | ND | |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | **0.24** | J | ND | | ND | | ND | |
| Chromium | 16 | 15 | 27 | 450 | 9.9 | J | 6.6 | J | 6.3 | J | 1.5 | J |
| Lead | 69 | 21 | 270 | 750 | **29.5** | | 4.1 | | 4 | | 1.7 | |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.04 | J | 0.04 | J | 0.03 | J | 0.03 | J |
| Selenium | 1 | 0.46 | 12 | 10000 | ND | | ND | | ND | | ND | |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | ND | | ND | | ND | | ND | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 0.67 | 5.24 | 2.7 | 6/9 | 0.36 J - 1.6 | 0 | 4 | 0 | 0 |
| Barium | 39 | 17 | 848 | 100000 | 1/9 | 11.8 | 0 | 0 | 0 | 0 |
| Cadmium | 0.08 | 0.05 | 2.7 | 810 | 1/9 | 0.24 J | 1 | 1 | 0 | 0 |
| Chromium | 16 | 15 | 27 | 450 | 9/9 | 1.5 J - 10.9 | 0 | 0 | 0 | 0 |
| Lead | 69 | 21 | 270 | 750 | 9/9 | 1.7 - 29.5 | 0 | 1 | 0 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 6/9 | 0.03 J - 0.06 J | 0 | 0 | 6 | 0 |
| Selenium | 1 | 0.46 | 12 | 10000 | 2/9 | 0.62 - 0.73 | 0 | 2 | 0 | 0 |
| Silver | 0.07 | 0.07 | 0.22 | 10000 | 1/9 | 1.8 | 1 | 1 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 5 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU313-IS01-02 09-13-1997 4' - 6' | SWMU313-IS02-02 09-13-1997 4' - 6' | SWMU313-IS03-02 09-13-1997 4' - 6' | SWMU313-IS04-02 09-13-1997 4' - 6' | SWMU313-SB01-01 03-22-2002 1' - 3' |
|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | ND | ND | ND | 1.2 | ND |
| Barium | 26 | 22 | 848 | 100000 | ND | ND | ND | ND | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 7.9 | 6.3 | 5.7 | 8.1 | 9.2 J |
| Lead | 8.6 | 8.2 | 270 | 750 | 5.2 | 4.6 | 2.5 | 3.7 | 4.1 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | ND | ND | ND | ND | 0.03 J |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU313_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU313-SB02-01 03-22-2002 1' - 3' | SWMU313-TW01-01 03-22-2002 1' - 3' | SWMU313-TW02-01 03-22-2002 1' - 3' | SWMU313-TW03-01 03-22-2002 1' - 3' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 1.2 J | ND | 0.91 J | 0.37 J |
| Barium | 26 | 22 | 848 | 100000 | 16.9 | ND | 10.7 | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 0.2 J | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 11.1 J | 5.8 J | 8.3 J | 4.1 J |
| Lead | 8.6 | 8.2 | 270 | 750 | 19.6 | 3.1 | 3.5 | 2.1 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 0.03 J | 0.04 J | 0.03 J | 0.02 J |
| Selenium | 0.43 | 0.69 | 12 | 10000 | ND | ND | 0.61 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU313_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.9 | 1.6 | 5.24 | 2.7 | 4/9 | 0.37 J - 1.2 J | 0 | 0 | 0 | 0 |
| Barium | 26 | 22 | 848 | 100000 | 2/9 | 10.7 - 16.9 | 0 | 0 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 1/9 | 0.2 J | 1 | 1 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 9/9 | 4.1 J - 11.1 J | 0 | 0 | 0 | 0 |
| Lead | 8.6 | 8.2 | 270 | 750 | 9/9 | 2.1 - 19.6 | 1 | 1 | 0 | 0 |
| Mercury | 0.05 | 0.08 | 0.015 | 610 | 5/9 | 0.02 J - 0.04 J | 0 | 0 | 5 | 0 |
| Selenium | 0.43 | 0.69 | 12 | 10000 | 1/9 | 0.61 | 1 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 5 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU313-TW01 04-04-2002 | | SWMU313-TW02 04-04-2002 | | SWMU313-TW03 04-04-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 22 | | 38.2 | | 53.7 | |
| Chromium | 5.8 | 50 | 2.9 | J | 13.2 | | 0.82 | J |
| Lead | 3.6 | 15 | ND | | 4.8 | | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

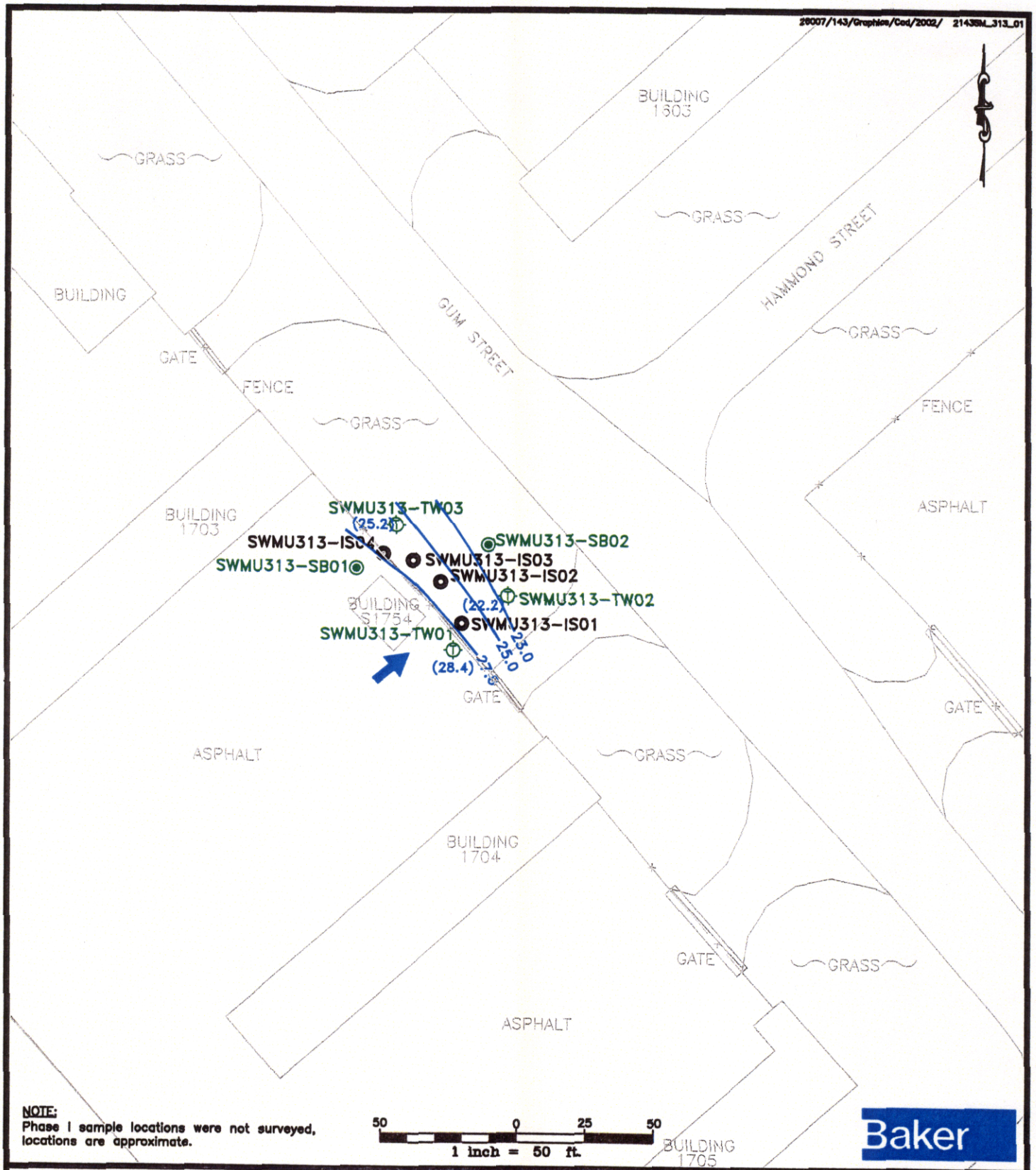
8/30/02
SWMU313_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 313
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 22 - 53.7 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 0.82 J - 13.2 | 1 | 0 |
| Lead | 3.6 | 15 | 1/3 | 4.8 | 1 | 0 |

J - Analyte detected. Report value is estimated.

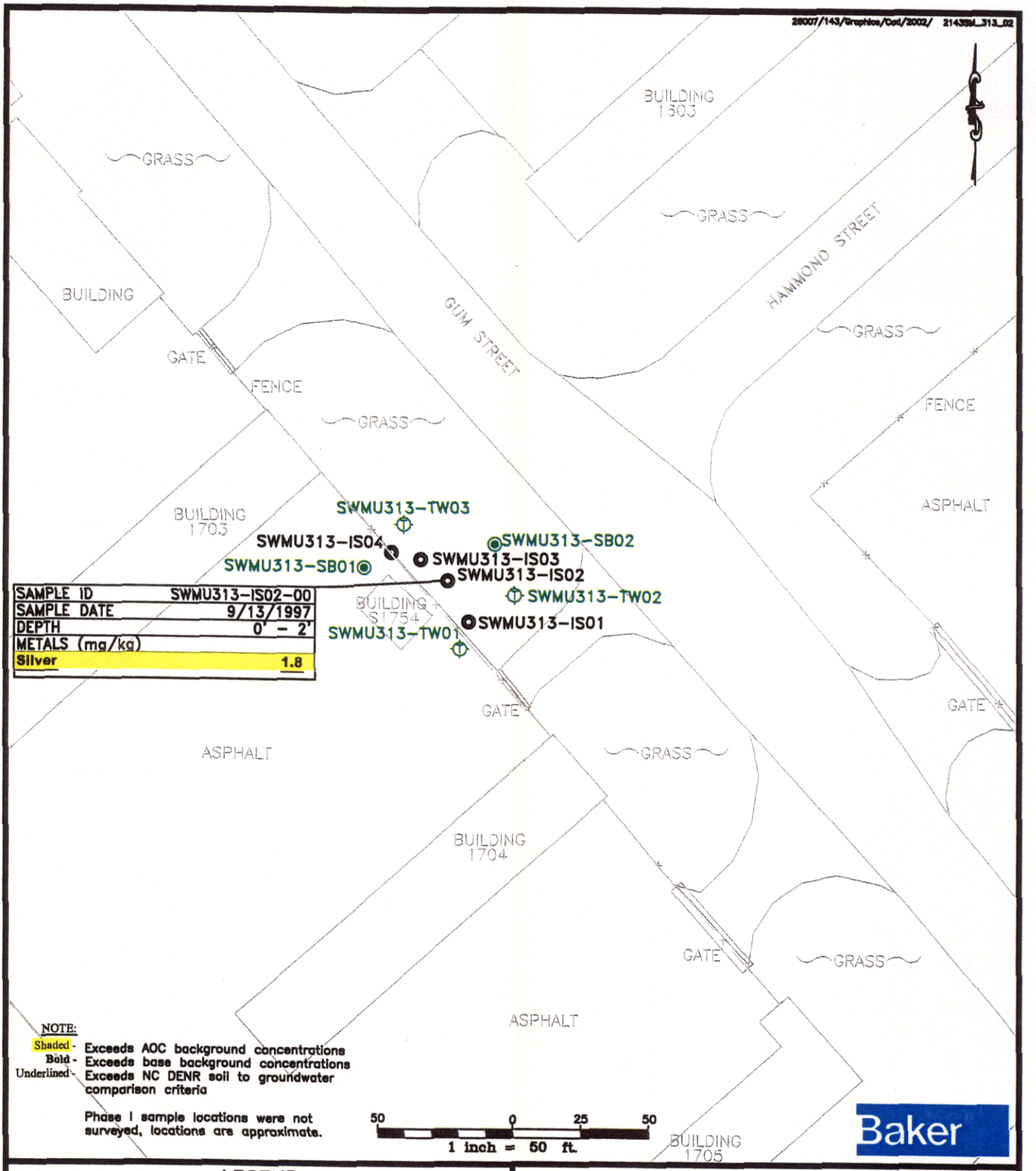



## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- —23.0— GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 313
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 313
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.30 SWMU 314 - SM187 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.30.1 SWMU Description and History

SWMU 314 consists of a newly constructed concrete oil/water separator and vehicle wash rack located south/southwest of Montford Landing Road and west/southwest (approximately 300 feet) of Northeast Creek at Camp Johnson. Water from the vehicle wash rack is transported to the oil/water separator via underground pipelines. No evidence of stains, spills, or releases was noted during the site visit conducted by Baker in October 1996. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 314 was recommended in the form of a Phase II CSI.

### 4.30.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 23 and April 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). At the completion of the Phase II CSI, additional samples were collected during a supplemental Phase II investigation conducted in June 2003.

The purpose of these investigations were to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Soil samples from five surface soil sample locations
- Groundwater sampling at three temporary wells
- Installation and sampling of one groundwater monitoring well

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 3.5 to 4.0 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 2.4 to

3.2 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south/southeast.

### 4.30.3 Investigation Findings

The soil and groundwater samples from the Phase II CSI were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. Samples collected during the supplemental Phase II CSI were submitted to Chemtech Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II and the additional Phase II CSI. The analytical and statistical summaries for positive detections from the CSIs were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX Residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Eighteen SVOCs (mostly PAHs) were detected in the soil sample set. All of the constituents that were detected at concentrations exceeding comparison criteria were detected in the surface soil samples. Surface soil sample SWMU 314-TW01-00 contained the majority of the detected SVOCs Benzo(a)pyrene, benzo(b)flouranthene, and dibenz(a,h)anthracene exceeded the USEPA Region IX residential PRG in this sample. In addition, benzo(a)pyrene exceeded the USEPA Region IX residential PRG in surface soil sample SWMU314-IS04-00. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Six metals were detected in the soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, and mercury. All of the detected inorganics exceeded the AOC and/or Base background criteria in one or more of the samples. However, only cadmium and mercury exceeded the NC DENR soil to groundwater screening criteria. Mercury concentrations in soil samples SWMU314-IS01-00 and SWMU314-IS04-00 exceeded the AOC background criteria and/or NC DENR soil to groundwater screening criteria; however, the concentrations were below the Base background and USEPA Region IX residential PRGs. The detections of mercury at concentrations below the Base background concentrations indicate that mercury is within background levels and therefore, its existence within the environment is not considered to be the result of SWMU-related activities. Cadmium was detected in soil sample SWMU314-SS01 at a concentration exceeding the Base background concentration and the NC DENR soil to groundwater screening criteria, but did not exceed the AOC-specific background concentration. Therefore, it is assumed that although the cadmium concentrations in this sample are elevated enough to cause some concern, the fact that they are below the AOC-specific background concentration indicates that the detection of this constituent is not related to SWMU activities.

Arsenic exceeded the AOC and Base background criteria, and USEPA Region IX residential PRGs in surface soil samples SWMU314-IS03-00, SWMU314-SS02, and SWMU314-SS03. Arsenic exceeded the AOC background and the USEPA Region IX residential PRGs in subsurface soil samples SWMU314-IS03-02 and SWMU314-IS04-02. However, the detected concentrations of arsenic did not exceeded the Base background concentrations or the NC DENR soil to groundwater concentrations, and therefore these subsurface soils are not considered to be a threat to the environment.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX Tap Water PRGs (secondary criteria)

The constituent concentrations detected in the samples were compared to the USEPA Region IX PRGs for tap water only if no comparison concentration existed for the constituent under the NC DENR 2L standards.

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

One SVOC [bis(2-ethylhexyl)phthalate] was detected in the groundwater sample from well SWMU314-TW02. The concentration was below the NC DENR 2L standard. No SVOCs were detected in samples from the remaining two wells.

Five metals were detected in groundwater samples from one or more of the wells, as follows: arsenic, barium, chromium, lead and selenium. Barium and chromium exceeded the Base background screening criteria in the sample from well SWMU314-TW03. However, the concentrations were below the 2L standards. Lead was also detected in this sample at a concentration exceeding the background criteria and the NC DENR 2L standard. Arsenic was detected in all four samples collected from the temporary wells, but the detected concentrations did not exceed the NC DENR 2L standard or the Base Background level. Therefore, even though the detected concentrations exceeded the USEPA Region IX PRG for tap water, it is not considered a constituent of concern because the tap water concentrations are secondary criteria and a NC DENR 2L standard exists for this constituent.

It should be noted that the turbidity was elevated in the groundwater sample from well SWMU314-TW03 and may have caused artificially high metals concentrations in the sample. The elevated turbidity may be attributable to the high percentage of silt that was encountered during drilling and installation of the temporary well.

During the supplemental investigation in 2003, a groundwater monitoring well (SWMU314-MW04) was installed next to the former location of SWMU314-TW03. This well was installed and sampled to confirm the high lead results obtained from 2002. Lead was not detected in the groundwater at SWMU314-MW04.

All of the compounds detected in groundwater were detected in soils at SWMU 314.

### 4.30.4 Conclusions

A few SVOCs and metals were detected in soil at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX Residential PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene
- Metals - arsenic

Lead was the only constituent that exceeded both the Base background screening criteria and NC DENR 2L standards in groundwater sample from well SWMU314-TW03. Lead was not detected in a sample collected from permanent monitoring well SWMU314-MW04, located adjacent to and downgradient from SWMU314-TW03. Therefore it may be assumed that the lead result from SWMU314-TW03 is not representative of site conditions, but rather the result of a turbid groundwater sample.

Based on evaluation of the results, additional action at SWMU 314 is warranted. The additional activities are presented in Section 5.0.

TA 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU336-TW01 | 3/20/2002 | BAKER | 24.04 | 24.1 | 16 | 16 | 3 | 1 | 5 | 11.7 | 12.34 |
| SWMU336-TW02 | 3/20/2002 | BAKER | 24.30 | 24.4 | 15 | 15 | 3 | 1 | 5 | 11.6 | 12.70 |
| SWMU336-TW03 | 6/23/2003 | BAKER | 26.59 | N/A | 12 | 18 | 6 | 5 | 8 | 12.56 | 14.03 |
| SWMU336-TW04 | 6/23/2003 | BAKER | 23.42 | N/A | 12 | 16 | 4 | 3 | 6 | 9.42 | 14.00 |
| SWMU336-TW05 | 6/23/2003 | BAKER | 26.42 | N/A | 12 | 17 | 5 | 4 | 7 | 12.56 | 13.86 |
| SWMU336-TW06 | 6/23/2003 | BAKER | 27.09 | N/A | 16 | 17 | 5.5 | 4 | 7 | 13.17 | 13.92 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 3 | Base Background Criteria Surface-F. Sand | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU314-IS01-00 | SWMU314-IS02-00 | SWMU314-IS03-00 | SWMU314-IS04-00 | SWMU314-TW01-00 | SWMU314-TW02-00 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 09-09-1997 | 09-09-1997 | 09-09-1997 | 09-09-1997 | 03-23-2002 | 03-23-2002 |
| Depth Range | | | | | 0' - 2' | 0' - 2' | 0' - 2' | 0' - 2' | 0' - 1' | 0' - 1' |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | ND | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND | 64 J | ND |
| Acetophenone | NE | NE | 500 | NE | NA | NA | NA | NA | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND | 96 J | ND |
| Atrazine | NE | NE | 24 | 2200 | NA | NA | NA | NA | 8 J | ND |
| Benzo(a)anthracene | NE | NE | 343 | 620 | ND | ND | ND | 69 J | 320 J | ND |
| Benzo(a)pyrene | NE | NE | 865 (1) | 62 | ND | ND | ND | 96 J | 510 | ND |
| Benzo(b)fluoranthene | NE | NE | 11000 (2) | 620 | ND | ND | ND | 130 J | 1400 J | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND | 220 J | ND |
| Benzo(k)fluoranthene | NE | NE | 110000 (2) | 6200 | ND | ND | ND | ND | 1600 | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 640 J | 170 J | 130 J | 120 J | ND | ND |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 7000 | 370 | ND | ND | ND | ND |
| Caprolactam | NE | NE | NE | 31000000 | NA | NA | NA | NA | 20 J | ND |
| Chrysene | NE | NE | 38150 | 62000 | ND | ND | ND | 73 J | 460 | ND |
| Dibenz(a,h)anthracene | NE | NE | 172 | 62 | ND | ND | ND | ND | 120 J | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND | 74 J | 150 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | ND | ND | ND | ND | 370 J | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | 110 J | 560 | ND |
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.19 | 0.671 | 5.24 | 0.39 | ND | ND | 2 | ND | ND | ND |
| Barium | 25.28 | 16.8 | 848 | 5400 | ND | ND | ND | ND | ND | ND |
| Cadmium | NE | 0.0549 | 2.72 | 37 | **1.3** | **2.2** | ND | **0.67** | **0.54** J | ND |
| Chromium | 6.19 | 15.2 | 27.2 | 210 | 3.7 | 5.6 | 13.7 | 6 | 8.7 | 2 |
| Lead | 11.89 | 20.9 | 270 | 400 | 10.1 | 12.6 | 7.8 | 24.9 | 51.2 | 8.5 |
| Mercury | 0.04 | 0.100 | 0.0154 | 23 | ND | 0.058 | ND | 0.038 | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 3 Surface Soil
Base comparison - Fine Sand Data Set for Surface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 9500 mg/kg.
(2) Site specific criteria were calculated with interin 2L and TOC of 9500 mg/kg
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established
NA - Not Analyzed
ND - Not Detected

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D. | Background Criteria AOC 3 | Base Background Criteria Surface-F. Sand | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU314-TW03-00 | SWMU314-SS01 | SWMU314-SS02 | SWMU314-SS03 | SWMU314-SS04 | SWMU314-SS05 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | | | | | 03-23-2002 | 06-23-2003 | 06-23-2003 | 06-23-2003 | 06-23-2003 | 06-23-2003 |
| Depth Range | | | | | 0' - 1' | 0' - 1' | 0' - 1' | 0' - 1' | 0' - 1' | 0' - 1' |
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| Acenaphthene | NE | NE | 8160 | 3700000 | ND | 51 J | ND | ND | ND | ND |
| Acenaphthylene | NE | NE | 11400 | NE | ND | ND | ND | ND | ND | ND |
| Acetophenone | NE | NE | 500 | NE | ND | ND | ND | ND | ND | 82 J |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND | ND | ND |
| Atrazine | NE | NE | 24 | 2200 | ND | ND | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 343 | 620 | ND | ND | ND | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 865 (1) | 62 | ND | ND | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 11000 (2) | 620 | ND | ND | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | ND | ND | ND | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 110000 (2) | 6200 | ND | ND | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | ND | 82 J | 67 J | 1700 | 41 J | 51 J |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | ND | ND | ND | ND | 200 J | ND |
| Caprolactam | NE | NE | NE | 31000000 | ND | ND | ND | ND | ND | ND |
| Chrysene | NE | NE | 38150 | 62000 | ND | ND | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 172 | 62 | ND | ND | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | ND | ND | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.19 | 0.671 | 5.24 | 0.39 | ND | ND | 1.5 J | 1.2 J | ND | ND |
| Barium | 25.28 | 16.8 | 848 | 5400 | 41.1 J | 15.3 J | 14.5 J | 11.7 J | 13.3 J | 7.2 J |
| Cadmium | NE | 0.0549 | 2.72 | 37 | **0.49** J | **3.5** | **2.4** | **2.1** | **2.3** | **1.7** |
| Chromium | 6.19 | 15.2 | 27.2 | 210 | 6.6 | ND | ND | ND | ND | ND |
| Lead | 11.89 | 20.9 | 270 | 400 | 38.2 | 24.5 | 23.4 | 17.2 | 29.9 | 7.4 |
| Mercury | 0.04 | 0.100 | 0.0154 | 23 | ND | ND | ND | ND | ND | ND |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 3 Surface Soil
Base comparison - Fine Sand Data Set for Surface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 9500 mg/kg.
(2) Site specific criteria were calculated with interin 2L and TOC of 9500 mg/kg
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established
NA - Not Analyzed
ND - Not Detected

**TABLE 3**

**STATISTICAL SUMMARY**
**SURFACE SOIL - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 3 | Base Background Criteria Surface-F. Sand | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detections | Number of Exceedances: Background Criteria AOC 3 | Number of Exceedances: Base Background Criteria Surface-F. Sand | Number of Exceedances: North Carolina Soil to Groundwater Stds | Number of Exceedances: USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| Acenaphthene | NE | NE | 8160 | 3700000 | 1/12 | 51 J - 51 J | NA | NA | 0 | 0 |
| Acenaphthylene | NE | NE | 11400 | NE | 1/12 | 64 J - 64 J | NA | NA | 0 | NA |
| Acetophenone | NE | NE | 500 | NE | 1/8 | 82 J - 82 J | NA | NA | 0 | NA |
| Anthracene | NE | NE | 995000 | 22000000 | 1/12 | 96 J - 96 J | NA | NA | 0 | 0 |
| Atrazine | NE | NE | 24 | 2200 | 1/8 | 8 J - 8 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 343 | 620 | 2/12 | 69 J - 320 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 865 (1) | 62 | 2/12 | 96 J - 510 | NA | NA | 0 | 2 |
| Benzo(b)fluoranthene | NE | NE | 11000 (2) | 620 | 2/12 | 130 J - 1400 J | NA | NA | 0 | 1 |
| Benzo(g,h,i)perylene | NE | NE | 6720000 | NE | 1/12 | 220 J - 220 J | NA | NA | 0 | NA |
| Benzo(k)fluoranthene | NE | NE | 110000 (2) | 6200 | 1/12 | 1600 - 1600 | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 9/12 | 41 J - 1700 | NA | NA | 0 | 0 |
| Butylbenzylphthalate | NE | NE | 27800 | 12000000 | 3/12 | 200 J - 7000 | NA | NA | 0 | 0 |
| Caprolactam | NE | NE | NE | 31000000 | 1/8 | 20 J - 20 J | NA | NA | NA | 0 |
| Chrysene | NE | NE | 38150 | 62000 | 2/12 | 73 J - 460 | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 172 | 62 | 1/12 | 120 J - 120 J | NA | NA | 0 | 1 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 2/12 | 74 J - 150 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3320 | 620 | 1/12 | 370 J - 370 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 2300000 | 2/12 | 110 J - 560 | NA | NA | 0 | 0 |
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.19 | 0.671 | 5.24 | 0.39 | 3/12 | 1.2 J - 2 | 3 | 3 | 0 | 3 |
| Barium | 25.28 | 16.8 | 848 | 5400 | 6/12 | 7.2 J - 41.1 J | 1 | 1 | 0 | 0 |
| Cadmium | NE | 0.0549 | 2.72 | 37 | 10/12 | 0.49 J - 3.5 | NA | 10 | 1 | 0 |
| Chromium | 6.19 | 15.2 | 27.2 | 210 | 7/12 | 2 - 13.7 | 3 | 0 | 0 | 0 |
| Lead | 11.89 | 20.9 | 270 | 400 | 12/12 | 7.4 - 51.2 | 8 | 6 | 0 | 0 |
| Mercury | 0.04 | 0.100 | 0.0154 | 23 | 2/12 | 0.038 - 0.058 | 1 | 0 | 1 | 0 |

Notes:
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 9500 mg/kg.
(2) Site specific criteria were calculated with interin 2L and TOC of 9500 mg/kg
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established
NA - Not Applicable

TABLE 4

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 3 | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU314-IS01-02<br>09-09-1997<br>4' - 6' | SWMU314-IS02-02<br>09-09-1997<br>4' - 6' | SWMU314-IS03-02<br>09-09-1997<br>4' - 6' | SWMU314-IS04-02<br>09-09-1997<br>4' - 6' | SWMU314-TW01-02<br>03-23-2002<br>3' - 5' |
|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 1600 J | 220 J | 74 J | 350 J | ND |
| **Metals (mg/kg)** | | | | | | | | | |
| Arsenic | 3.47 | 1.62 | 5.24 | 0.39 | ND | ND | 1.3 | **1.9** | ND |
| Barium | 37.74 | 22.0 | 848 | 5400 | ND | ND | ND | ND | 16.6 J |
| Cadmium | NE | NE | 2.72 | 37 | 0.74 | ND | ND | 1.2 | ND |
| Chromium | 19.51 | 16.3 | 27.2 | 210 | 5.4 | 6.8 | 11.1 | 9.5 | 3 |
| Lead | 20.70 | 8.16 | 270 | 400 | **19.2** | 80.6 | 6.4 | 38.9 | 3.9 |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 3 Subsurface Soil
Base comparison - Sand Data Set for Subsurface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 9500 mg/kg.
(2) Site specific criteria were calculated with interin 2L and TOC of 9500 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established

**TABLE 4**

**DETECTION SUMMARY**
**SUBSURFACE SOILS - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | Background Criteria AOC 3 | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU314-TW02-02<br>03-23-2002<br>3' - 5' | | SWMU314-TW03-02<br>03-23-2002<br>3' - 5' | |
|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | ND | | ND | |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 3.47 | 1.62 | 5.24 | 0.39 | ND | | ND | |
| Barium | 37.74 | 22.0 | 848 | 5400 | 12.1 | J | 13.2 | J |
| Cadmium | NE | NE | 2.72 | 37 | ND | | ND | |
| Chromium | 19.51 | 16.3 | 27.2 | 210 | 3.4 | | 7 | |
| Lead | 20.70 | 8.16 | 270 | 400 | **13.2** | | 6.8 | |

Notes:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
AOC comparison - AOC 3 Subsurface Soil
Base comparison - Sand Data Set for Subsurface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria
Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 9500 mg/kg.
(2) Site specific criteria were calculated with interin 2L and TOC of 9500 mg/kg
J - Analyte detected. Report value is estimated.
ND - Not Detected
NE - Not established

**TABLE 5**

**STATISTICAL SUMMARY**
**SUBSURFACE SOIL - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Background Criteria AOC 3 | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detections | Number of Exceedances: Background Criteria AOC 3 | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semivolatiles (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | NE | 6670 | 35000 | 4/7 | 74 J - 1600 J | NA | NA | 0 | 0 |
| **Metals (mg/kg)** | | | | | | | | | | |
| Arsenic | 3.47 | 1.62 | 5.24 | 0.39 | 2/7 | 1.3 - 1.9 | 0 | 1 | 0 | 2 |
| Barium | 37.74 | 22.0 | 848 | 5400 | 3/7 | 12.1 J - 16.6 J | 0 | 0 | 0 | 0 |
| Cadmium | NE | NE | 2.72 | 37 | 2/7 | 0.74 - 1.2 | NA | NA | 0 | 0 |
| Chromium | 19.51 | 16.3 | 27.2 | 210 | 7/7 | 3 - 11.1 | 0 | 0 | 0 | 0 |
| Lead | 20.70 | 8.16 | 270 | 400 | 7/7 | 3.9 - 80.6 | 2 | 4 | 0 | 0 |

Notes:

J - Analyte detected. Report value is estimated.

U - Not Detected

NE - Not established

NA - Not applicable

AOC comparison - AOC 3 Subsurface Soil

Background comparison - Sand Data Set for Subsurface Soil

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | Base Background Criteria<br>Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water | SWMU314-GW01<br>04-06-2002 | SWMU314-GW02<br>04-06-2002 | SWMU314-GW03<br>04-06-2002 | SWMU314-MW04<br>07-21-2003 |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | ND | 1 J | ND | NA |
| **METALS (ug/L)** | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 2.4 J | 3.7 J | 7.6 J | 4.2 J |
| Barium | 37.31 | 2000 | 2600 | 18.6 | 49.7 | 203 | 31.2 J |
| Chromium | 5.76 | 50 | NE | ND | 4.1 J | 44 | 0.95 J |
| Lead | 3.61 | 15 | NE | ND | 2.1 J | 31.5 | ND |
| Selenium | NE | 50 | 180 | ND | ND | ND | 4.8 J |

Notes:
Shaded - Exceeds base background concentrations
Bold - Exceeds NC 2L groundwater protection standards
Underline - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not established
NA - Not Applicable

**TABLE 7**

**STATISTICAL SUMMARY**
**GROUNDWATER- SWMU 314**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

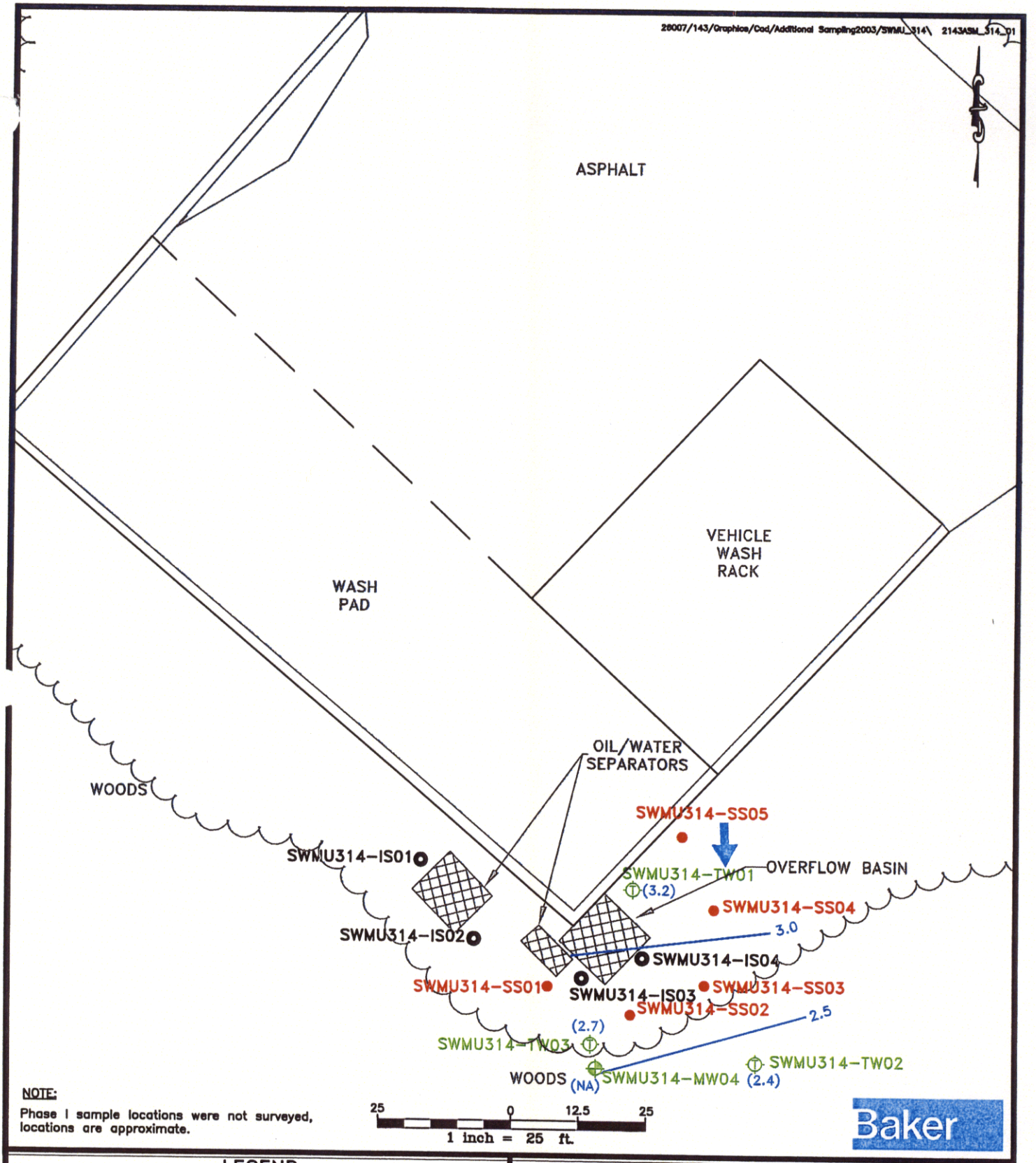
| | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water | Frequency of Detection | Range of Positive Detections | Base Background Criteria Groundwater-Shallow | **North Carolina 2L Groundwater Protection Stds** | USEPA Region IX PRGs Tap Water |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | 1/3 | 1 J - 1 J | NA | 0 | 0 |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12.1 | 10 | 0.045 | 4/4 | 2.4 J - 7.6 J | 0 | 0 | 4 |
| Barium | 37.31 | 2000 | 2600 | 4/4 | 18.6 - 203 | 2 | 0 | 0 |
| Chromium | 5.76 | 50 | NE | 3/4 | 0.95 J - 44 | 1 | 0 | NA |
| Lead | 3.61 | 15 | NE | 2/4 | 2.1 J - 31.5 | 1 | 1 | NA |
| Selenium | NE | 50 | 180 | 1/4 | 4.8 J - 4.8 J | NA | 0 | 0 |

Notes:

J - Analyte detected. Report value is estimated.

NE - Not established

NA - Not applicable




## LEGEND

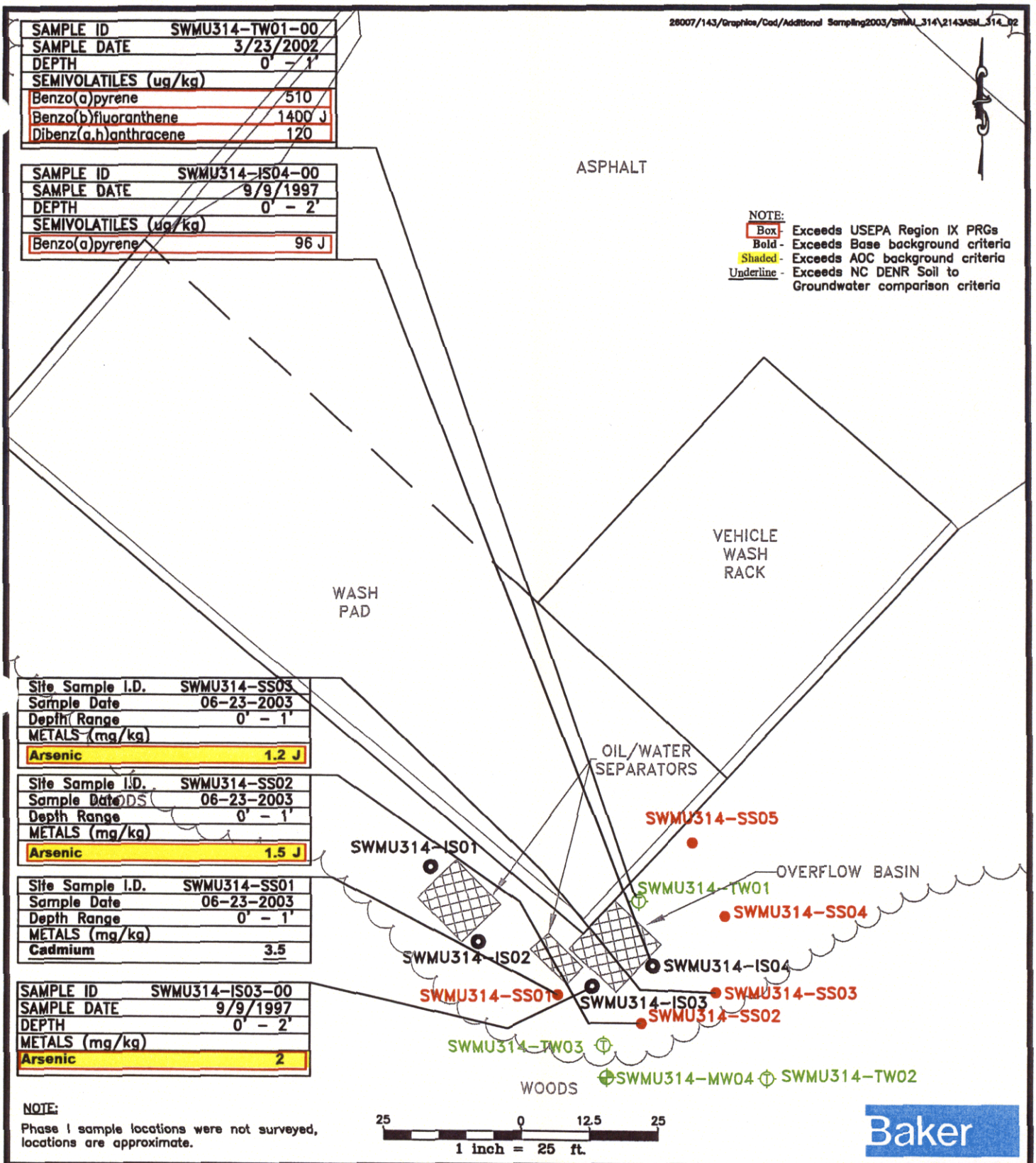
- PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SURFACE SOILS
- ADDITIONAL PHASE II MONITORING WELL
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 1
# PHASE II CONFIRMATORY SAMPLING INVESTIGATION
# SWMU 314
# CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03523EB32Y

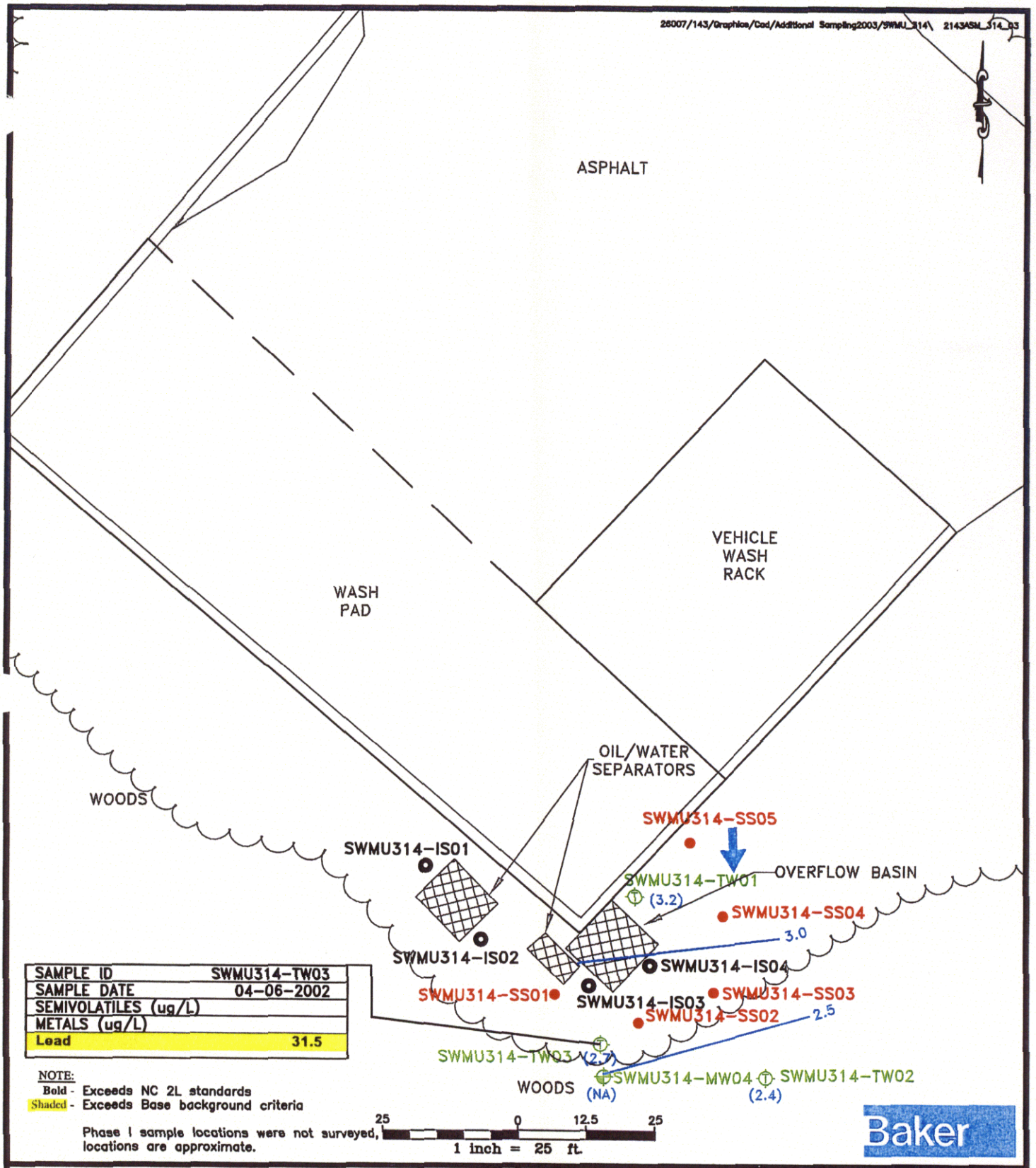



## LEGEND

- PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SURFACE SOILS
- ADDITIONAL PHASE II MONITORING WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 314
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU314-TW03 |
|---|---|
| SAMPLE DATE | 04-06-2002 |
| SEMIVOLATILES (ug/L) | |
| METALS (ug/L) | |
| **Lead** | **31.5** |

NOTE:
**Bold** - Exceeds NC 2L standards
Shaded - Exceeds Base background criteria

Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- PHASE II TEMPORARY WELL
- PHASE I SOIL BORING
- ADDITIONAL PHASE II SURFACE SOILS
- ADDITIONAL PHASE II MONITORING WELL
- GROUNDWATER FLOW DIRECTION
- 2.5 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
## SWMU 314
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.31 SWMU 315 - SM269 Oil/Water Separator near Building M200

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.31.1 SWMU Description and History

SWMU 315 consists of an oil/water separator that is associated with a vehicle wash rack. The SWMU is located in Montford Point between Coolidge and Taft Roads just west of Northeast Creek. The oil/water separator and vehicle wash rack are situated in a gravel area between Buildings M-200, M-201, and M-230. The separator is a concrete, in-ground unit that is still active. During the October 1996 site visit conducted by Baker, petroleum stains were observed on the interior walls and along the outside edge of the separator. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator and wash rack has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the oil/water separator and wash rack (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, one SVOC (pentachlorophenol) and a few metals (arsenic, mercury, and silver) exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 315 was recommended in the form of a Phase II CSI.

### 4.31.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 23 and April 6, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at one soil boring and three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 15.3 to 16.1 feet below the ground surface. The groundwater elevation in the three wells was 4.3 feet above mean MSL. It should be noted that the direction of groundwater flow in the vicinity of the SWMU could not be determined because the groundwater elevations at the three wells were the same.

### 4.31.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are shown on Tables 2 through 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Eleven SVOCs (mostly PAHs) were detected in the surface soil sample set. Bis(2ethylhexyl)phthalate was the only SVOC detected in the subsurface soil samples. Most of the SVOCs were detected in surface soil sample SWMU315-03-00. Pentachlorophenol exceeded the NC DENR soil to groundwater screening criteria in this sample. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Seven RCRA metals were detected in the surface soil sample set, as follows: arsenic, barium, chromium, lead, mercury, selenium, and silver. These seven metals exceeded the AOC and/or Base background criteria in the surface soil samples. Arsenic, mercury, and silver exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria or USEPA Region IX residential PRGs in one or more of the surface soil samples.

None of the metals detected the subsurface soil samples exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria or USEPA Region IX residential PRGs.

Groundwater

The analytical results and statistical summary for positive detections are shown on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX PRGs (for compounds that did not have a 2L standard)

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Five SVOCs were detected in the groundwater sample from well SWMU315-TW01, as follows: 2-methylnaphthalene, acetophenone, dibenzofuran, fluorene, and phenanthrene. Acetophenone was he only SVOC that exceeded the USEPA Region IX PRG. It should be noted that a North Carolina

2L/interim 2L standard was not established for this compound. No SVOCs were detected above the laboratory reporting limits in samples from the remaining wells.

Two metals (barium and chromium) were detected in the groundwater samples. There were no exceedances of the background criteria or the 2L standards.

Most of the compounds detected in the groundwater (except for acetophenone, dibenzofuran and fluorene) were detected in soils at SWMU 315.

### 4.31.4 Conclusions

One SVOC (pentachlorophenol) and three metals (mercury, arsenic and silver) were detected in soil at concentrations exceeding both the AOC and Base background screening criteria and the NC DENR soil to groundwater screening criteria or USEPA Region IX residential PRGs.

Acetophenone was the only compound that exceeded the applicable screening criteria in groundwater.

The compounds that were detected in the surface soil samples were delineated using Phase II CSI sample locations. The detections of arsenic, silver, and mercury were not much above background concentrations and may be indicative of an area of the Base where these compounds naturally exist at a higher concentration than AOC or Base background. It is assumed, based on the operations conducted at this SWMU, that detections of these metals are not related to activities associated with the oil/water separator. The detection of acetophenone is considered isolated and anomalous.

Based on evaluation of the results, no further action is warranted at SWMU 315 because the detections of acetaphenone and pentachlorophenol are isolated, anomalous detects in groundwater and soil. The concentrations of metals detected in surface soil were slightly above background and appear to be ubiquitous in soil and these COPCs are not indicative of SWMU failure or release.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU315-TW01 | 3/23/02 | BAKER | 19.78 | 19.8 | 30 | 30 | 18 | 16.5 | 20 | 15.5 | 4.3 |
| SWMU315-TW02 | 3/23/02 | BAKER | 20.41 | 20.4 | 30 | 30 | 18 | 16.5 | 20 | 16.12 | 4.3 |
| SWMU315-TW03 | 3/23/02 | BAKER | 19.64 | 19.5 | 28 | 28 | 16 | 14.5 | 18 | 15.3 | 4.3 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU315

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU315-IS01-00 09-10-1997 0' - 2' | SWMU315-IS02-00 09-10-1997 0' - 2' | SWMU315-IS03-00 09-10-1997 0' - 2' | SWMU315-IS04-00 09-10-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 3700 (2) | 1600000 (1) | ND | ND | ND | 150 J |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | 36 J | ND |
| Benzo(a)anthracene | NE | NE | 358 | 620 | ND | ND | 44 J | 21 J |
| Benzo(b)fluoranthene | NE | NE | 3330 (2) | 620 | ND | ND | 42 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 19200 (3) | 35000 | 64 J | 76 J | 83 J | 130 J |
| Chrysene | NE | NE | 39800 | 62000 | 37 J | ND | 51 J | 46 J |
| Fluoranthene | NE | NE | 276000 | 2300000 | 52 J | 43 J | 98 J | 53 J |
| Naphthalene | NE | NE | 585 | 56000 | ND | ND | ND | 61 J |
| Pentachlorophenol | NE | NE | 62 (3) | 3000 | ND | ND | 120 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | 44 J | ND | 59 J | 95 J |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | 59 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 0.39 | 3.6 | 1.8 | 1.3 | ND |
| Barium | 25 | 17 | 848 | 5400 | ND | ND | ND | 35 |
| Chromium | 6.2 | 15 | 27 | 210 | 5.2 | 6.3 | 4.7 | 6.6 |
| Lead | 12 | 21 | 270 | 400 | 14.9 | 11.8 | 5.7 | 13.1 |
| Mercury | 0.04 | 0.1 | 0.015 | 23 | 0.041 | ND | ND | 0.13 |
| Selenium | 0.53 | 0.46 | 12 | 390 | **0.51** | ND | ND | ND |
| Silver | 0.09 | 0.07 | 0.22 | 390 | ND | ND | ND | 1.1 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Residential Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 2876mg/kg.
(3) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2876 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU315-SB01-00 03-23-2002 0' - 1' | SWMU315-TW01-00 03-23-2002 0' - 1' | SWMU315-TW02-00 03-23-2002 0' - 1' | SWMU315-TW03-00 03-23-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 3700 (2) | 1600000 (1) | ND | ND | ND | ND |
| Anthracene | NE | NE | 995000 | 22000000 | ND | ND | ND | ND |
| Benzo(a)anthracene | NE | NE | 358 | 620 | ND | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 3330 (2) | 620 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 19200 (3) | 35000 | 8300 | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 62000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND | ND |
| Naphthalene | NE | NE | 585 | 56000 | ND | ND | ND | ND |
| Pentachlorophenol | NE | NE | 62 (3) | 3000 | ND | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 0.39 | ND | 3.2 | 0.64 J | **0.69** J |
| Barium | 25 | 17 | 848 | 5400 | 7.2 J | ND | 9.9 J | **17.2** J |
| Chromium | 6.2 | 15 | 27 | 210 | 1.2 | 1.8 | 22.6 | 5.5 |
| Lead | 12 | 21 | 270 | 400 | 2.8 | 2.7 | 78 | 12.8 |
| Mercury | 0.04 | 0.1 | 0.015 | 23 | ND | ND | ND | 0.04 |
| Selenium | 0.53 | 0.46 | 12 | 390 | ND | ND | ND | ND |
| Silver | 0.09 | 0.07 | 0.22 | 390 | ND | ND | ND | 0.79 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Residential Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 2876mg/kg.
(3) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2876 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 37200 (2) | 1600000 (1) | 1/8 | 150 J | NA | NA | 0 | 0 |
| Anthracene | NE | NE | 995000 | 22000000 | 1/8 | 36 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 358 | 620 | 2/8 | 21 J - 44 J | NA | NA | 0 | 0 |
| Benzo(b)fluoranthene | NE | NE | 3330 (2) | 620 | 1/8 | 42 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 19200 (3) | 35000 | 5/8 | 64 J - 8300 | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 62000 | 3/8 | 37 J - 51 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 4/8 | 43 J - 98 J | NA | NA | 0 | 0 |
| Naphthalene | NE | NE | 585 | 56000 | 1/8 | 61 J | NA | NA | 0 | 0 |
| Pentachlorophenol | NE | NE | 62 (3) | 3000 | 1/8 | 120 J | NA | NA | 1 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 3/8 | 44 J - 95 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 2300000 | 1/8 | 59 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.2 | 0.67 | 5.24 | 0.39 | 6/8 | 0.64 J - 3.6 | 4 | 5 | 0 | 6 |
| Barium | 25 | 17 | 848 | 5400 | 4/8 | 7.2 J - 35 | 1 | 2 | 0 | 0 |
| Chromium | 6.2 | 15 | 27 | 210 | 8/8 | 1.2 - 22.6 | 3 | 1 | 0 | 0 |
| Lead | 12 | 21 | 270 | 400 | 8/8 | 2.7 - 78 | 4 | 1 | 0 | 0 |
| Mercury | 0.04 | 0.1 | 0.015 | 23 | 3/8 | 0.04 - 0.13 | 2 | 1 | 3 | 0 |
| Selenium | 0.53 | 0.46 | 12 | 390 | 1/8 | 0.51 | 0 | 1 | 0 | 0 |
| Silver | 0.09 | 0.07 | 0.22 | 390 | 2/8 | 0.79 - 1.1 | 2 | 2 | 2 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Residential Soil
(2) - Site-specific criteria calculated with interim 2L and TOC of 2876mg/kg.
(3) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 2876 mg/kg.
AOC comparison - AOC 3 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU315-IS01-07 09-10-1997 14' - 16' | SWMU315-IS02-07 09-10-1997 14' - 16' | SWMU315-IS03-08 09-10-1997 16' - 18' | SWMU315-IS04-07 09-10-1997 14' - 16' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 1500 J | 83 J | 94 J | 84 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 0.39 | ND | ND | ND | ND |
| Barium | 38 | 22 | 848 | 5400 | ND | ND | ND | ND |
| Chromium | 20 | 16 | 27 | 210 | 6.2 | 2.3 | 1.4 | 2.2 |
| Lead | 21 | 8.2 | 270 | 400 | 2.4 | 1.3 | 1.4 | 1.7 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU315_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU315-SB01-11 03-23-2002 21' - 23' | SWMU315-TW01-11 03-23-2002 21' - 23' | SWMU315-TW02-11 03-23-2002 21' - 23' | SWMU315-TW03-11 03-23-2002 21' - 23' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | ND | ND | ND | 1200 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 0.39 | ND | ND | ND | **1.8** |
| Barium | 38 | 22 | 848 | 5400 | ND | ND | ND | 12.1 J |
| Chromium | 20 | 16 | 27 | 210 | 2.9 | 5 J | 1.5 | 9.1 |
| Lead | 21 | 8.2 | 270 | 400 | 2.2 | 1.8 | 1.7 | 7.5 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU315_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 5/8 | 83 J - 1500 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 3.5 | 1.6 | 5.24 | 0.39 | 1/8 | 1.8 | 0 | 1 | 0 | 1 |
| Barium | 38 | 22 | 848 | 5400 | 1/8 | 12.1 J | 0 | 0 | 0 | 0 |
| Chromium | 20 | 16 | 27 | 210 | 8/8 | 1.4 - 9.1 | 0 | 0 | 0 | 0 |
| Lead | 21 | 8.2 | 270 | 400 | 8/8 | 1.3 - 7.5 | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Background concentrations were collected for inorganics
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU315-TW01 04-06-2002 | SWMU315-TW02 04-06-2002 | SWMU315-TW03 04-06-2002 |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | |
| 2-Methylnaphthalene | NE | 28 | 15 | ND | ND |
| Acetophenone | NE | 0.042 (2) | **4** J | ND | ND |
| Dibenzofuran | NE | 28 | 1 J | ND | ND |
| Fluorene | NE | 280 | 1 J | ND | ND |
| Phenanthrene | NE | 210 | 1 J | ND | ND |
| **METALS (ug/L)** | | | | | |
| Barium | 145 | 2000 | 82 | 68.8 | 69.3 |
| Chromium | 5.8 | 50 | 0.88 J | 1.9 J | 3.3 J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

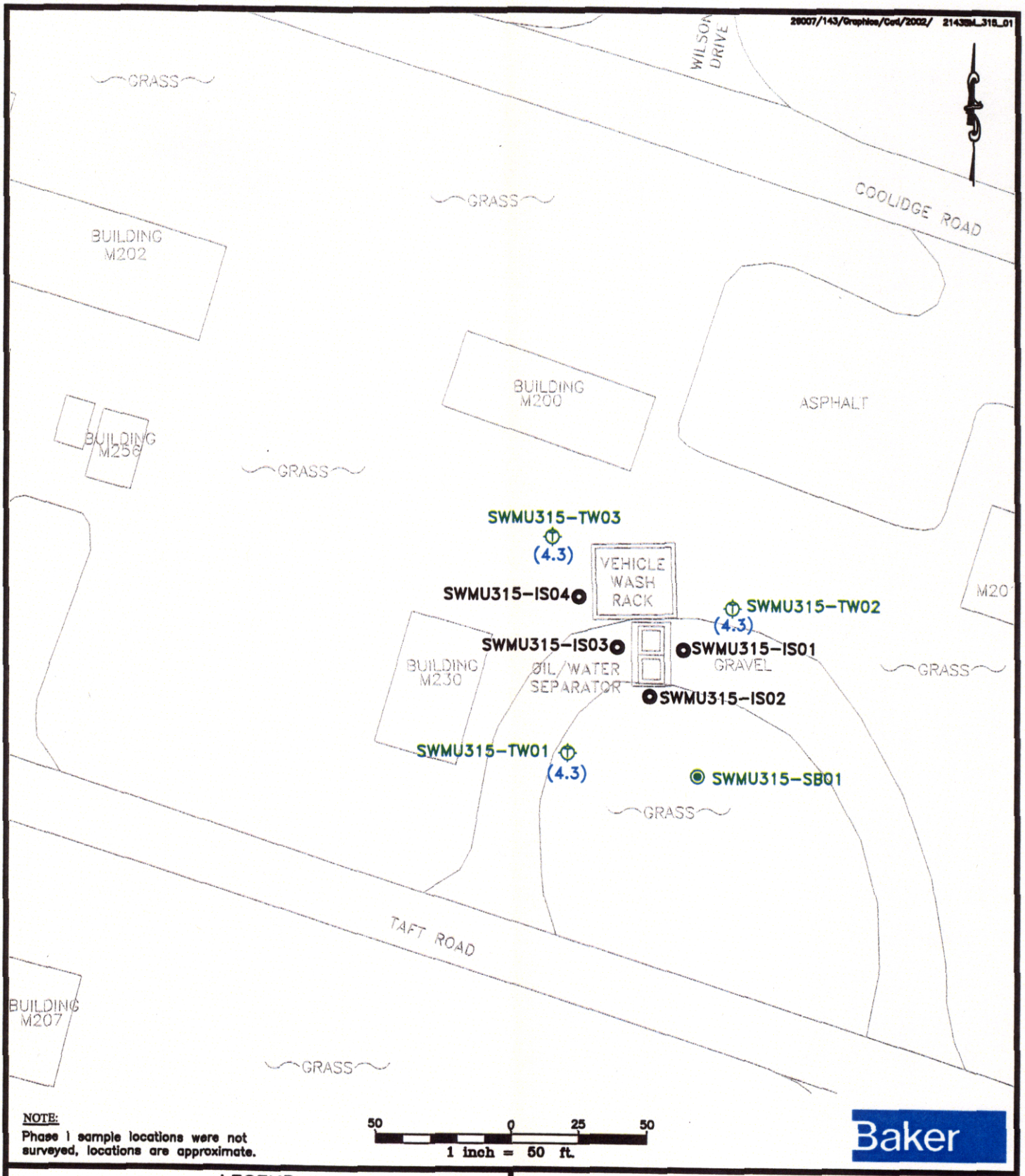
8/23/02
SWMU315_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 315
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 2-Methylnaphthalene | NE | 28 | 1/3 | 15 | NA | 0 |
| Acetophenone | NE | 0.042 (2) | 1/3 | 4 J | NA | 1 |
| Dibenzofuran | NE | 28 | 1/3 | 1 J | NA | 0 |
| Fluorene | NE | 280 | 1/3 | 1 J | NA | 0 |
| Phenanthrene | NE | 210 | 1/3 | 1 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 68.8 - 82 | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 0.88 J - 3.3 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

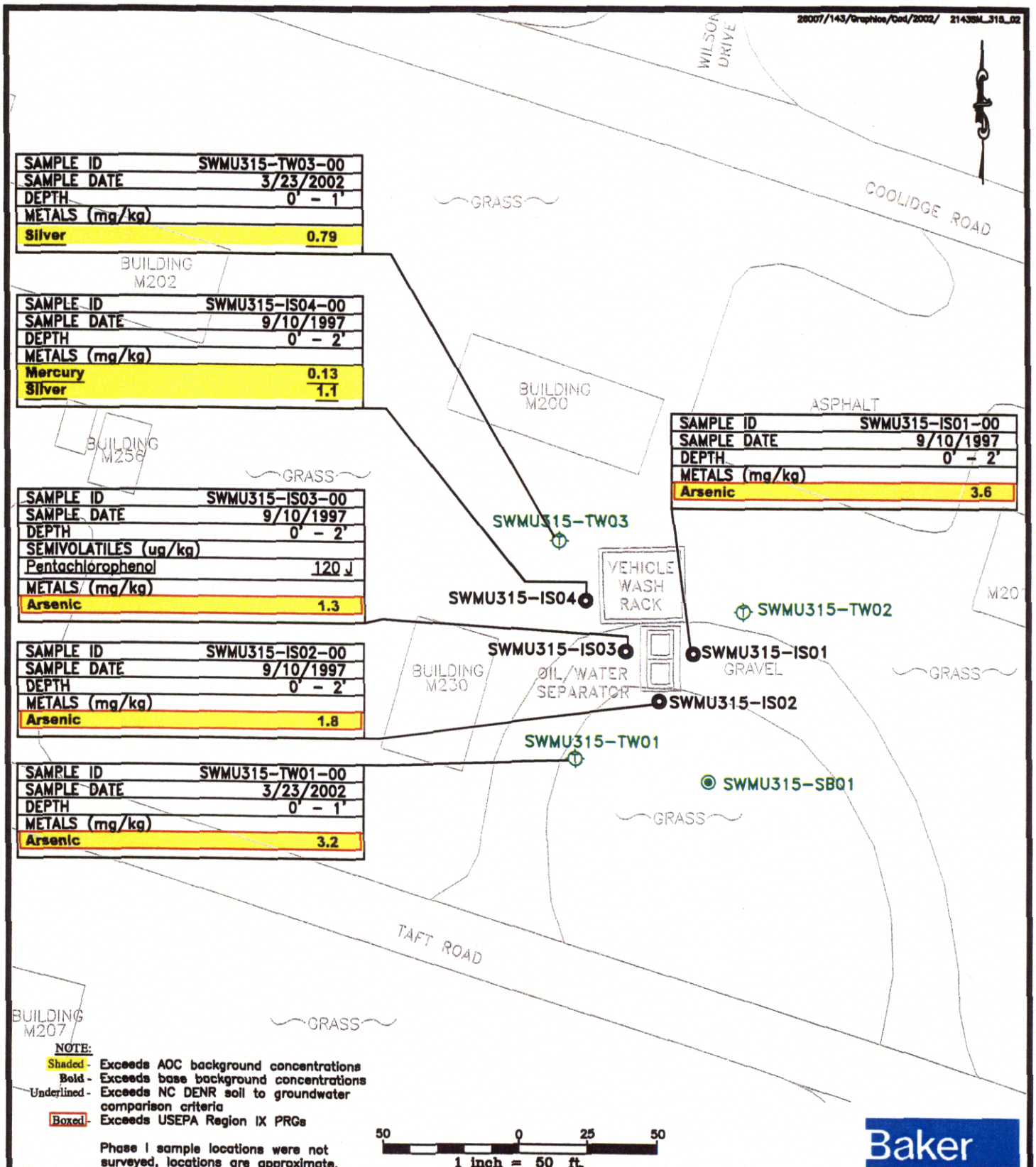
## LEGEND

- TEMPORARY WELL
- SOIL BORING SAMPLE
- PHASE I SOIL BORING
- (4.3) – GROUNDWATER ELEVATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 315
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB33Y




| SAMPLE ID | SWMU315-TW03-00 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Silver** | **0.79** |

| SAMPLE ID | SWMU315-IS04-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Mercury** | **0.13** |
| **Silver** | **1.1** |

| SAMPLE ID | SWMU315-IS01-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Arsenic** | **3.6** |

| SAMPLE ID | SWMU315-IS03-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| SEMIVOLATILES (ug/kg) | |
| Pentachlorophenol | 120 J |
| METALS (mg/kg) | |
| **Arsenic** | **1.3** |

| SAMPLE ID | SWMU315-IS02-00 |
|---|---|
| SAMPLE DATE | 9/10/1997 |
| DEPTH | 0' - 2' |
| METALS (mg/kg) | |
| **Arsenic** | **1.8** |

| SAMPLE ID | SWMU315-TW01-00 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Arsenic** | **3.2** |

NOTE:

Shaded - Exceeds AOC background concentrations

Bold - Exceeds base background concentrations

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

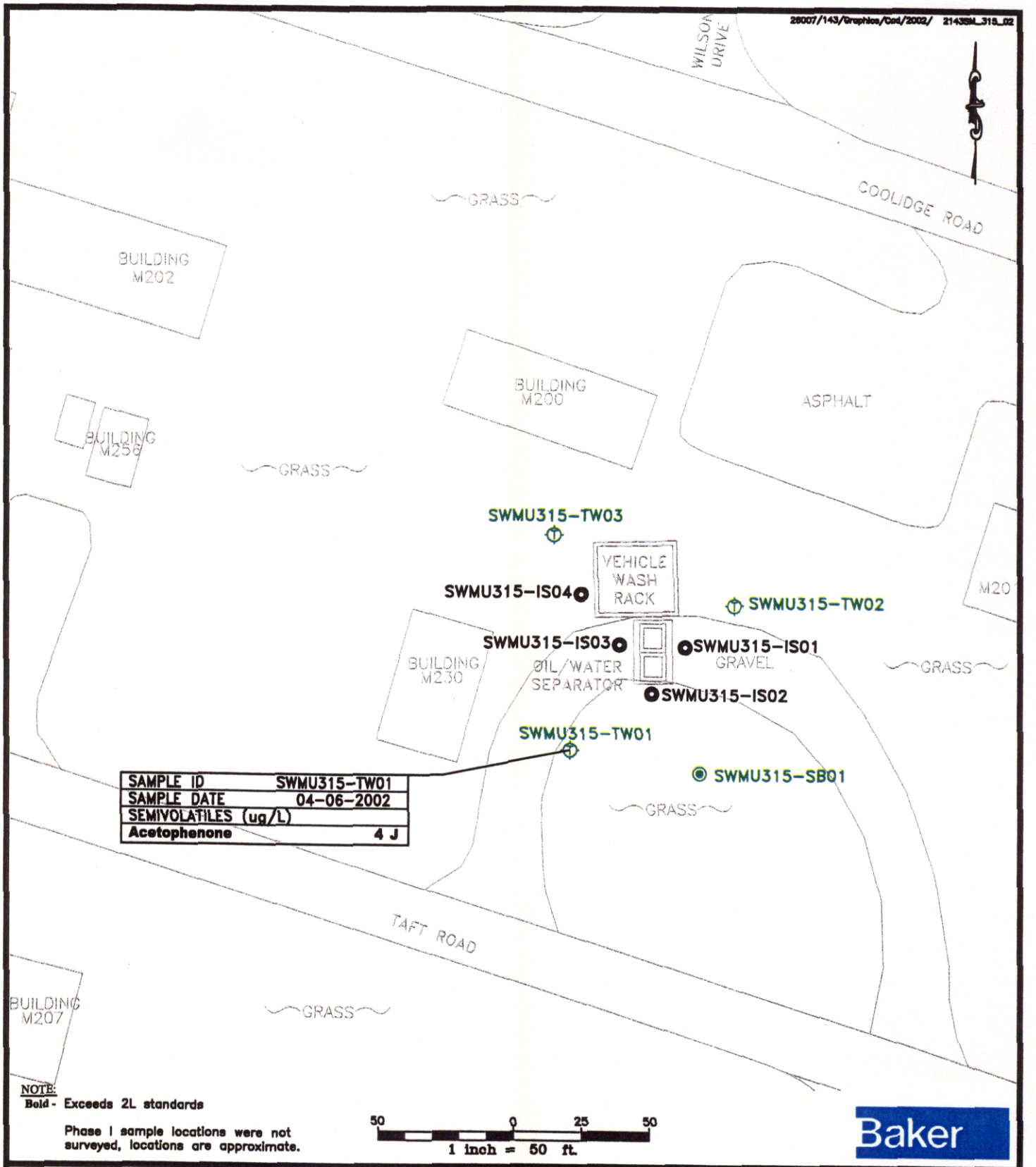
Phase I sample locations were not surveyed, locations are approximate.

## LEGEND

- TEMPORARY WELL
- SOIL BORING SAMPLE
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 315
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- SOIL BORING SAMPLE
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 315
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.32 SWMU 316 - TC773 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.32.1 SWMU Description and History

SWMU 316 consists of a concrete oil/water separator and vehicle wash rack located east of Buildings TC-771 and TC-773. Water from the wash rack is transported to the oil/water separator via underground pipelines. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator and vehicle wash rack has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from four soil borings advanced around the perimeter of the SWMU (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, benzo(a)pyrene and arsenic exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 316 was recommended in the form of a Phase II CSI.

### 4.32.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21 and April 4, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 6.6 to 6.9 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 10.1 to 10.4 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow northwest.

### 4.32.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included as Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 though 5 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Thirteen SVOCs (mostly PAHs) were detected in the sample set. Most of the SVOCs were detected in surface soil samples SWMU316-IS01-00, SWMU316-IS02-00 and SWMU316-TW01-00 and subsurface soil sample SWMU 316-IS03-02. Benzo(a)pyrene was detected in these four samples at concentrations exceeding the NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Seven metals were detected in the surface soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. All of these metals, except selenium, were also detected in the subsurface soil sample set. Cadmium, chromium and selenium exceeded the AOC and/or Base background criteria in one or more of the samples; however, the concentrations were below the NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Mercury exceeded the NC DENR soil to groundwater criteria in the surface and subsurface soil samples from borings SWMU316-TW01 through SWMU316-TW03; however, the concentrations were below background criteria and the USEPA Region IX residential PRG. Arsenic exceeded the USEPA Region IX residential PRG in surface soil sample SWMU316-TW03-00 and both the AOC and Base background criteria and the USEPA Region IX residential PRG in subsurface soil sample SWMU 316-IS03-02. None of the other metals detected in the samples exceeded the applicable screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 5 and 6 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Three SVOCs were detected in groundwater samples from one or more of the wells, as follows: 4-methylphenol, fluorene, and phenanthrene. None of the concentrations exceeded the 2L standards.

Three metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium and lead. None of the concentrations exceeded the Base background screening criteria or the 2L standards.

### 4.32.4 Conclusions

Several SVOCs and metals were detected in soil at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene
- Metals - arsenic

There were not any compounds the exceeded the Base background screening criteria or the 2L standards in groundwater.

Based on evaluation of results, no further action is warranted at SWMU 316 because COPCs detected in surface soils may be attributable to the asphalt or tack oil and are not indicative of SWMU failure ore release. Arsenic detections are essentially background.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU316-TW01 | 3/21/02 | BAKER | 17.04 | 17.4 | 16 | 16 | 4 | 2 | 6 | 6.85 | 10.2 |
| SWMU316-TW02 | 3/21/02 | BAKER | 16.90 | 17.4 | 16 | 16 | 4 | 2 | 6 | 6.8 | 10.1 |
| SWMU316-TW03 | 3/21/02 | BAKER | 17.00 | 17.1 | 16 | 16 | 4 | 2 | 5.9 | 6.6 | 10.4 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU316

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU316-IS01-00 09-09-1997 0' - 2' | SWMU316-IS02-00 09-09-1997 0' - 2' | SWMU316-IS03-00 09-09-1997 0' - 2' | SWMU316-IS04-00 09-09-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | 250 J | 81 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | 280 J | 100 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | 410 | 140 J | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 180 J | 68 J | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | 150 J | 60 J | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | ND | ND | ND | ND |
| Carbazole | NE | NE | NE | 24000 | 43 J | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 62000 | 370 J | 140 J | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 62 | 44 J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 690 | 300 J | ND | 62 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | 160 J | 62 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 230 J | 150 J | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | 480 | 200 J | ND | 54 J |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.4 | 0.67 | 5.24 | 0.39 | ND | ND | ND | ND |
| Barium | 20 | 17 | 848 | 5400 | ND | ND | ND | ND |
| Cadmium | 0.16 | 0.05 | 2.7 | 37 | ND | ND | ND | ND |
| Chromium | 12 | 15 | 27 | 210 | 5.3 | 7.8 | 4.7 | 15.2 |
| Lead | 115 | 21 | 270 | 400 | 4.4 | 2.9 | 5.4 | 4.5 |
| Mercury | 0.05 | 0.1 | 0.015 | 23 | ND | ND | ND | ND |
| Selenium | 0.89 | 0.46 | 12 | 390 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU316-TW01-00 03-21-2002 0' - 1' | SWMU316-TW02-00 03-21-2002 0' - 1' | SWMU316-TW03-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | 46 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | 75 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | 100 J | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 93 J | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | 100 J | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 46 J | 220 J | 60 J |
| Carbazole | NE | NE | NE | 24000 | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 62000 | 85 J | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 62 | 31 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | 150 J | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | 170 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 31 J | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | 100 J | ND | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 1.4 | 0.67 | 5.24 | 0.39 | ND | ND | 0.59 J |
| Barium | 20 | 17 | 848 | 5400 | 3.7 | 5.9 | 11.7 J |
| Cadmium | 0.16 | 0.05 | 2.7 | 37 | ND | ND | **0.072** J |
| Chromium | 12 | 15 | 27 | 210 | 1.1 | 2.6 | 9.3 |
| Lead | 115 | 21 | 270 | 400 | 2.6 | 11.9 | 5.5 |
| Mercury | 0.05 | 0.1 | 0.015 | 23 | 0.025 J | 0.026 J | 0.026 J |
| Selenium | 0.89 | 0.46 | 12 | 390 | ND | ND | **0.58** J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | 3/7 | 46 J - 250 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | 3/7 | 75 J - 280 J | NA | NA | 1 | 3 |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | 3/7 | 100 J - 410 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 3/7 | 68 J - 180 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | 3/7 | 60 J - 150 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 3/7 | 46 J - 220 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 24000 | 1/7 | 43 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 62000 | 3/7 | 85 J - 370 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 62 | 2/7 | 31 J - 44 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 4/7 | 62 J - 690 | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | 3/7 | 62 J - 170 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 3/7 | 31 J - 230 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 2300000 | 4/7 | 54 J - 480 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.4 | 0.67 | 5.24 | 0.39 | 1/7 | 0.59 J | 0 | 0 | 0 | 1 |
| Barium | 20 | 17 | 848 | 5400 | 3/7 | 3.7 - 11.7 J | 0 | 0 | 0 | 0 |
| Cadmium | 0.16 | 0.05 | 2.7 | 37 | 1/7 | 0.072 J | 0 | 1 | 0 | 0 |
| Chromium | 12 | 15 | 27 | 210 | 7/7 | 1.1 - 15.2 | 1 | 1 | 0 | 0 |
| Lead | 115 | 21 | 270 | 400 | 7/7 | 2.6 - 11.9 | 0 | 0 | 0 | 0 |
| Mercury | 0.05 | 0.1 | 0.015 | 23 | 3/7 | 0.025 J - 0.026 J | 0 | 0 | 3 | 0 |
| Selenium | 0.89 | 0.46 | 12 | 390 | 1/7 | 0.58 J | 0 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625mg/kg.
AOC comparison - AOC 1 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU316-IS01-04 09-09-1997 8' - 10' | SWMU316-IS02-02 09-09-1997 4' - 6' | SWMU316-IS03-02 09-09-1997 4' - 6' | SWMU316-IS04-03 09-09-1997 6' - 8' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | ND | ND | 94 J | ND |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | ND | ND | 100 J | ND |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | ND | ND | 200 J | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | 71 J | ND |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | ND | ND | 70 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 120 J | 46 J | 390 J | ND |
| Chrysene | NE | NE | 39800 | 62000 | ND | ND | 150 J | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | 220 J | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | ND | ND | 77 J | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | 46 J | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | 180 J | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 0.39 | ND | ND | 1.9 | ND |
| Barium | 16 | 22 | 848 | 5400 | ND | ND | ND | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 210 | 12.4 | 5.9 | 8.7 | 3.3 |
| Lead | 15 | 8.2 | 270 | 400 | 4.7 | 4.8 | 5 | 2 |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU316-TW01-04 03-21-2002 7' - 9' | SWMU316-TW02-04 03-21-2002 7' - 9' | SWMU316-TW03-04 03-21-2002 7' - 9' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 72 J | 70 J | 150 J |
| Chrysene | NE | NE | 39800 | 62000 | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2300000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 2300000 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 0.39 | ND | ND | ND |
| Barium | 16 | 22 | 848 | 5400 | 7 | 13.8 | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND | 0.046 J | ND |
| Chromium | 12 | 16 | 27 | 210 | 5.9 | 15.3 | 5.6 |
| Lead | 15 | 8.2 | 270 | 400 | 6.1 | 6.5 | 3.7 |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | 0.034 J | 0.038 J | 0.021 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU316_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 620 | 1/7 | 94 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 148 (1) | 62 | 1/7 | 100 J | NA | NA | 0 | 1 |
| Benzo(b)fluoranthene | NE | NE | 1880 (2) | 620 | 1/7 | 200 J | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/7 | 71 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 18800 (2) | 6200 | 1/7 | 70 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 6/7 | 46 J - 390 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 62000 | 1/7 | 150 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2300000 | 1/7 | 220 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 620 | 1/7 | 77 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/7 | 46 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 2300000 | 1/7 | 180 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 0.39 | 1/7 | 1.9 | 1 | 1 | 0 | 1 |
| Barium | 16 | 22 | 848 | 5400 | 2/7 | 7 - 13.8 | 0 | 0 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | 1/7 | 0.046 J | 1 | 1 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 210 | 7/7 | 3.3 - 15.3 | 2 | 0 | 0 | 0 |
| Lead | 15 | 8.2 | 270 | 400 | 7/7 | 2 - 6.5 | 0 | 0 | 0 | 0 |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | 3/7 | 0.021 J - 0.038 J | 0 | 0 | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 1625 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 1625mg/kg.
AOC comparison - AOC 1 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU316-TW01 04-04-2002 | | SWMU316-TW02 04-04-2002 | | SWMU316-TW03 04-04-2002 | |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 4-Methylphenol | NE | 3.5 | 2 | J | 3 | J | 1 | J |
| Fluorene | NE | 280 | ND | | 0.6 | J | ND | |
| Phenanthrene | NE | 210 | 1 | J | 2 | J | 1 | J |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 37.1 | J | 130 | J | 140 | J |
| Chromium | 5.8 | 50 | 1.1 | J | 0.75 | J | 1.1 | J |
| Lead | 3.6 | 15 | ND | | ND | | 1.9 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

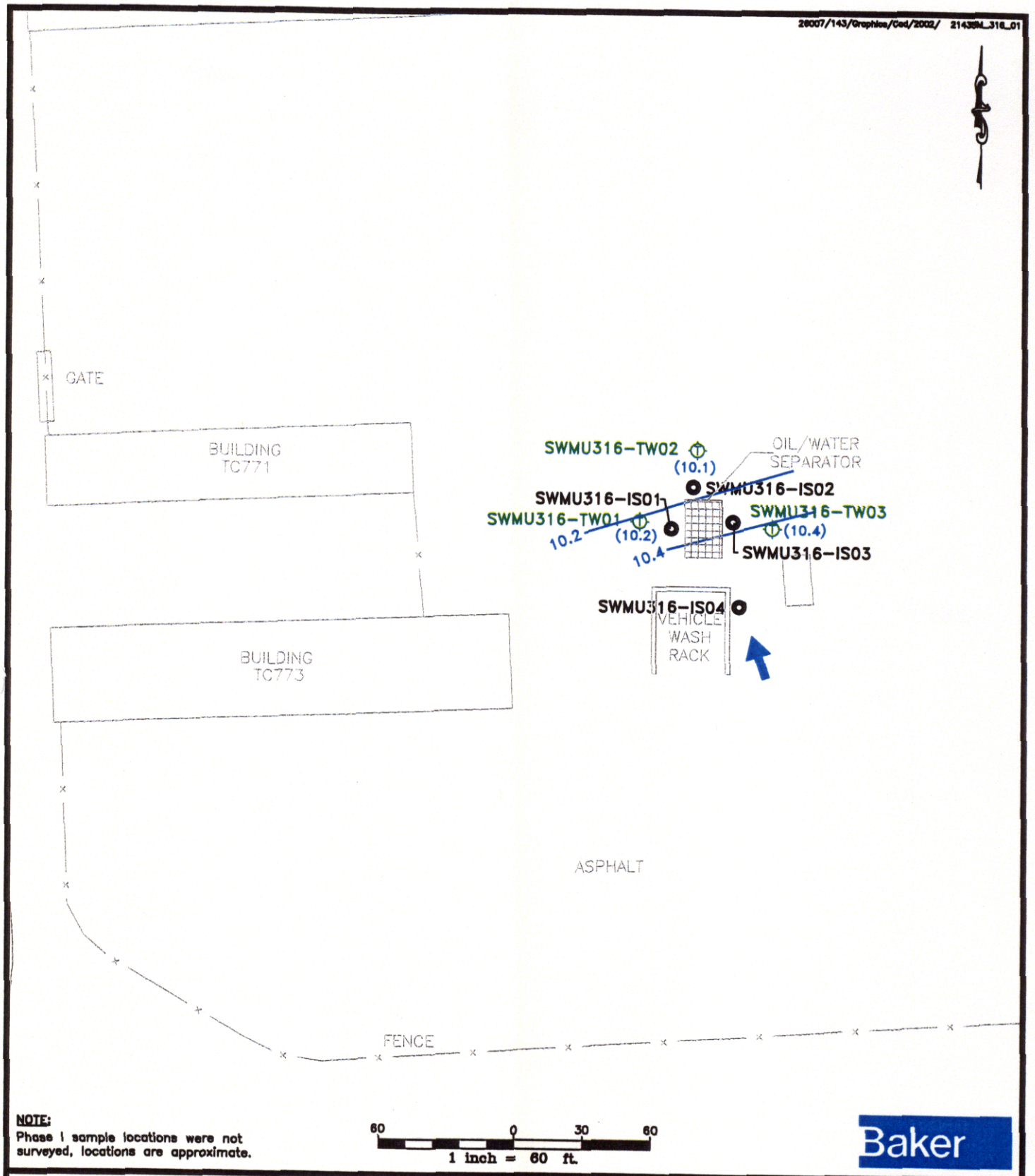
9/4/02
SWMU316_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 316
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 4-Methylphenol | NE | 3.5 | 3/3 | 1 J - 3 J | NA | 0 |
| Fluorene | NE | 280 | 1/3 | 0.6 J | NA | 0 |
| Phenanthrene | NE | 210 | 3/3 | 1 J - 2 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 37.1 J - 140 J | 0 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 0.75 J - 1.1 J | 0 | 0 |
| Lead | 3.6 | 15 | 1/3 | 1.9 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

60 0 30 60
1 inch = 60 ft.

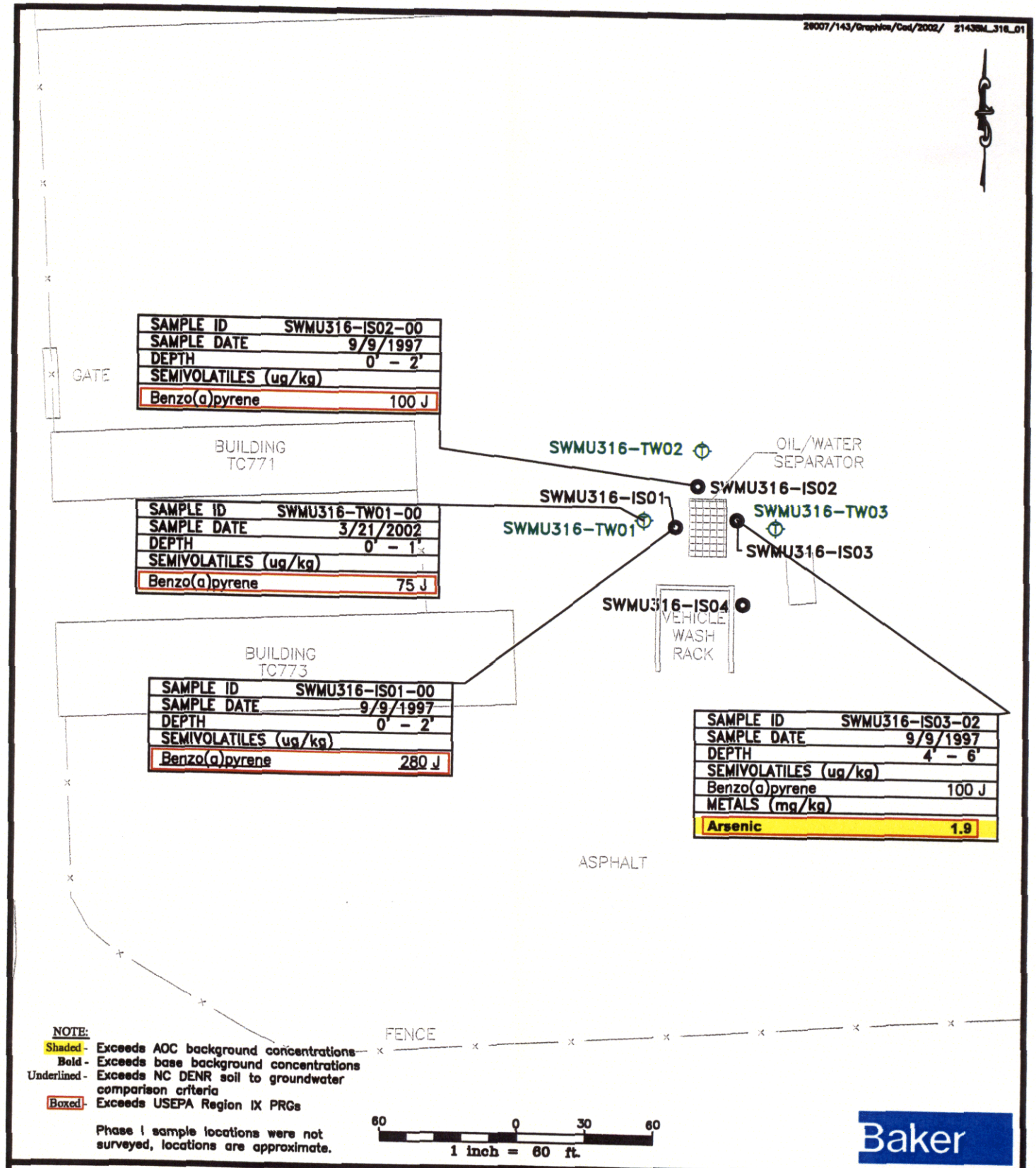
Baker

## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 10.0 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 316
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 316
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.33 SWMU 317 - TT2453 Release

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.33.1 SWMU Description and History

SWMU 317 is an area near a used antifreeze AST adjacent to Building TT-2453 (auto care facility). The RFA Report (EnSafe, 1996) indicated that a release from the AST had occurred. During the site visit conducted by Baker in October 1996, no evidence of staining, spills, or releases were identified. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if the reported release near the AST has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from one soil boring advanced within the reported release area adjacent to the antifreeze AST (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on the evaluation of the results, lead exceeded the regulatory driven criteria and established background/secondary screening criteria. Therefore, additional investigation at SWMU 317 was recommended in the form of a Phase II CSI.

Subsequent to the Phase II CSI, Building TT-2453 and the associated ASTs/USTs were demolished/removed. In addition, several wells and a soil vapor extraction/air sparging (SVE/AS) system were installed in and around the former auto care facility. Investigation/ remediation is ongoing under the UST Program.

### 4.33.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and April 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two temporary well borings and one soil boring
- Groundwater sampling at two temporary wells and one existing well

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 19.9 to 22.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 7 to 8 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow southwest.

### 4.33.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for RCRA metals. A summary of the laboratory analytical results is in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven metals (arsenic, barium, cadmium, chromium, lead, mercury and selenium) were detected in the sample set. Lead exceeded the AOC and Base background criteria and NC DENR soil to groundwater screening criteria in one surface soil sample (SWMU317 IS01-00), but did not exceed the applicable screening criteria in any of the subsurface soil samples. Barium, cadmium and selenium concentrations exceeded the AOC and/or Base background screening criteria; however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX residential PRGs. Mercury exceeded the NC DENR soil to groundwater screening criteria; however, the concentrations were below the background screening criteria and the USEPA Region IX residential PRGs. Arsenic and chromium exceeded the AOC and/or Base background criteria and the NC DENR soil to groundwater criteria or the USEPA Region IX residential PRG; however, these two metals it did not exceed more than two of these criteria in any one given sample.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Five metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, selenium, and silver. Chromium exceeded the Base background criteria in the sample from well SWMU317-TW01; however, the concentration was below the North Carolina 2L standards. None of the other metals detected in the samples exceeded the applicable screening criteria.

### 4.33.4 Conclusions

Lead was the only metal detected in soil that exceeded both the AOC and Base background screening criteria and the NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs. None of the metals detected in groundwater exceeded both the background criteria an 2L standards. This is an isolated detection during the Phase I CSI in 1997. Since then, the soil in the

vicinity of this SWMU has been disturbed during the demolition of Building TT2453, the removal of the USTs/ASTs, and the installation of the remediation system currently operating at the SWMU. Therefore, no further action is recommended at this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU317-TW01 | 4/9/02 | BAKER | 27.882 | 27.721 | 25 | 25 | 13 | 10.5 | 15 | 19.88 | 8.0 |
| SWMU317-TW03 | 4/9/02 | BAKER | 28.04 | 27.5 | 25 | 25 | 13 | 10.5 | 15 | 20.05 | 8.0 |
| SWMU317-MW07 | 3/13/95 | R.E. WRIGHT | 29.65 | 27.75 | 24.7 | 24.67 | 12 | 9 | 15 | 22.64 | 7.01 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU317

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU317-IS01-00 09-09-1997 0' - 2' | SWMU317-SB01-00 03-24-2002 0' - 1' | SWMU317-TW01-00 03-24-2002 0' - 1' | SWMU317-TW03-00 03-24-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 4.5 | 0.88 | 5.24 | 0.39 | **2.3** | ND | **3.8** J | 0.33 J |
| Barium | 32 | 19 | 848 | 5400 | 59.8 | 9.7 J | 18.6 J | 14.3 J |
| Cadmium | 0.07 | 0.05 | 2.7 | 37 | 2.1 | ND | 0.14 J | ND |
| Chromium | 24 | 8.9 | 27 | 210 | **10.2** | 2.7 J | 26.5 J | 6.1 J |
| Lead | 17 | 26 | 270 | 400 | 348 | 3.8 J | 8.1 J | 7.9 J |
| Mercury | 0.11 | 0.12 | 0.015 | 23 | 0.039 | ND | 0.06 J | ND |
| Selenium | 1.6 | 1.3 | 12 | 390 | ND | ND | 1.3 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 4.5 | 0.88 | 5.24 | 0.39 | 3/4 | 0.33 J - 3.8 J | 0 | 2 | 0 | 2 |
| Barium | 32 | 19 | 848 | 5400 | 4/4 | 9.7 J - 59.8 | 1 | 1 | 0 | 0 |
| Cadmium | 0.07 | 0.05 | 2.7 | 37 | 2/4 | 0.14 J - 2.1 | 2 | 2 | 0 | 0 |
| Chromium | 24 | 8.9 | 27 | 210 | 4/4 | 2.7 J - 26.5 J | 1 | 2 | 0 | 0 |
| Lead | 17 | 26 | 270 | 400 | 4/4 | 3.8 J - 348 | 1 | 1 | 1 | 0 |
| Mercury | 0.11 | 0.12 | 0.015 | 23 | 2/4 | 0.039 - 0.06 J | 0 | 0 | 2 | 0 |
| Selenium | 1.6 | 1.3 | 12 | 390 | 1/4 | 1.3 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 4 Surface Soil
Base comparison - Combined Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU317-IS01-04 09-09-1997 8' - 10' | SWMU317-SB01-02 03-24-2002 3' - 5' | SWMU317-TW01-02 03-24-2002 3' - 5' | SWMU317-TW01A-10 04-09-2002 19' - 21' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 6.3 | 11 | 5.24 | 0.39 | 2.6 | 6.6 J | 4.6 J | ND |
| Barium | 113 | 29 | 848 | 5400 | ND | 18 J | 9.7 J | 12.5 J |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND | 0.3 J | ND | ND |
| Chromium | 36 | 27 | 27 | 210 | 13.8 | **34.8** J | 4.2 J | 18.6 J |
| Lead | 12 | 14 | 270 | 400 | 9 | 9.3 J | 5.2 J | 2.9 J |
| Mercury | 0.04 | 0.09 | 0.015 | 23 | ND | 0.03 J | 0.03 J | ND |
| Selenium | 1.5 | 1.7 | 12 | 390 | ND | 1.8 J | 0.91 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU317_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU317-TW03-02 03-24-2002 3' - 5' | SWMU317-TW03A-10 04-09-2002 19' - 21' |
|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | |
| Arsenic | 6.3 | 11 | 5.24 | 0.39 | ND | 0.33 J |
| Barium | 113 | 29 | 848 | 5400 | 6.5 J | **31.5** J |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | ND | ND |
| Chromium | 36 | 27 | 27 | 210 | 1.4 J | 6.8 J |
| Lead | 12 | 14 | 270 | 400 | 2.7 J | 1.2 J |
| Mercury | 0.04 | 0.09 | 0.015 | 23 | ND | ND |
| Selenium | 1.5 | 1.7 | 12 | 390 | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU317_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 6.3 | 11 | 5.24 | 0.39 | 4/6 | 0.33 J - 6.6 J | 1 | 0 | 1 | 3 |
| Barium | 113 | 29 | 848 | 5400 | 5/6 | 6.5 J - 31.5 J | 0 | 1 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 37 | 1/6 | 0.3 J | 1 | 1 | 0 | 0 |
| Chromium | 36 | 27 | 27 | 210 | 6/6 | 1.4 J - 34.8 J | 0 | 1 | 1 | 0 |
| Lead | 12 | 14 | 270 | 400 | 6/6 | 1.2 J - 9.3 J | 0 | 0 | 0 | 0 |
| Mercury | 0.04 | 0.09 | 0.015 | 23 | 2/6 | 0.03 J | 0 | 0 | 2 | 0 |
| Selenium | 1.5 | 1.7 | 12 | 390 | 2/6 | 0.91 J - 1.8 J | 1 | 1 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
AOC comparison - AOC 4 Subsurface Soil
Base comparison - Clay Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU317-TW01 04-09-2002 | | SWMU317-MW07 04-08-2002 | | SWMU317-TW03 04-09-2002 | |
|---|---|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | | | |
| Barium | 145 | 2000 | 38.3 | | 23.3 | | 44.6 | |
| Chromium | 5.8 | 50 | 8.5 | | ND | | 1.5 | J |
| Lead | 3.6 | 15 | 1.2 | J | 1.1 | J | 1.9 | J |
| Selenium | 2.8 | 50 | ND | | ND | | 2.3 | J |
| Silver | 0.74 | 18 | ND | | 0.52 | J | ND | |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - If NC 2L Standard not available, Interim Standard was used.

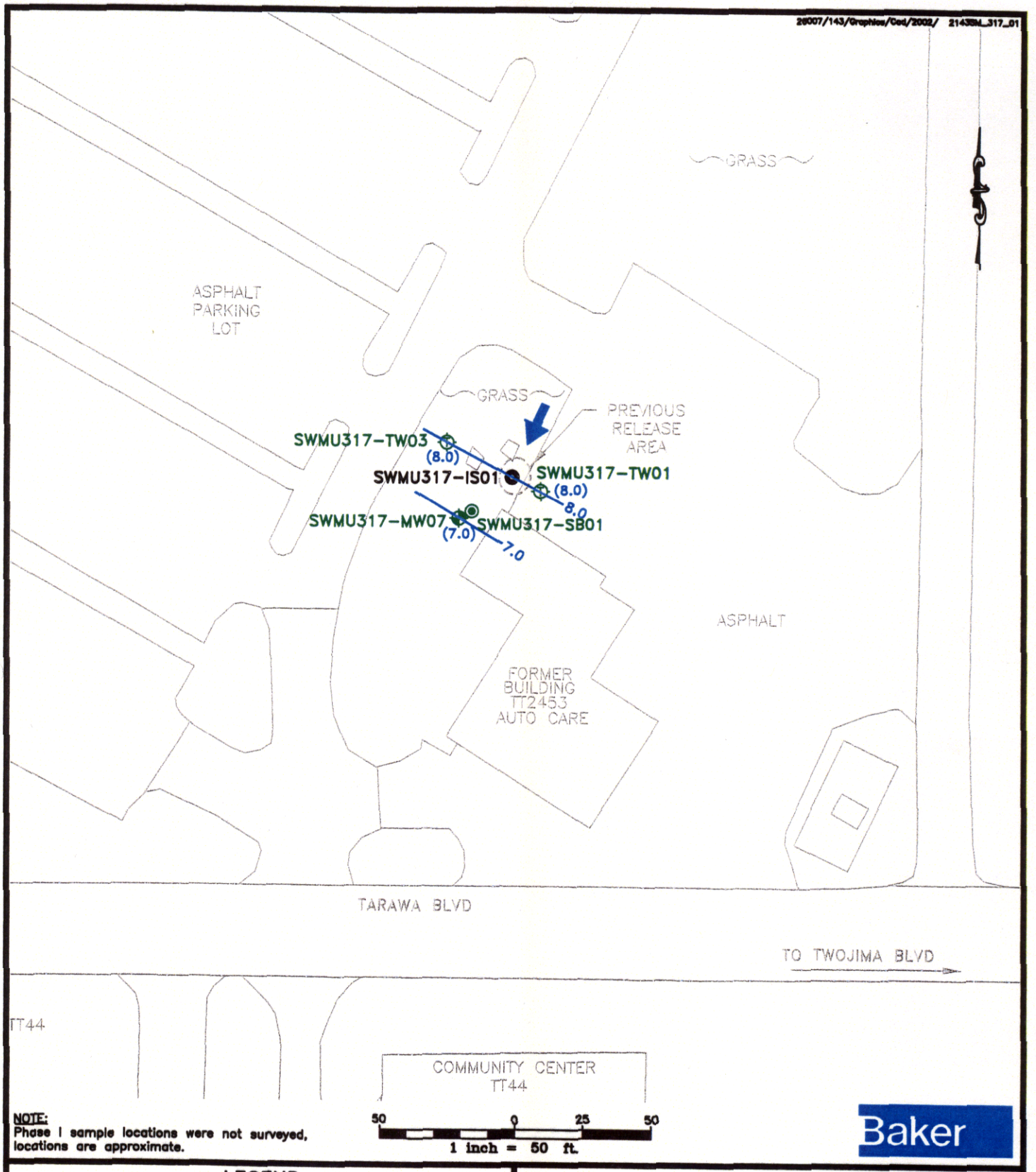
9/12/02
SWMU317_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 317
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 3/3 | 23.3 - 44.6 | 0 | 0 |
| Chromium | 5.8 | 50 | 2/3 | 1.5 J - 8.5 | 1 | 0 |
| Lead | 3.6 | 15 | 3/3 | 1.1 J - 1.9 J | 0 | 0 |
| Selenium | 2.8 | 50 | 1/3 | 2.3 J | 0 | 0 |
| Silver | 0.74 | 18 | 1/3 | 0.52 J | 0 | 0 |

J - Analyte detected. Report value is estimated.
(1) - If NC 2L Standard not available, Interim Standard was used.




NOTE:
Phase I sample locations were not surveyed, locations are approximate.

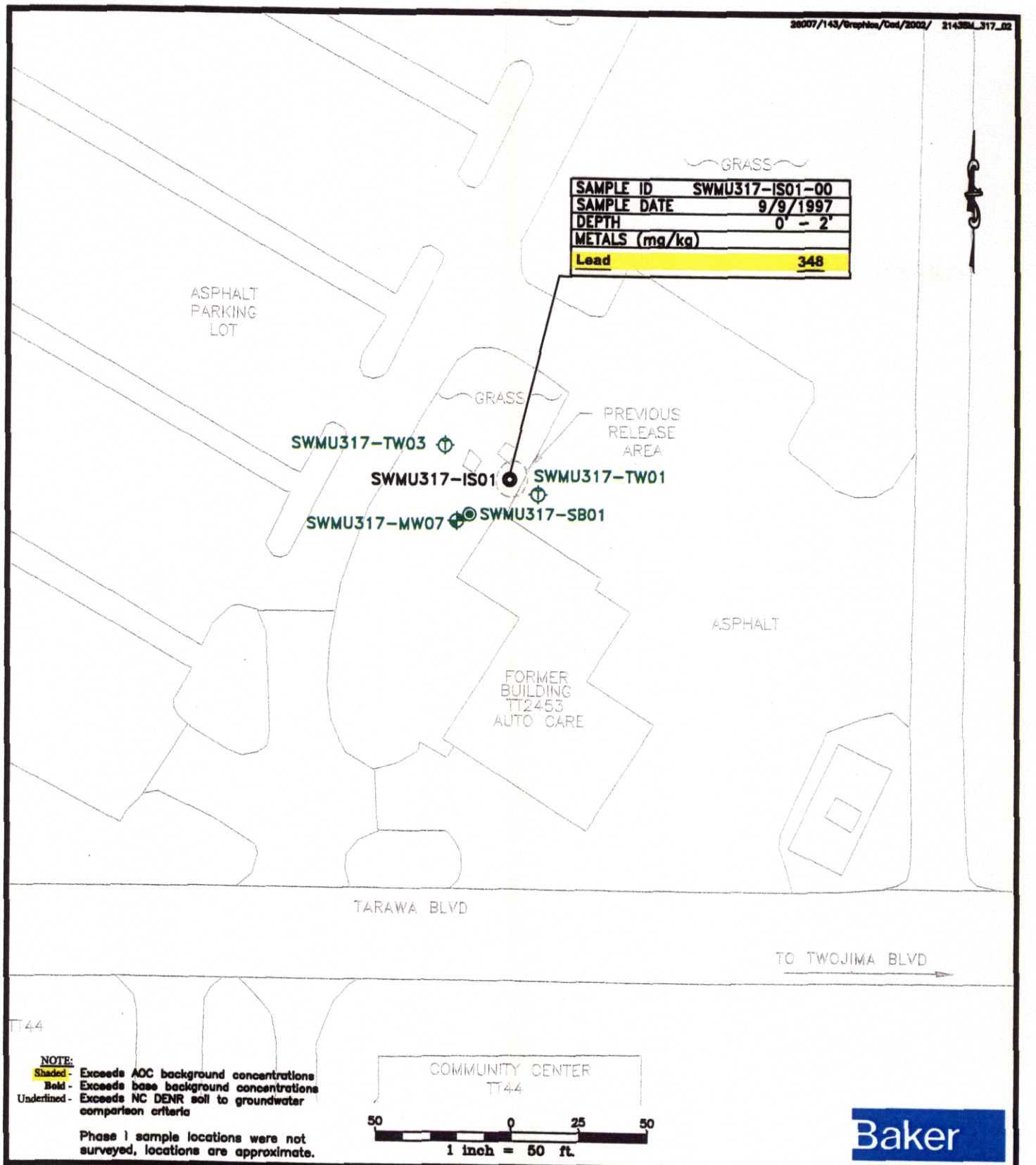
## LEGEND

- TEMPORARY WELL
- MONITORING WELL
- SOIL BORING
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 8.0 — GROUNDWATER CONTOUR
- PREVIOUS RELEASE AREA

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 317
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB35Y




NOTE:
Shaded - Exceeds AOC background concentrations
Bold - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Phase I sample locations were not surveyed, locations are approximate.

Baker

## LEGEND

- TEMPORARY WELL
- MONITORING WELL
- SOIL BORING
- PHASE I SOIL BORING
- PREVIOUS RELEASE AREA

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 317
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.34 SWMU 318 - AS515 Oil/Water Separator

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.34.1 SWMU Description and History

SWMU 318 is a concrete, multi-chambered oil/water separator and grit chamber located adjacent to the helicopter wash pad at the New River MCAS. The primary function of the SWMU is to collect water, soap, oil, grease, and dirt from the helicopter wash pad; separate the solids from the liquids; and then segregate the oil and grease from the remaining liquids. The helicopter wash pad is covered with concrete. The area surrounding the SWMU is covered with grass. A drainage ditch that collects stormwater run-off from the surrounding area is located adjacent to the oil/water separator. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was performed in September 1997. The purpose of the investigation was to determine if operation of the oil/water separator has impacted surface and subsurface soils in the vicinity of the SWMU. Surface soil samples were collected at three soil borings advanced around the perimeter of the SWMU (see Figure 1). Initially, two soil samples were proposed to be collected from each boring. However, the shallow depth to groundwater precluded collection of deeper samples. In addition, one surface soil sample was collected from the drainage ditch adjacent to the oil/water separator. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. Based on the evaluation of the results, several VOCs, SVOCs, and metals exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 318 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.34.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 19 and 20, and April 2, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on results from the Phase I CSI.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Surface soil sampling at two locations in the drainage ditch
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 5.2 to 6.3 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 11.8 to 11.9 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow east/northeast.

### 4.34.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Fifteen VOCs were detected in the sample set. None of these VOCs exceeded the Region IX industrial PRGs. 1,2-dichlorobenzene and 1,4-dichlorobenzene exceeded the NC DENR soil to groundwater screening criteria in surface soil sample SWMU318-SS01-00, which was collected from the drainage ditch adjacent to the SWMU. These two compounds were not detected in the subsurface soil samples. Bromoform exceeded the NC DENR soil to groundwater criteria in the surface soil sample from boring SWMU318-TW02. 1,1,2-trichloroethane and methylene chloride also exceeded the NC DENR soil to groundwater criteria in the subsurface soil sample from this boring. In addition, methylene chloride was detected in subsurface soil sample SWMU318-TW01-04 at concentrations exceeding NC DENR soil to groundwater criteria. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

Twenty-five SVOCs (mostly PAHs) were detected in the sample set. Most of the SVOCs were detected in the surface soil samples. The following six SVOCs exceeded the NC DENR soil to groundwater screening criteria and/or the USEPA Region IX industrial PRGs in surface soil sample SWMU 318-SS01-00, which was collected from the drainage ditch adjacent to the SWMU: Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene. None of the other SVOCs detected in the surface soil samples exceeded the applicable screening criteria. In addition, none of the SVOCs detected in subsurface samples exceeded the applicable screening criteria.

All eight RCRA metals were detected in the surface soil sample set. Arsenic, cadmium, chromium, mercury and silver exceeded the AOC and Base background screening criteria, NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs in one or more of the surface soil samples. Barium, lead and selenium also exceeded the AOC and/or Base background screening criteria in the surface soil; however, the concentrations were below the NC DENR soil to groundwater

criteria and USEPA Region IX industrial PRGs. Six of the metals were detected in the subsurface soil samples. However, none of the metals exceeded the combination of background criteria, NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented in Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Thirteen VOCs were detected in the sample set. Benzene, trichloroethene, and vinyl chloride exceeded the North Carolina 2L standards in samples from one or more of the wells. None of the other VOCs detected in the samples exceed the North Carolina 2L standards.

Six SVOCs were detected in the sample set, as follows: 2-4-dimethylphenol, 2-methylnaphthalene, 4-methylphenol, acenaphthalene, bis(2-ethylhexyl)phthelate, and naphthalene. 4-methylphenol and naphthalene exceeded the North Carolina 2L standards in samples from one or more of the wells. None of the other SVOCs detected in the samples exceeded the 2L standards.

Four metals were detected in the sample set, as follows: arsenic, barium, chromium, and lead. Arsenic exceeded the Base background criteria and North Carolina 2L standard. Barium, chromium and lead exceeded the Base background criteria; however, the concentrations were below the North Carolina 2L standards. It should be noted that turbidity was elevated in the groundwater samples from the temporary wells and may have caused artificially high metals concentrations in the samples. The elevated turbidity may be attributable to clay layers that were encountered during drilling and installation of the temporary wells.

Most of the SVOCs and metals detected in groundwater were also detected in the soils at the SWMU. However, most of the VOCs detected in groundwater were not detected in soils at the SWMU.

### 4.34.4 Conclusions

Several VOCs, SVOCs and metals were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region III industrial PRGs in soil were as follows:

- VOCs - 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1,2-trichloroethane, bromoform and Methylene chloride
- SVOCs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, indeno(1,2,3-cd)pyrene, and naphthalene
- Metals - arsenic, cadmium, chromium, mercury and silver

Compounds that exceeded both the Base background screening criteria and 2L standards in groundwater were as follows:

- VOCs - benzene, trichloroethene and vinyl chloride
- SVOCs - 4-methylphenol and naphthalene
- Metals - arsenic

It should be noted that the elevated turbidity in the groundwater samples from the temporary wells may have caused artificially high concentrations in the samples.

Based on evaluation of the analytical results, additional investigation at SWMU 318 is warranted with respect to VOCs, SVOCs, and metals in soil and groundwater. The additional investigation activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU318-TW01 | 3/20/02 | BAKER | 16.93 | 17.0 | 16 | 16 | 4 | 2 | 6 | 5.15 | 11.8 |
| SWMU318-TW02 | 3/20/02 | BAKER | 18.17 | 18.0 | 16 | 16 | 4 | 2 | 6 | 6.25 | 11.9 |
| SWMU318-TW03 | 3/19/02 | BAKER | 17.80 | 17.8 | 17 | 17 | 4.9 | 3 | 7 | 5.92 | 11.9 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU318

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-IS01-00 09-14-1997 0' - 2' | SWMU318-IS02-00 09-14-1997 0' - 2' | SWMU318-IS03-00 09-14-1997 0' - 2' | SWMU318-SS01-00 09-17-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (3)** | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 1680 (2) | 370000 | ND | ND | ND | 9200 |
| 1,4-Dichlorobenzene | NE | NE | 3110 (2) | 8100 | 1.8 | ND | ND | 4300 |
| 2-Butanone | NE | NE | 692 | 28000000 | NA | NA | NA | NA |
| 2-Hexanone | NE | NE | 1380 (4) | 82000000 (1) | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | NA | NA | NA | NA |
| Acetone | NE | NE | 2810 | 6200000 | NA | NA | NA | NA |
| Benzene | NE | NE | 5.6 | 1500 | ND | ND | ND | ND |
| Bromoform | NE | NE | 2.22 (2) | 310000 | NA | NA | NA | NA |
| Carbon disulfide | NE | NE | 4940 | 720000 | NA | NA | NA | NA |
| Methylene chloride | NE | NE | 22 | 21000 | NA | NA | NA | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 3920 (4) | 41000000 (1) | ND | ND | ND | 2600 J |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | ND | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | NA | NA | NA | NA |
| Benzaldehyde | NE | NE | NE | 88000000 | NA | NA | NA | NA |
| Benzo(a)anthracene | NE | NE | 1040 (2) | 2900 | 56 J | ND | ND | 4100 J |
| Benzo(a)pyrene | NE | NE | 276 (2) | 290 | 110 J | ND | ND | 5000 J |
| Benzo(b)fluoranthene | NE | NE | 3500 (4) | 2900 | 110 J | ND | ND | 5900 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 99 J | ND | ND | 5000 J |
| Benzo(k)fluoranthene | NE | NE | 35000 (4) | 29000 | ND | ND | ND | 6900 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 20200 (2) | 180000 | 230 J | 1400 J | 180 J | 22000 J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND | ND | ND | 2000 J |
| Caprolactam | NE | NE | NE | 100000000 | NA | NA | NA | NA |
| Carbazole | NE | NE | NE | 120000 | ND | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 69 J | ND | ND | 6700 J |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | ND | ND | ND | 2400 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 510 (2) | 290 | 45 J | ND | ND | 2300 J |
| Dimethyl phthalate | NE | NE | NE | 100000000 | ND | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 69 J | ND | ND | 7700 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 9880 (2) | 2900 | 91 J | ND | ND | 4700 J |
| Naphthalene | NE | NE | 1600 (2) | 190000 | ND | ND | ND | 17000 J |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 71 J | ND | ND | 7800 J |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-IS01-00 09-14-1997 0' - 2' | SWMU318-IS02-00 09-14-1997 0' - 2' | SWMU318-IS03-00 09-14-1997 0' - 2' | SWMU318-SS01-00 09-17-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 3.1 | 14.3 | 3.7 | ND |
| Barium | 33 | 23 | 848 | 100000 | 50.3 | 44 | ND | 396 |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | 1.6 | 3 | ND | 57.2 |
| Chromium | 19 | 12 | 27 | 450 | 24.6 | 48.2 | 18.2 | 91.1 |
| Lead | 23 | 26 | 270 | 750 | 30.7 | 45.8 | 21.9 | 110 |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 0.067 | 0.14 | 0.052 | 0.045 |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 0.81 | 0.85 | ND | ND |
| Silver | 0.23 | 0.79 | 0.22 | 10000 | ND | ND | ND | 7.2 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
(4) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg.
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-SS02-00 03-19-2002 0' - 1' | SWMU318-SS03-00 03-19-2002 0' - 1' | SWMU318-TW01-00 03-20-2002 0' - 1' | SWMU318-TW02-00 03-20-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (3)** | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 1680 (2) | 370000 | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | NE | NE | 3110 (2) | 8100 | ND | ND | ND | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | 11 J | 16 J | 20 | 9 J |
| 2-Hexanone | NE | NE | 1380 (4) | 82000000 (1) | ND | ND | 3 J | ND |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | ND | ND | 1 J | ND |
| Acetone | NE | NE | 2810 | 6200000 | 32 | 40 J | 78 | 37 |
| Benzene | NE | NE | 5.6 | 1500 | 2 J | ND | 2 J | ND |
| Bromoform | NE | NE | 2.22 (2) | 310000 | ND | ND | ND | 13 |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | 3 J | ND | ND |
| Methylene chloride | NE | NE | 22 | 21000 | 4 J | 2 J | 11 | 18 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 3920 (4) | 41000000 (1) | ND | 120 J | ND | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND | 34 J | ND | ND |
| Acetophenone | NE | NE | NE | 1600 | ND | 120 J | ND | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | ND | ND | 33 J |
| Benzo(a)anthracene | NE | NE | 1040 (2) | 2900 | 52 J | 220 J | ND | ND |
| Benzo(a)pyrene | NE | NE | 276 (2) | 290 | 82 J | 190 J | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 3500 (4) | 2900 | 140 J | 260 J | ND | 29 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 86 J | 120 J | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 35000 (4) | 29000 | 130 J | 300 J | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 20200 (2) | 180000 | 300 J | 1100 J | 380 J | 380 J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 86 J | 65 J | ND | ND |
| Caprolactam | NE | NE | NE | 100000000 | ND | 100 J | ND | ND |
| Carbazole | NE | NE | NE | 120000 | ND | 44 J | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 99 J | 290 J | ND | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | ND | ND | ND | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 170 J | 55 J | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 510 (2) | 290 | ND | 68 J | ND | ND |
| Dimethyl phthalate | NE | NE | NE | 100000000 | ND | 48 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 120 J | 440 J | ND | 22 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 9880 (2) | 2900 | 160 J | 240 J | ND | 47 J |
| Naphthalene | NE | NE | 1600 (2) | 190000 | ND | 430 J | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | 110 J | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 90 J | 370 J | ND | ND |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-SS02-00 03-19-2002 0' - 1' | SWMU318-SS03-00 03-19-2002 0' - 1' | SWMU318-TW01-00 03-20-2002 0' - 1' | SWMU318-TW02-00 03-20-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | **1.4** J | **3.3** | **2** | ND |
| Barium | 33 | 23 | 848 | 100000 | **33.2** | **47.8** J | **36.3** | 13.4 |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | **3.5** | **0.41** J | **0.46** J | **0.14** J |
| Chromium | 19 | 12 | 27 | 450 | **20.5** | **24.9** | **20.2** | 6.7 |
| Lead | 23 | 26 | 270 | 750 | **45.4** J | 20.8 J | **66.1** J | 11.2 J |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 0.066 | 0.099 | 0.059 | 0.023 J |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 1 | **1.3** | 0.56 J | ND |
| Silver | 0.23 | 0.79 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
(4) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-TW03-00 03-19-2002 0' - 1' |
|---|---|---|---|---|---|
| **VOLATILES (ug/kg) (3)** | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 1680 (2) | 370000 | ND |
| 1,4-Dichlorobenzene | NE | NE | 3110 (2) | 8100 | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | 8 J |
| 2-Hexanone | NE | NE | 1380 (4) | 82000000 (1) | ND |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | ND |
| Acetone | NE | NE | 2810 | 6200000 | 38 J |
| Benzene | NE | NE | 5.6 | 1500 | ND |
| Bromoform | NE | NE | 2.22 (2) | 310000 | ND |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND |
| Methylene chloride | NE | NE | 22 | 21000 | 1 J |
| **SEMIVOLATILES (ug/kg)** | | | | | |
| 2-Methylnaphthalene | NE | NE | 3920 (4) | 41000000 (1) | ND |
| Acenaphthene | NE | NE | 8160 | 38000000 | ND |
| Acetophenone | NE | NE | NE | 1600 | ND |
| Benzaldehyde | NE | NE | NE | 88000000 | ND |
| Benzo(a)anthracene | NE | NE | 1040 (2) | 2900 | ND |
| Benzo(a)pyrene | NE | NE | 276 (2) | 290 | ND |
| Benzo(b)fluoranthene | NE | NE | 3500 (4) | 2900 | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND |
| Benzo(k)fluoranthene | NE | NE | 35000 (4) | 29000 | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 20200 (2) | 180000 | 1100 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | ND |
| Caprolactam | NE | NE | NE | 100000000 | ND |
| Carbazole | NE | NE | NE | 120000 | ND |
| Chrysene | NE | NE | 39800 | 290000 | ND |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 37 J |
| Dibenz(a,h)anthracene | NE | NE | 510 (2) | 290 | ND |
| Dimethyl phthalate | NE | NE | NE | 100000000 | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 9880 (2) | 2900 | ND |
| Naphthalene | NE | NE | 1600 (2) | 190000 | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND |

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-TW03-00 03-19-2002 0' - 1' |
|---|---|---|---|---|---|
| **METALS (mg/kg)** | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 0.67 J |
| Barium | 33 | 23 | 848 | 100000 | **24.6** |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | 0.57 |
| Chromium | 19 | 12 | 27 | 450 | 9.2 |
| Lead | 23 | 26 | 270 | 750 | 16.7 J |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 0.027 J |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 0.58 |
| Silver | 0.23 | 0.79 | 0.22 | 10000 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Phase I (1997) volatiles were only analyzed for SW8020 (BTEX).
(4) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg
J - Analyte detected. Report value is estimated.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,2-Dichlorobenzene | NE | NE | 1680 (2) | 370000 | 1/9 | 9200 | NA | NA | 1 | 0 |
| 1,4-Dichlorobenzene | NE | NE | 3110 (2) | 8100 | 2/9 | 1.8 - 4300 | NA | NA | 1 | 0 |
| 2-Butanone | NE | NE | 692 | 28000000 | 5/5 | 8 J - 20 | NA | NA | 0 | 0 |
| 2-Hexanone | NE | NE | 1380 (3) | 82000000 (1) | 1/5 | 3 J | NA | NA | 0 | 0 |
| 4-Methyl-2-pentanone | NE | NE | 2280 | 2900000 | 1/5 | 1 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 6200000 | 5/5 | 32 - 78 | NA | NA | 0 | 0 |
| Benzene | NE | NE | 5.6 | 1500 | 2/9 | 2 J | NA | NA | 0 | 0 |
| Bromoform | NE | NE | 2.2 (2) | 310000 | 1/5 | 13 | NA | NA | 1 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/8 | 3 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 22 | 21000 | 5/5 | 1 J - 18 | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Methylnaphthalene | NE | NE | 3920 (3) | 41000000 (1) | 2/9 | 120 J - 2600 J | NA | NA | 0 | 0 |
| Acenaphthene | NE | NE | 8160 | 38000000 | 1/9 | 34 J | NA | NA | 0 | 0 |
| Acetophenone | NE | NE | NE | 1600 | 1/5 | 120 J | NA | NA | 0 | 0 |
| Benzaldehyde | NE | NE | NE | 88000000 | 1/5 | 33 J | NA | NA | 0 | 0 |
| Benzo(a)anthracene | NE | NE | 1040 (2) | 2900 | 4/9 | 56 J - 4100 J | NA | NA | 1 | 1 |
| Benzo(a)pyrene | NE | NE | 276 (2) | 290 | 4/9 | 82 J - 5000 J | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 3500 (2) | 2900 | 5/9 | 29 J - 5900 J | NA | NA | 1 | 1 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 4/9 | 86 J - 5000 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 35000 (3) | 29000 | 3/9 | 130 J - 6900 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 20200 (2) | 180000 | 9/9 | 180 J - 22000 J | NA | NA | 1 | 0 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 3/9 | 65 J - 2000 J | NA | NA | 0 | 0 |
| Caprolactam | NE | NE | NE | 100000000 | 1/5 | 100 J | NA | NA | 0 | 0 |
| Carbazole | NE | NE | NE | 120000 | 1/9 | 44 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 4/9 | 69 J - 6700 J | NA | NA | 0 | 0 |
| Di-n-butyl phthalate | NE | NE | 24800 | 88000000 | 1/9 | 2400 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 3/9 | 37 J - 170 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 510 (2) | 290 | 3/9 | 45 J - 2300 J | NA | NA | 1 | 1 |
| Dimethyl phthalate | NE | NE | NE | 100000000 | 1/9 | 48 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 5/9 | 22 J - 7700 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 9880 (2) | 2900 | 5/9 | 47 J - 4700 J | NA | NA | 0 | 1 |
| Naphthalene | NE | NE | 1600 (2) | 190000 | 2/9 | 430 J - 17000 J | NA | NA | 1 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/9 | 110 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 4/9 | 71 J - 7800 J | NA | NA | 0 | 0 |

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| METALS (mg/kg) | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 7/9 | 0.67 J - 14.3 | 5 | 6 | 1 | 4 |
| Barium | 33 | 23 | 848 | 100000 | 8/9 | 13.4 - 396 | 6 | 7 | 0 | 0 |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | 8/9 | 0.14 J - 57.2 | 8 | 8 | 3 | 0 |
| Chromium | 19 | 12 | 27 | 450 | 9/9 | 6.7 - 91.1 | 6 | 7 | 2 | 0 |
| Lead | 23 | 26 | 270 | 750 | 9/9 | 11.2 J - 110 | 6 | 6 | 0 | 0 |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 9/9 | 0.023 J - 0.14 | 1 | 1 | 9 | 0 |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 6/9 | 0.56 J -1.3 | 1 | 0 | 0 | 0 |
| Silver | 0.23 | 0.79 | 0.22 | 10000 | 1/9 | 7.2 | 1 | 1 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU318-TW01-04 03-20-2002 7' - 9' | SWMU318-TW02-04 03-20-2002 7' - 9' | SWMU318-TW03-04 03-19-2002 7' - 9' |
|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | |
| 1,1,2-Trichloroethane | NE | NE | 5.16 (2) | 1900 | ND | 93 | ND |
| 2-Butanone | NE | NE | 692 | 28000000 | 8 J | 9 J | 5 J |
| 2-Hexanone | NE | NE | 1380 (3) | 82000000 (1) | ND | 300 | ND |
| Acetone | NE | NE | 2810 | 6200000 | 28 | 57 | 24 J |
| Bromodichloromethane | NE | NE | 3.1 | 2400 | ND | 2 J | ND |
| Carbon disulfide | NE | NE | 4940 | 720000 | ND | ND | 3 J |
| Cyclohexane | NE | NE | NE | 140000 | ND | 12 | ND |
| Isopropylbenzene | NE | NE | NE | 520000 | ND | 15 | ND |
| Methylcyclohexane | NE | NE | NE | 8800000 | ND | 10 | ND |
| Methylene chloride | NE | NE | 24.2 (2) | 21000 | 33 | 32 | 1 J |
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 380 J | 370 J | 660 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | ND | ND | 25 J |
| Dibenzofuran | NE | NE | 13900 (3) | 5100000 | ND | 130 J | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | 59 J | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 2 | 2.4 | 4.8 J |
| Barium | 47 | 29 | 848 | 100000 | 22 | 19.7 | **30** |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 0.066 J | ND | ND |
| Chromium | 38 | 27 | 27 | 450 | 23.3 | 24.1 | 4.1 |
| Lead | 15 | 14 | 270 | 750 | 11.7 J | 11.6 J | 1 J |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 0.027 J | 0.024 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,1,2-Trichloroethane | NE | NE | 5.16 (2) | 1900 | 1/3 | 93 | NA | NA | 1 | 0 |
| 2-Butanone | NE | NE | 692 | 28000000 | 3/3 | 5 J - 9 J | NA | NA | 0 | 0 |
| 2-Hexanone | NE | NE | 1380 (3) | 82000000 (1) | 1/3 | 300 | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 6200000 | 3/3 | 24 J - 57 | NA | NA | 0 | 0 |
| Bromodichloromethane | NE | NE | 3.1 | 2400 | 1/3 | 2 J | NA | NA | 0 | 0 |
| Carbon disulfide | NE | NE | 4940 | 720000 | 1/3 | 3 J | NA | NA | 0 | 0 |
| Cyclohexane | NE | NE | NE | 140000 | 1/3 | 12 | NA | NA | 0 | 0 |
| Isopropylbenzene | NE | NE | NE | 520000 | 1/3 | 15 | NA | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | NE | 8800000 | 1/3 | 10 | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 24.2 (2) | 21000 | 3/3 | 1 J - 33 | NA | NA | 2 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 3/3 | 370 J - 660 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/3 | 25 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 13900 (3) | 5100000 | 1/3 | 130 J | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/3 | 59 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 14 | 11 | 5.24 | 2.7 | 3/3 | 2 - 4.8 J | 0 | 0 | 0 | 1 |
| Barium | 47 | 29 | 848 | 100000 | 3/3 | 19.7 - 30 | 0 | 1 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 1/3 | 0.066 J | 1 | 1 | 0 | 0 |
| Chromium | 38 | 27 | 27 | 450 | 3/3 | 4.1 - 24.1 | 0 | 0 | 0 | 0 |
| Lead | 15 | 14 | 270 | 750 | 3/3 | 1 J - 11.7 J | 0 | 0 | 0 | 0 |
| Mercury | 0.07 | 0.09 | 0.015 | 610 | 2/3 | 0.024 J - 0.027 J | 0 | 0 | 2 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Region III PRG Industrial Soil
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3029 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 3029mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Clay Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU318-TW01 04-02-2002 | | SWMU318-TW02 04-02-2002 | | SWMU318-TW03 04-02-2002 | |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | | |
| 1,1-Dichloroethane | NE | 700 | 1 | J | ND | | 2 | J |
| 1,1-Dichloroethene | NE | 7 | 0.5 | J | ND | | 0.7 | J |
| 1,2,4-Trichlorobenzene | NE | 70 | 1 | J | ND | | ND | |
| 1,2-Dichlorobenzene | NE | 62 | 3 | J | ND | | ND | |
| Benzene | NE | 1 | **2** | J | **4** | J | **2** | J |
| cis-1,2-Dichloroethene | NE | 70 | 22 | | 13 | | 0.8 | J |
| Cyclohexane | NE | 35000 (2) | 1 | J | ND | | 3 | J |
| Ethylbenzene | NE | 29 | 1 | J | 4 | J | ND | |
| Isopropylbenzene | NE | 70 | ND | | 1 | J | ND | |
| Toluene | NE | 1000 | 1 | J | 2 | J | ND | |
| Trichloroethene | NE | 2.8 | **15** | | **8** | | ND | |
| Vinyl chloride | NE | 0.015 | **2** | J | **0.9** | J | ND | |
| Xylene (Total) | NE | 530 | ND | | 3 | J | ND | |
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 2,4-Dimethylphenol | NE | 140 | ND | | 2 | J | ND | |
| 2-Methylnaphthalene | NE | 28 | 5 | J | 12 | | 2 | J |
| 4-Methylphenol | NE | 3.5 | ND | | ND | | **4** | J |
| Acenaphthene | NE | 80 | ND | | 2 | J | 0.7 | J |
| bis(2-Ethylhexyl)phthalate | NE | 3 | ND | | ND | | 2 | J |
| Naphthalene | NE | 21 | **40** | | **97** | | 7 | J |
| **METALS (ug/L)** | | | | | | | | |
| Arsenic | 12 | 10 | **10.9** | J | **13.2** | J | 3.5 | J |
| Barium | 145 | 2000 | 130 | J | 260 | J | 98.2 | J |
| Chromium | 5.8 | 50 | 17.4 | J | 41.9 | J | 12.9 | J |
| Lead | 3.6 | 15 | 5.1 | J | 10.2 | J | 5.3 | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

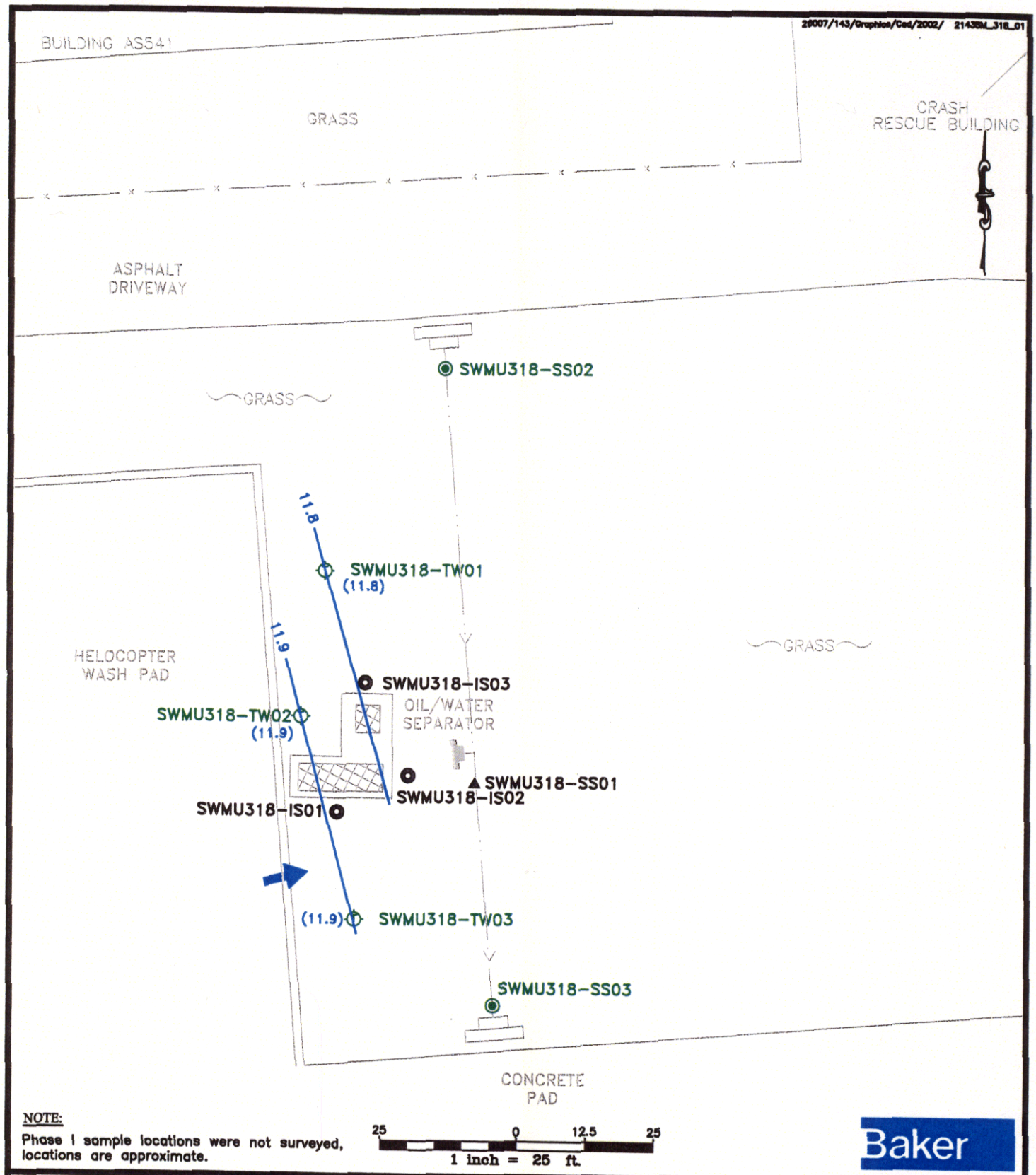
9/12/02
SWMU318_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 318
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 1,1-Dichloroethane | NE | 700 | 2/3 | 1 J - 2 J | NA | 0 |
| 1,1-Dichloroethene | NE | 7 | 2/3 | 0.5 J - 0.7 J | NA | 0 |
| 1,2,4-Trichlorobenzene | NE | 70 | 1/3 | 1 J | NA | 0 |
| 1,2-Dichlorobenzene | NE | 62 | 1/3 | 3 J | NA | 0 |
| Benzene | NE | 1 | 3/3 | 2 J - 4 J | NA | 3 |
| cis-1,2-Dichloroethene | NE | 70 | 3/3 | 0.8 J - 22 | NA | 0 |
| Cyclohexane | NE | 35000 (2) | 2/3 | 1 J - 3 J | NA | 0 |
| Ethylbenzene | NE | 29 | 2/3 | 1 J - 4 J | NA | 0 |
| Isopropylbenzene | NE | 70 | 1/3 | 1 J | NA | 0 |
| Toluene | NE | 1000 | 2/3 | 1 J - 2 J | NA | 0 |
| Trichloroethene | NE | 2.8 | 2/3 | 7 - 15 J | NA | 2 |
| Vinyl chloride | NE | 0.015 | 2/3 | 0.9 J - 2 J | NA | 2 |
| Xylene (Total) | NE | 530 | 1/3 | 3 J | NA | 0 |
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 2,4-Dimethylphenol | NE | 140 | 1/3 | 2 J | NA | 0 |
| 2-Methylnaphthalene | NE | 28 | 3/3 | 2 J - 12 | NA | 0 |
| 4-Methylphenol | NE | 3.5 | 1/3 | 4 J | NA | 1 |
| Acenaphthene | NE | 80 | 2/3 | 0.7 J - 2 J | NA | 0 |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 1/3 | 2 J | NA | 0 |
| Naphthalene | NE | 21 | 3/3 | 7 J - 97 | NA | 2 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 3/3 | 3.5 J - 13.2 J | 1 | 2 |
| Barium | 145 | 2000 | 3/3 | 98.2 J - 260 J | 1 | 0 |
| Chromium | 5.8 | 50 | 3/3 | 12.9 J - 41.9 J | 3 | 0 |
| Lead | 3.6 | 15 | 3/3 | 5.1 J - 10.2 J | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)



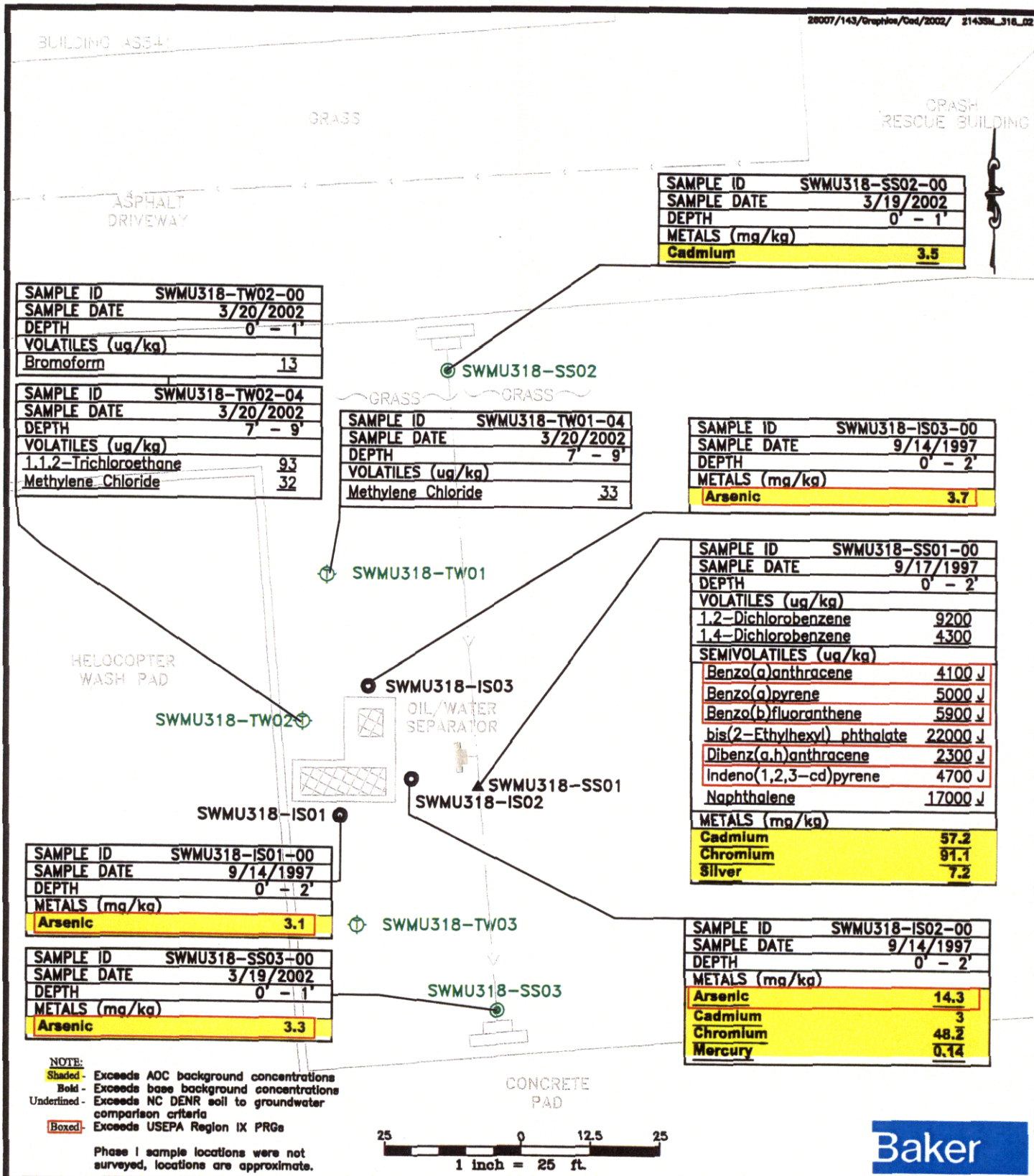

**LEGEND**

- TEMPORARY WELL
- SOIL BORING PHASE II SURFACE SOIL
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 11.8 — GROUNDWATER CONTOUR
- INDICATES DRAWING DITCH AND FLOW DIRECTION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 318
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB364

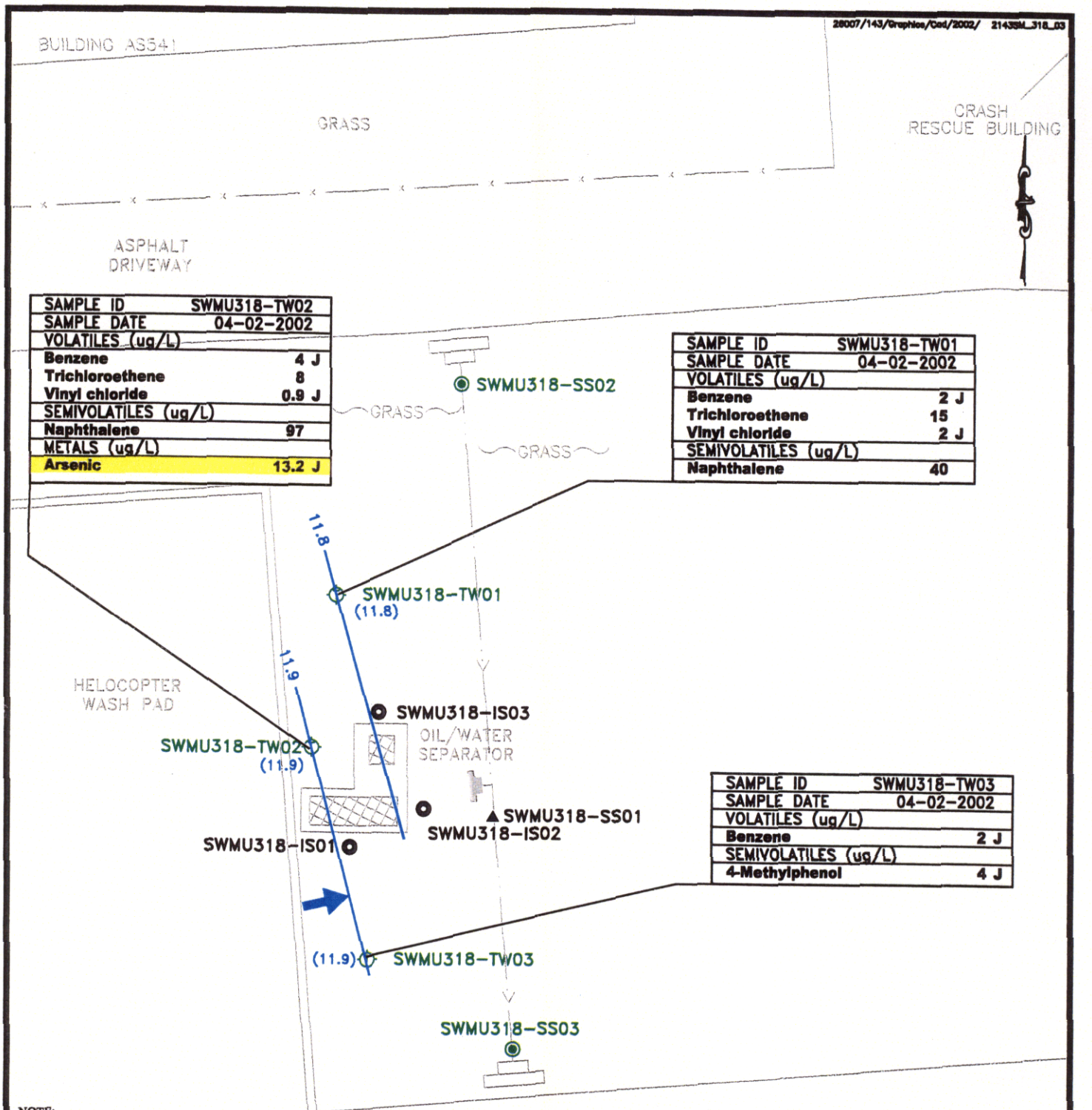



## LEGEND

- TEMPORARY WELL
- SOIL BORING PHASE II SURFACE SOIL
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- INDICATES DRAWING DITCH AND FLOW DIRECTION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 318
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Shaded - Exceeds background concentrations
Bold - Exceeds 2L standard

Phase I sample locations were not surveyed, locations are approximate.

SOURCE: MCB CAMP LEJEUNE MARCH 2000

25 0 12.5 25
1 inch = 25 ft.

Baker

LEGEND

- TEMPORARY WELL
- SOIL BORING PHASE II SURFACE SOIL
- PHASE I SURFACE SOIL
- PHASE I SOIL BORING
- GROUNDWATER FLOW DIRECTION
- 11.8 — GROUNDWATER CONTOUR
- INDICATES DRAWING DITCH AND FLOW DIRECTION

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 318
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.35 SWMU 319 - Camp Geiger Wastewater Treatment Plant

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.35.1 SWMU Description and History

SWMU 319 was identified in the RFA Report (EnSafe, 1996) as an AST located at the Camp Geiger Wastewater Treatment Plant. During the site visit conducted by Baker in October 1996, the only AST identified at the site was installed within the last year. In addition, no figure showing the location of the previous AST was presented in the RFA Report. No evidence of petroleum staining or releases was identified in the vicinity of the existing AST. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if operation of the AST(s) and Wastewater Treatment Plant has impacted surface and subsurface soils in the vicinity of the SWMU. Surface and subsurface soil samples were collected from six soil borings advanced in and around the Wastewater Treatment Plant (see Figure 1). The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. Based on evaluation of the results, a few SVOCs and mercury exceeded the regulatory driven criteria and established background/secondary criteria. Therefore, additional investigation at SWMU 319 was recommended in the form of a Phase II CSI.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs instead of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.35.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 21, 2002 in general accordance with the Final Project Plans (Baker, 2002). The wastewater treatment plant has since been demolished and site soils regraded as part of the State Route 24 project. However, surface and subsurface soil samples were collected from one boring that was drilled in the proximity of the former SWMU to confirm whether or not contamination is still present. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

### 4.35.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for SVOCs and RCRA metals. A summary of the laboratory analytical results is included in Appendix E.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 1 though 4 and were compared to the following screening criteria:

- AOC background criteria

- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary concentrations.

Soil

Thirteen SVOCs (mostly PAHs) were detected in the sample set. The majority of SVOCs were detected in the surface and subsurface soil samples from boring SWMU319-IS01 and surface soil sample SWMU319-SB01-00. Benzo(a)pyrene exceeded the NC DENR soil to groundwater screening criteria and USEPA Region IX industrial PRGs in the surface and subsurface soil samples from boring SWMU319-IS01. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Four metals were detected in the surface soil sample set, as follows: barium, chromium, lead and mercury. Mercury exceeded the AOC and Base background criteria and the NC DENR soil to groundwater screening criteria in surface soil sample SWMU319-IS03-00. Mercury also exceeded the AOC background and the NC DENR criteria in two other samples, but the concentrations were below the Base background criteria and USEPA Region IX industrial PRG.

Seven metals were detected in the subsurface soil sample set, as follows: arsenic, barium, cadmium, chromium, lead, mercury and silver. Cadmium and lead exceeded the background screening criteria in a few samples; however, the concentrations were below the NC DENR soil to groundwater criteria and USEPA Region IX industrial PRGs. Mercury and silver exceeded the AOC and Base background criteria and the NC DENR soil to groundwater criteria in subsurface sample SWMU319-SB01-01.

### 4.35.4 Conclusions

A few SVOCs and metals were detected in soil at concentrations exceeded the applicable screening criteria. Compounds that exceeded both the AOC and Base background criteria and NC DENR soil to groundwater screening criteria and/or Region IX industrial PRGs in soil were as follows:

- SVOCs - benzo(a)pyrene
- Metals - mercury and silver

Based on evaluation of the results, COPCs were detected slightly above screening criteria. The area of the SWMU has been disturbed during demolition and highway construction activities. Sample distribution throughout the footprint of the former wastewater treatment plant does not indicate evidence of gross contamination We recommend no further action at this SWMU based on the lack of evidence of any substantial impact to the soils and/or the SWMU.

TABLE 1

DETECTION SUMMARY
SURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU319-IS01-00 09-09-1997 0' - 2' | | SWMU319-IS02-00 09-09-1997 0' - 2' | SWMU319-IS03-00 09-09-1997 0' - 2' | SWMU319-IS04-00 09-09-1997 0' - 2' |
|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1420 (1) | 2900 | 360 | | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | 660 | | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | 740 | | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 510 | | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | 250 | J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 110 | J | ND | ND | ND |
| Chrysene | NE | NE | 39800 | 290000 | 450 | | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 110 | J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 520 | | ND | ND | ND |
| Fluorene | NE | NE | 44300 | 33000000 | ND | | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 420 | | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 190 | J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 400 | | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | | |
| Barium | 20 | 17 | 848 | 100000 | ND | | ND | ND | ND |
| Chromium | 12 | 15 | 27 | 450 | 5.7 | | 7.7 | 6.1 | 5.2 |
| Lead | 115 | 21 | 270 | 750 | 16.7 | | 13.3 | 15.1 | 7.1 |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | 0.071 | | ND | 0.17 | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 1

DETECTION SUMMARY
SURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU319-IS05-00 09-09-1997 0' - 2' | SWMU319-IS06-00 09-09-1997 0' - 2' | SWMU319-SB01-00 03-21-2002 0' - 1' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1420 (1) | 2900 | ND | ND | 39 J |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | ND | ND | 51 J |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | ND | ND | 43 J |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | ND | ND | 52 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | ND | 66 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | 43 J |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | 110 J |
| Fluorene | NE | NE | 44300 | 33000000 | ND | ND | 20 J |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | 60 J |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | 130 J |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | 79 J |
| **METALS (mg/kg)** | | | | | | | |
| Barium | 20 | 17 | 848 | 100000 | ND | ND | 9.9 |
| Chromium | 12 | 15 | 27 | 450 | 4.2 | 2.1 | 4.3 |
| Lead | 115 | 21 | 270 | 750 | 3.1 | 1.6 | 12.6 J |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | ND | ND | 0.09 |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 2

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 1420 (1) | 2900 | 2/7 | 39 J - 360 | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | 2/7 | 51 J - 660 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | 2/7 | 43 J - 740 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/7 | 510 | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | 2/7 | 52 J - 250 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 2/7 | 66 J - 110 J | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 2/7 | 43 J - 450 | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/7 | 110 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 2/7 | 110 J - 520 | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 33000000 | 1/7 | 20 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 2/7 | 60 J - 420 | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 2/7 | 130 J -190 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 2/7 | 79 J - 400 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 20 | 17 | 848 | 100000 | 1/7 | 9.9 | 0 | 0 | 0 | 0 |
| Chromium | 12 | 15 | 27 | 450 | 7/7 | 2.1 - 7.7 | 0 | 0 | 0 | 0 |
| Lead | 115 | 21 | 270 | 750 | 7/7 | 1.6 - 16.7 | 0 | 0 | 0 | 0 |
| Mercury | 0.05 | 0.1 | 0.015 | 610 | 3/7 | 0.071 - 0.17 | 3 | 1 | 3 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
AOC comparison - AOC 1 Surface Soil
Base comparison - Fine Sand Surface Soil

TABLE 3

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | **Base Background** | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU319-IS01-01 09-09-1997 2' - 4' | SWMU319-IS02-05 09-09-1997 10' - 12' | SWMU319-IS03-05 09-09-1997 10' - 12' | SWMU319-IS04-05 09-09-1997 10' - 12' |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 220 J | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | 410 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | 420 | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 260 J | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | 170 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 470 | ND | 570 | 95 J |
| Chrysene | NE | NE | 39800 | 290000 | 270 J | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 88 J | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | 280 J | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 220 J | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | 130 J | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | 300 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 2.7 | 1.6 | ND | ND | ND |
| Barium | 16 | 22 | 848 | 100000 | ND | ND | ND | ND |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | ND | ND |
| Chromium | 12 | 16 | 27 | 450 | 11.3 | 5.3 | 6.4 | 7.4 |
| Lead | 15 | 8.2 | 270 | 750 | 16.4 | 4 | 4.6 | 2.2 |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | 0.08 | ND | ND | ND |
| Silver | 0.05 | 0.09 | 0.22 | 10000 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU319_SOIL.xls

TABLE 3

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU319-IS05-04 09-09-1997 8' - 10' | SWMU319-IS06-04 09-09-1997 8' - 10' | SWMU319-SB01-01 03-21-2002 1' - 3' |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | ND | ND | ND |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | ND | ND | ND |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | ND | ND | ND |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | ND | ND | ND |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | 120 J | 120 J |
| Chrysene | NE | NE | 39800 | 290000 | ND | ND | ND |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | ND | ND | ND |
| Fluoranthene | NE | NE | 276000 | 30000000 | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | ND | ND | ND |
| Phenanthrene | NE | NE | 59600 | NE | ND | ND | ND |
| Pyrene | NE | NE | 286000 | 54000000 | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 2.7 | ND | ND | ND |
| Barium | 16 | 22 | 848 | 100000 | ND | ND | 15.8 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | ND | ND | 0.14 J |
| Chromium | 12 | 16 | 27 | 450 | 6.9 | 3.5 | 4.1 |
| Lead | 15 | 8.2 | 270 | 750 | 8.2 | 2 | 21.1 J |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | ND | ND | 0.17 |
| Silver | 0.05 | 0.09 | 0.22 | 10000 | ND | ND | 0.41 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

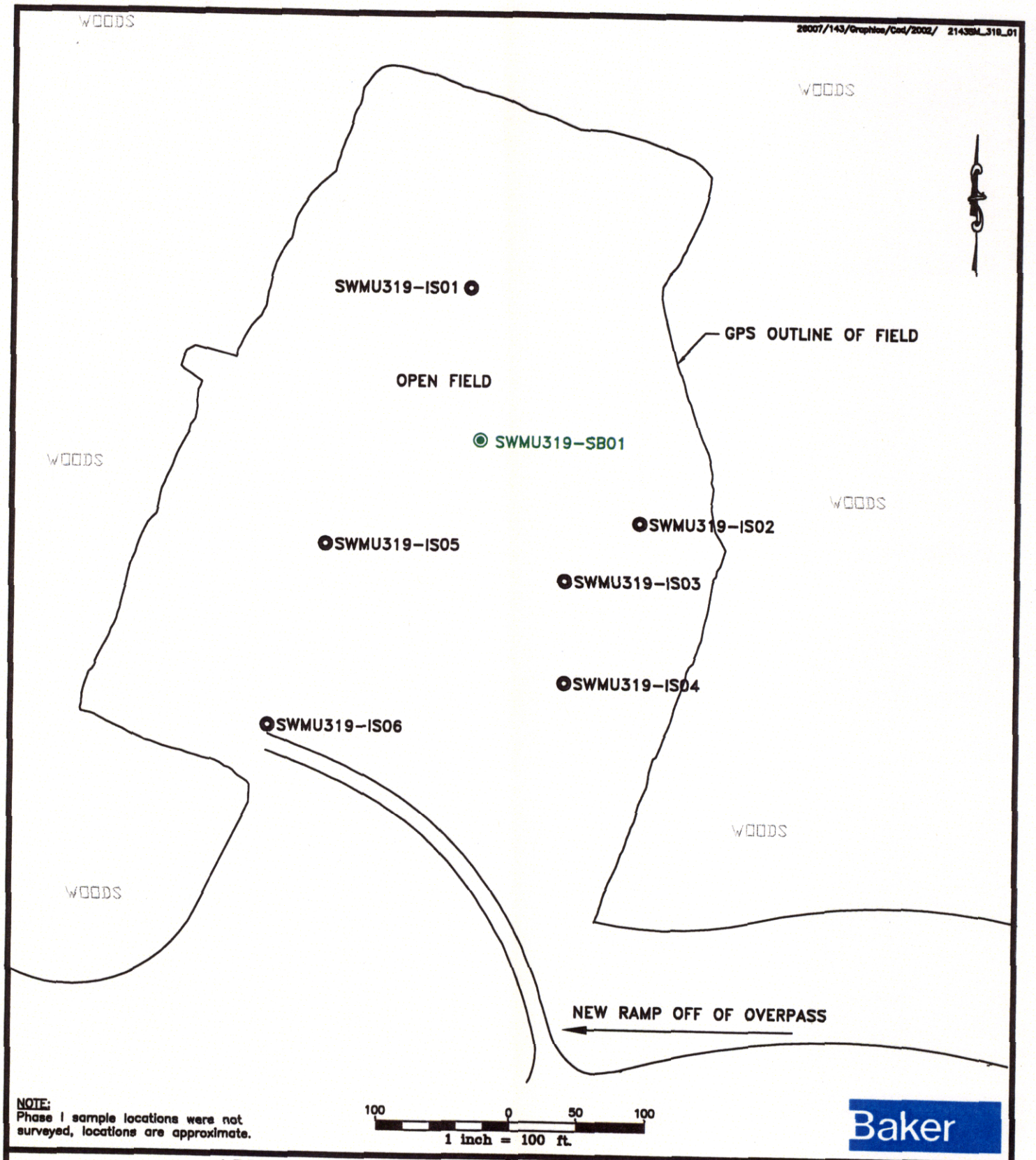
10/7/02
SWMU319_SOIL.xls

TABLE 4

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 319
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzo(a)anthracene | NE | NE | 358 | 2900 | 1/7 | 220 J | NA | NA | 0 | 0 |
| Benzo(a)pyrene | NE | NE | 378 (1) | 290 | 1/7 | 410 | NA | NA | 1 | 1 |
| Benzo(b)fluoranthene | NE | NE | 4800 (2) | 2900 | 1/7 | 420 | NA | NA | 0 | 0 |
| Benzo(ghi)perylene | NE | NE | 6720000 | NE | 1/7 | 260 J | NA | NA | 0 | 0 |
| Benzo(k)fluoranthene | NE | NE | 48000 (2) | 29000 | 1/7 | 170 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 5/7 | 95 J - 570 | NA | NA | 0 | 0 |
| Chrysene | NE | NE | 39800 | 290000 | 1/7 | 270 J | NA | NA | 0 | 0 |
| Dibenz(a,h)anthracene | NE | NE | 168 | 290 | 1/7 | 88 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 30000000 | 1/7 | 280 J | NA | NA | 0 | 0 |
| Indeno(1,2,3-cd)pyrene | NE | NE | 3260 | 2900 | 1/7 | 220 J | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/7 | 130 J | NA | NA | 0 | 0 |
| Pyrene | NE | NE | 286000 | 54000000 | 1/7 | 300 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.8 | 1.6 | 5.24 | 2.7 | 1/7 | 1.6 | 0 | 0 | 0 | 0 |
| Barium | 16 | 22 | 848 | 100000 | 1/7 | 15.8 | 0 | 0 | 0 | 0 |
| Cadmium | 0.01 | 0.01 | 2.7 | 810 | 1/7 | 0.14 J | 1 | 1 | 0 | 0 |
| Chromium | 12 | 16 | 27 | 450 | 7/7 | 3.5 - 11.3 | 0 | 0 | 0 | 0 |
| Lead | 15 | 8.2 | 270 | 750 | 7/7 | 2 - 21.1 J | 2 | 2 | 0 | 0 |
| Mercury | 0.08 | 0.08 | 0.015 | 610 | 2/7 | 0.08 - 0.17 | 1 | 1 | 2 | 0 |
| Silver | 0.05 | 0.09 | 0.22 | 10000 | 1/7 | 0.41 J | 1 | 1 | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 4150 mg/kg.
(2) - Site-specific criteria calculated with interim 2L and TOC of 4150mg/kg.
AOC comparison - AOC 1 Subsurface Soil
Base comparison - Sand Subsurface Soil



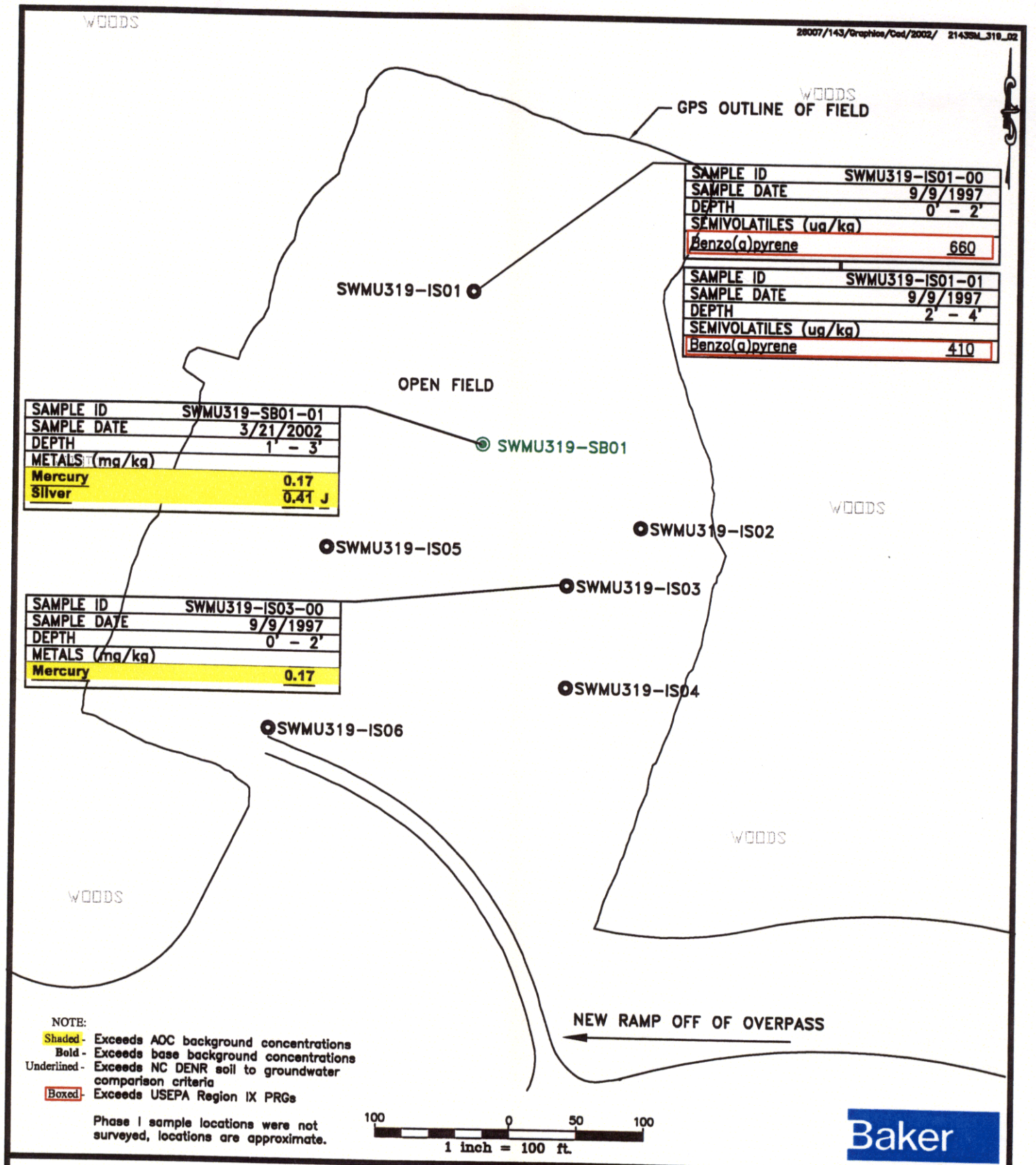

LEGEND

- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 319
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037538B37X




LEGEND

- SOIL BORING
- PHASE I SOIL BORING

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 319
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.36 SWMU 336 - AS4106 Paint Stripper

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.36.1 SWMU Description and History

SWMU 336 consists of a pair of paint stripping vats located in a separate room within Building AS-4106 at MCAS New River. The floor beneath the vats is concrete with two floor drains located on either side of the vats. A spill kit is located near the exit doors. Spills that occur at this SWMU are properly contained and cleaned up according the Base personnel. A SWMU investigation plan is presented as Figure 1.

Sediment samples were proposed to be collected from the floor drains as part of the Phase I CSIs that were conducted in September 1997. The purpose of the sediment sampling was to determine if a release(s) occurred at the SWMU because the contaminated material would most likely exit the SWMU via the floor drains. However, the floor drains contained no sediment that could be sampled.

### 4.36.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 20 and April 3, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two temporary well borings advanced along the path of the drain lines exiting the room with the paint stripping vats.
- Groundwater sampling at two temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 11.6 to 11.7 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 12.3 to 12.7 feet above mean MSL.

### 4.36.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

The analytical results and statistical summaries for positive detections from the two phases were compared to the following screening criteria and are presented in Tables 2 through 5:

- AOC background criteria

- Base background criteria
- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria and the NC DENR soil to groundwater criteria and/or USEPA Region IX industrial PRGs.

Seven VOCs were detected in the soil sample set, as follows: 1,1,1-trichloroethane, acetone, methylene chloride, tetrachloroethene, toluene, trichlorofluoromethane, and xylenes (total). Methylene chloride exceeded the NC DENR soil to groundwater screening criteria in one of the surface and subsurface soil samples. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

Three SVOCs were detected in the soil sample set, as follows: bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and di-n-octyl phthalate. None of the detected SVOCs exceeded the NC DENR soil to groundwater screening criteria or the USEPA Region IX industrial PRGs.

Seven metals were detected in the surface soil sample set, as follow: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Barium and chromium were detected above the AOC and/or Base background criteria. However, the concentrations did not exceed the NC DENR soil to groundwater screening criteria or the USEPA Region IX industrial PRGs. Cadmium was detected above the AOC and Base background criteria, as well as the NC DENR soil to groundwater screening criteria. Mercury exceeded the NC DENR soil to groundwater criteria; however the concentrations were below the AOC and Base background criteria and Region IX PRG.

Four metals were detected in the subsurface soil samples, as follows: barium, chromium, lead, and mercury. None of these four metals exceeded the background criteria or USEPA Region IX PRGs. Mercury was the only metal that exceeded the NC DENR soil to groundwater values, however it did not exceed the AOC or Base background criteria.

Groundwater

The analytical results and statistical summary for positive detections were compared to the following screening criteria and are presented on Tables 6 and 7:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Six VOCs were detected in the groundwater samples, as follows: 1,1,1-trichloroethane, 1,1,2-trichloro-1,2,2-trifluoroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, and tetrachloroethene. Tetrachloroethene was detected in the sample from well SWMU 336-TW01 at concentrations above the 2L standard. No other VOCs were detected above the 2L standards.

No SVOCs were detected above the laboratory reporting limits in the groundwater samples from SWMU 336.

Three metals were detected in the groundwater samples, as follows: barium, chromium, and lead. None of these metals exceeded the established screening criteria.

Most of the compounds detected in groundwater (except for 1,1,2-trichloro-1,2,2-trifluoroethane, 1,1-dichloroethane, 1,1-dichloroethene, and cis-1,2-dichloroethene) were detected in the soils at SWMU 336.

### 4.36.4 Conclusions

One VOC (methylene chloride) and one metal (cadmium) were detected in soil at concentrations exceeding both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria.

One VOC (tetrachloroethene) exceeded the NC 2L standard in groundwater.

Based on evaluation of the results, additional investigation at SWMU 336 is warranted to investigate VOCs and metals in soil and/or groundwater. The additional investigation activities are presented in Section 5.0.

TABLE 1
SUMMARY OF PHASE II CONFIRMATORY SAMPLING
TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS
RCRA CONFIRMATORY SAMPLING INVESTIGATION
MCB, CAMP LEJEUNE, NORTH CAROLINA
CTO-0143

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU336-TW01 | 3/20/02 | BAKER | 24.04 | 24.1 | 16 | 16 | 3 | 1 | 5 | 11.7 | 12.3 |
| SWMU336-TW02 | 3/20/02 | BAKER | 24.30 | 24.4 | 15 | 15 | 3 | 1 | 5 | 11.6 | 12.7 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU336

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU336-TW01-00 03-20-2002 0' - 1' | | SWMU336-TW02-00 03-20-2002 0' - 1' | |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Acetone | NE | NE | 2810 | 6200000 | 33 | | 8 | J |
| Methylene chloride | NE | NE | 25 (1) | 21000 | 12 | | 28 | |
| Toluene | NE | NE | 7270 | 520000 | 3 | J | ND | |
| Xylenes (total) | NE | NE | 4960 | 210000 | 1 | J | ND | |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 860 | | 100 | J |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 860 | | ND | |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 110 | J | ND | |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 0.3 | J | 0.68 | J |
| Barium | 33 | 23 | 848 | 100000 | 17.6 | | 48.2 | |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | 1.8 | | 4.4 | |
| Chromium | 19 | 12 | 27 | 450 | **13.8** | | **15.3** | |
| Lead | 23 | 26 | 270 | 750 | 18.9 | J | 17.7 | J |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 0.06 | | 0.06 | |
| Selenium | 1.2 | 2.9 | 12 | 10000 | ND | | 0.62 | |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| Acetone | NE | NE | 2810 | 6200000 | 2/2 | 8 J - 33 | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 25 (2) | 21000 | 2/2 | 12 - 28 | NA | NA | 1 | 0 |
| Toluene | NE | NE | 7270 | 520000 | 1/2 | 3 J | NA | NA | 0 | 0 |
| Xylenes (total) | NE | NE | 4960 | 210000 | 1/2 | 1 J | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 2/2 | 100 J - 860 | NA | NA | 0 | 0 |
| Butyl benzyl phthalate | NE | NE | 27800 | 100000000 | 1/2 | 860 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 10000000 | 1/2 | 110 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 1.7 | 1.3 | 5.24 | 2.7 | 2/2 | 0.3 J - 0.68 J | 0 | 0 | 0 | 0 |
| Barium | 33 | 23 | 848 | 100000 | 2/2 | 17.6 - 48.2 | 1 | 1 | 0 | 0 |
| Cadmium | 0.04 | 0.04 | 2.7 | 810 | 2/2 | 1.8 - 4.4 | 2 | 2 | 1 | 0 |
| Chromium | 19 | 12 | 27 | 450 | 2/2 | 13.8 - 15.3 | 0 | 2 | 0 | 0 |
| Lead | 23 | 26 | 270 | 750 | 2/2 | 17.7 J - 18.9 J | 0 | 0 | 0 | 0 |
| Mercury | 0.1 | 0.13 | 0.015 | 610 | 2/2 | 0.06 | 0 | 0 | 2 | 0 |
| Selenium | 1.2 | 2.9 | 12 | 10000 | 1/2 | 0.62 | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU336-TW01-04 03-20-2002 7' - 9' | | SWMU336-TW02-04 03-20-2002 7' - 9' | |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1400000 | 5 | J | ND | |
| Acetone | NE | NE | 2810 | 6200000 | ND | | 6 | J |
| Methylene chloride | NE | NE | 25 (1) | 21000 | 41 | | 9 | |
| Tetrachloroethene | NE | NE | 7.4 | 19000 | 7 | | ND | |
| Toluene | NE | NE | 7270 | 520000 | ND | | 2 | J |
| Trichlorofluoromethane | NE | NE | 31500 | 2000000 | ND | | 2 | J |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | ND | | 95 | J |
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 47 | 37 | 848 | 100000 | 11.5 | | 7.1 | |
| Chromium | 38 | 31 | 27 | 450 | 11.6 | | 9.5 | |
| Lead | 15 | 13 | 270 | 750 | 5.5 | J | 4.5 | J |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 0.03 | J | 0.03 | J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

9/12/02
SWMU336_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NE | NE | 1670 | 1400000 | 1/2 | 5 J | NA | NA | 0 | 0 |
| Acetone | NE | NE | 2810 | 6200000 | 1/2 | 6 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 25 (1) | 21000 | 2/2 | 9 - 41 | NA | NA | 1 | 0 |
| Tetrachloroethene | NE | NE | 7.4 | 19000 | 1/2 | 7 | NA | NA | 0 | 0 |
| Toluene | NE | NE | 7270 | 520000 | 1/2 | 2 J | NA | NA | 0 | 0 |
| Trichlorofluoromethane | NE | NE | 31500 | 2000000 | 1/2 | 2 J | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 180000 | 1/2 | 95 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 47 | 37 | 848 | 100000 | 2/2 | 7.1 - 11.5 | 0 | 0 | 0 | 0 |
| Chromium | 38 | 31 | 27 | 450 | 2/2 | 9.5 - 11.6 | 0 | 0 | 0 | 0 |
| Lead | 15 | 13 | 270 | 750 | 2/2 | 4.5 J - 5.5 J | 0 | 0 | 0 | 0 |
| Mercury | 0.07 | 0.1 | 0.015 | 610 | 2/2 | 0.03 J | 0 | 0 | 2 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Combined Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU336-GW01 04-03-2002 | | SWMU336-GW02 04-03-2002 | |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 1,1,1-Trichloroethane | NE | 200 | 19 | | ND | |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | NE | 210000 | ND | | 1 | J |
| 1,1-Dichloroethane | NE | 700 | 21 | | ND | |
| 1,1-Dichloroethene | NE | 7 | 2 | J | ND | |
| cis-1,2-Dichloroethene | NE | 70 | 0.8 | J | ND | |
| Tetrachloroethene | NE | 0.7 | 27 | | ND | |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 29.3 | J | 55.2 | J |
| Chromium | 5.8 | 50 | 0.84 | J | 2 | J |
| Lead | 3.6 | 15 | ND | | 2.6 | J |

**No SVOCs were detected in the samples**

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

9/12/02
SWMU336_WATER.xls

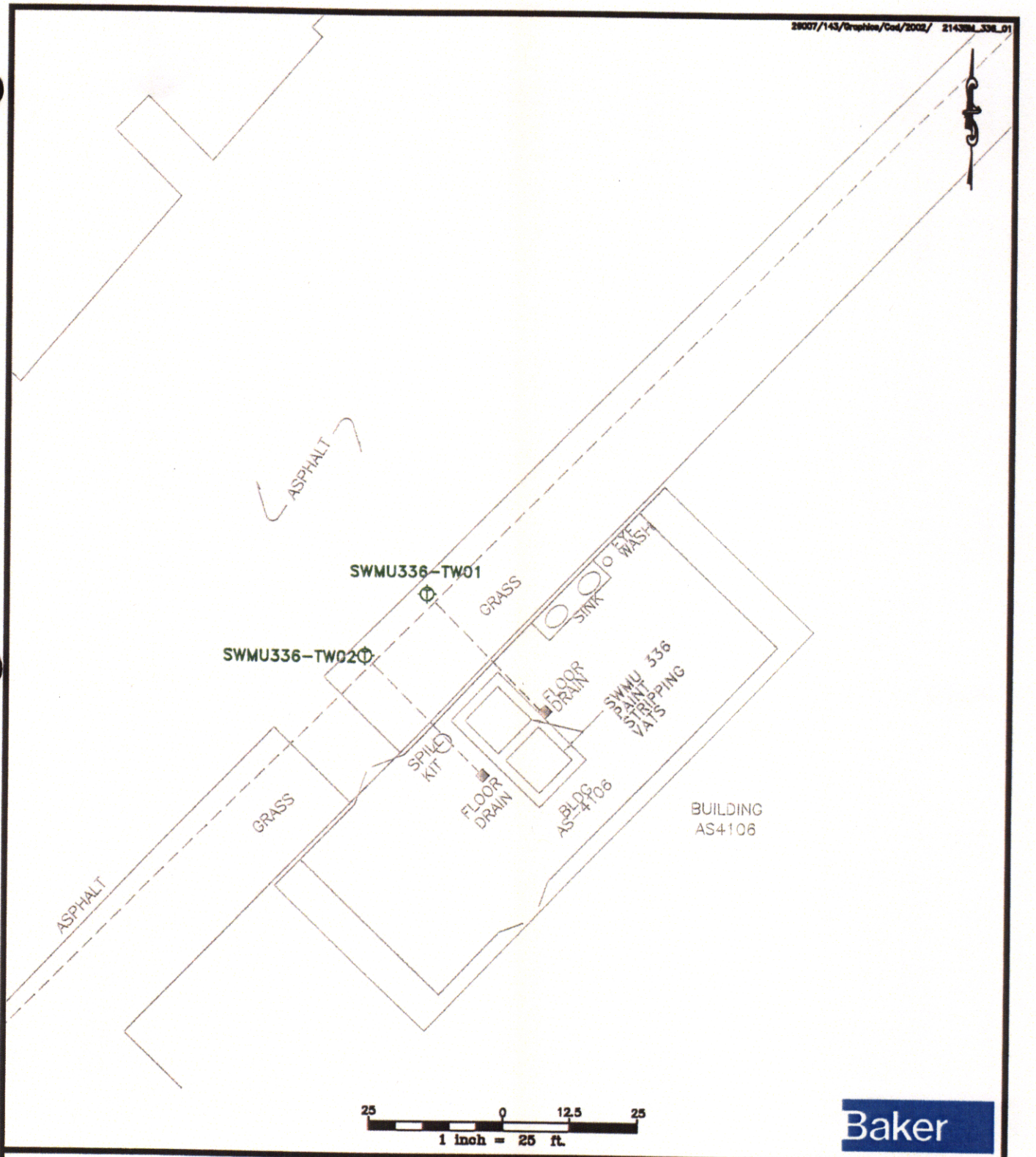
TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 1,1,1-Trichloroethane | NE | 200 | 1/2 | 19 | NA | 0 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | NE | 210000 | 1/2 | 1 J | NA | 0 |
| 1,1-Dichloroethane | NE | 700 | 1/2 | 21 | NA | 0 |
| 1,1-Dichloroethene | NE | 7 | 1/2 | 2 J | NA | 0 |
| cis-1,2-Dichloroethene | NE | 70 | 1/2 | 0.8 J | NA | 0 |
| Tetrachloroethene | NE | 0.7 | 1/2 | 27 | NA | 1 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 2/2 | 29.3 J - 55.2 J | 0 | 0 |
| Chromium | 5.8 | 50 | 2/2 | 0.84 J - 2 J | 0 | 0 |
| Lead | 3.6 | 15 | 1/2 | 2.6 J | 0 | 0 |

**No SVOCs were detected in the samples**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.



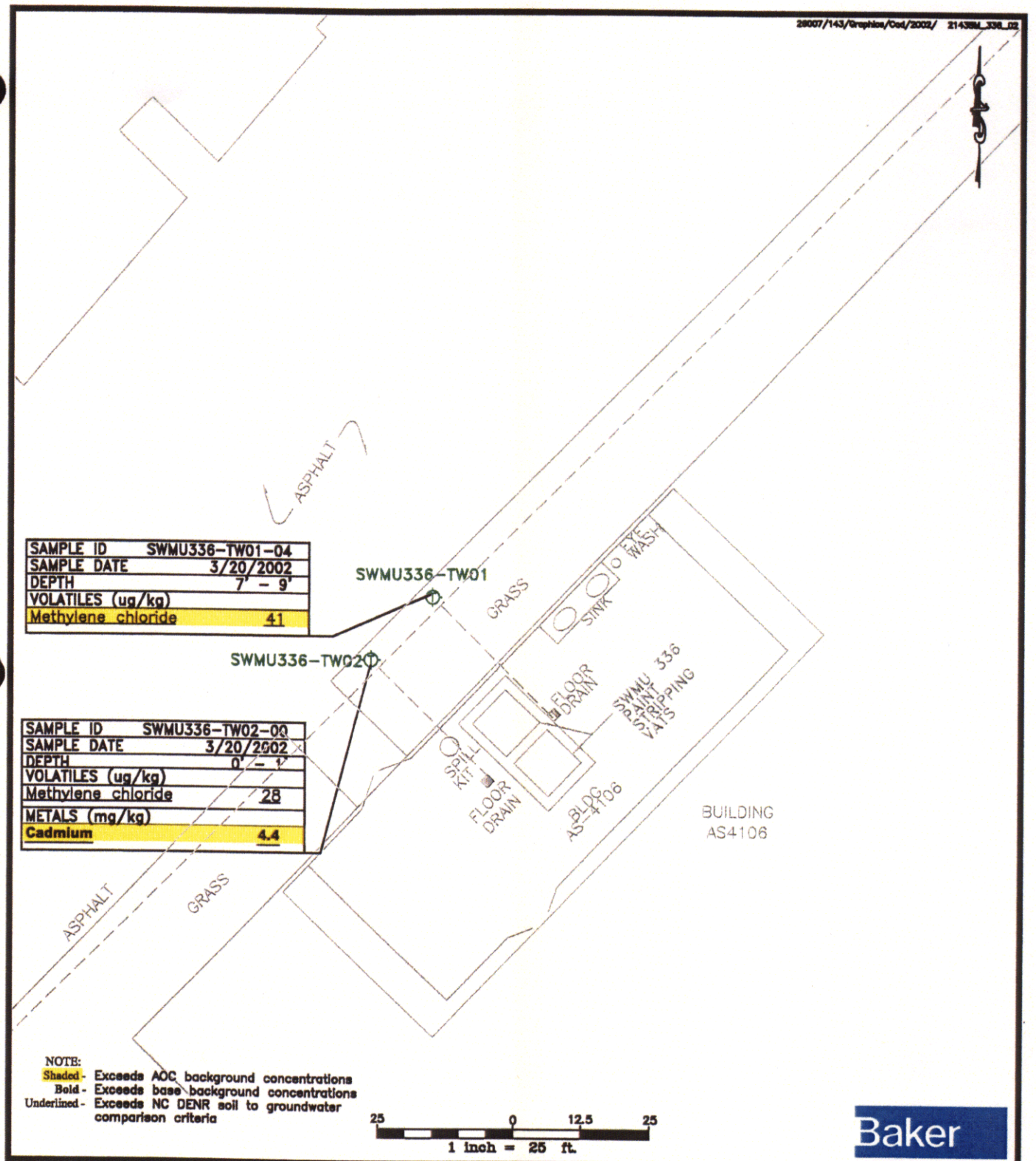

Baker

**LEGEND**

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 336
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

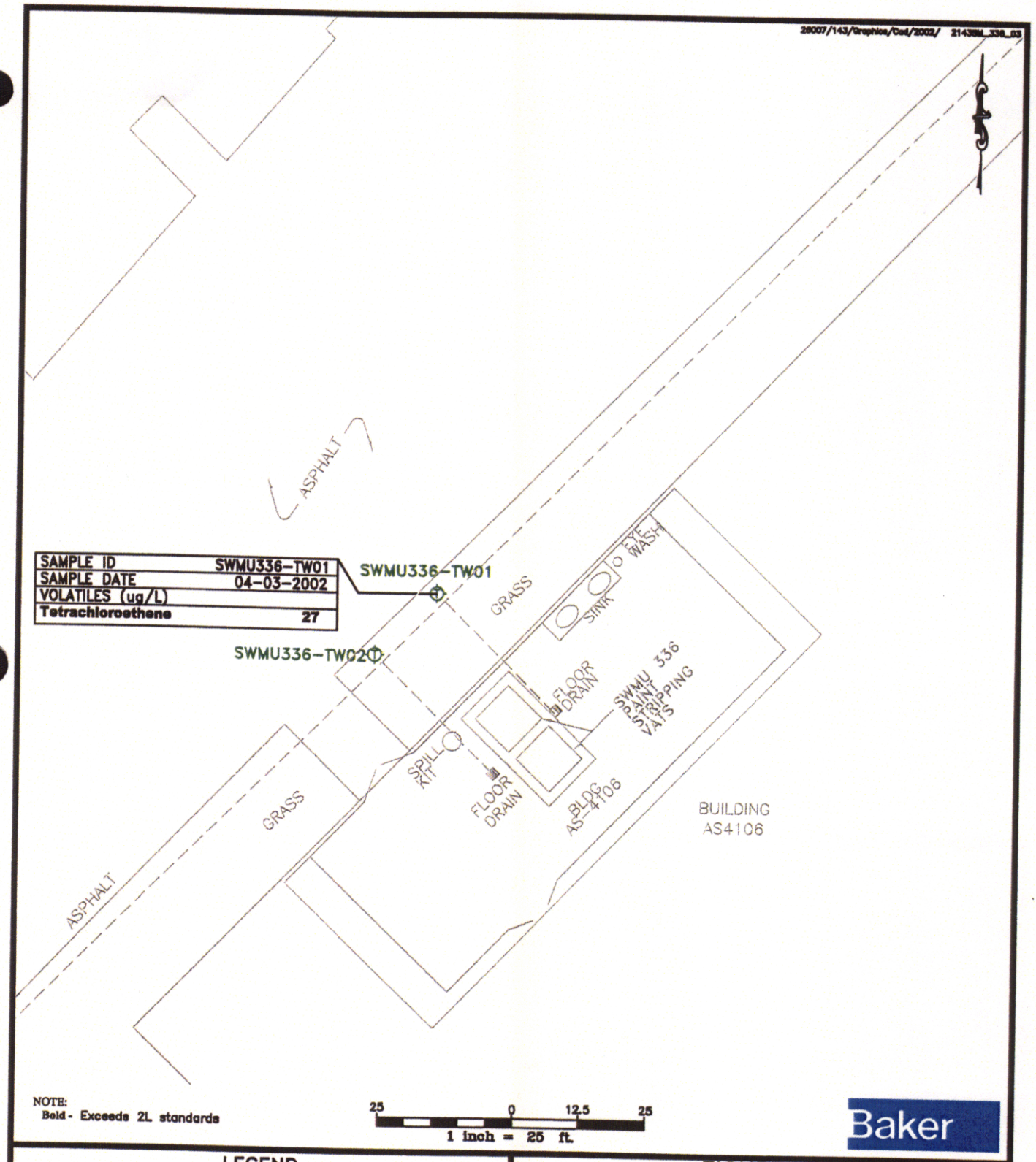



LEGEND

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 336
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Bold - Exceeds 2L standards

25 0 12.5 25
1 inch = 25 ft.

Baker

LEGEND

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 336
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.37 SWMU 339 - AS4146 Sandblasting Area

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.37.1 SWMU Description and History

SWMU 339 is a covered sandblasting area located behind Building AS-4146 along White Street at the MCAS. The SWMU consists of a 10-foot by 15-foot enclosed tarp area that contains sandblasting equipment and spent sand and grit. Paint (possibly containing lead) is removed from various aircraft equipment and parts inside the enclosed tarp. The used sand and grit is shoveled into 55-gallon drums and disposed as hazardous waste. The area between the SWMU and Building AS-4146 is covered with concrete. The equipment storage area behind the SWMU is covered with asphalt.

A stormwater collection system surrounds Building AS-4146 and eventually drains into the main collection system for the MCAS. One of the stormwater collection basins is located approximately 10 feet from SWMU and collects stormwater run-off from the general area around the SWMU. A SWMU investigation plan is presented as Figure 1.

A Phase I CSI was conducted in September 1997. The purpose of the investigation was to determine if (1) sandblasting operations have impacted surface and subsurface soils in the vicinity of the SWMU and (2) if wastes (e.g., sand, grit, lead-based paint chips) have accumulated in the storm water collection basin adjacent to the SWMU. Two soil samples were collected from one soil boring advanced approximately 20 feet west of the SWMU (see Figure 1). In addition, a sediment sample (sand/grit material) was collected from the stormwater catch basin located approximately 10 feet east of the SWMU. The samples were submitted to Quanterra Laboratories and analyzed for VOCs, SVOCs, and RCRA metals. The analytical results were compared to background criteria, NC DENR soil to groundwater screening criteria, and USEPA Region IX residential PRGs. The sediment sample was compared to North Carolina sediment screening values. Based on evaluation of the soil results, a one VOC (acetone) and one SVOC (4-methylphenol) exceeded the regulatory driven criteria. Therefore, additional investigation at SWMU 339 was recommended in the form of a Phase II CSI.

The sediment sample collected from the stormwater catch basin contained elevated concentrations of SVOCs and metals that exceeded regulatory driven criteria. The elevated concentrations of the SVOCs and metals detected in this sample indicated that stormwater run-off may be transporting contaminated sand from the blasting area into the stormwater system. As a result, Baker recommended that controls be instituted to eliminate the transportation of contaminated sand and grit into the stormwater collection system.

While writing the Project Plans for the Phase II CSI, it was determined that the SWMU was located in an industrial setting. Therefore, the soil data collected during the Phase II CSI would be compared to the USEPA Region IX industrial PRGs in lieu of the residential PRGs. In addition, it was determined that the COPCs identified in Phase I should be re-evaluated against the industrial PRGs.

### 4.37.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 20 and April 3, 2002, in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1 and were selected based on

previous investigation results from the Phase I CSI. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at three temporary well borings
- Resampling of subsurface soils at boring SWMU339-IS01 to confirm the concentrations of VOCs detected in the Phase I CSI.
- Groundwater sampling at three temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 1.2 to 2.4 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 18.1 to 18.9 feet above mean MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow south/southwest.

### 4.37.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs and SVOCs. A summary of the analytical results is included as Appendix G.

Soil

For the purpose of this investigation, the analytical results for the COPCs identified in Phase I were combined with the analytical results collected during Phase II. The analytical results and statistical summaries for positive detections from the two phases are presented on Tables 2 though 5 and were compared to the following screening criteria:

- Default and site-specific NC DENR soil to groundwater criteria
- USEPA Region IX industrial PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Ten VOCs were detected in the soil sample set. None of these detected VOCs exceeded the USEPA Region IX Industrial PRGs. Methylene chloride was the only VOC detected in the surface soil samples that exceeded the NC DENR soil to groundwater criteria. Acetone, bromoform, chloroform, and methylene chloride exceeded the NC DENR soil to groundwater criteria in one or more of the subsurface soil samples. None of the other VOCs detected in the subsurface samples exceeded the applicable screening criteria.

Four SVOCs were detected in the soil sample set, as follows: 4-methylphenol, benzaldehyde, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate. None of these SVOCs exceeded the USEPA Region IX industrial PRGs. 4-methylphenol exceeded the NC DENR soil to groundwater criteria in subsurface soil sample SWMU339-IS01-01, which was collected in September 1997 during the Phase I CSI. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

It should be noted that the concentrations of acetone (3200 ug/kg) and 4-methylphenol (2600 ug/kg) detected in the subsurface soil sample SWMU 339-IS01-01 which was collected in September 1997 during the Phase I CSI, appeared to be anomalously high. As a result, this location was resampled

during the Phase II. The concentrations of acetone (40 ug/kg) and 4-methylphenol (not detected) decreased significantly and were below the applicable screening criteria. As a result, the detections of acetone and 4-methylphenol are not perceived to be COPCs at the SWMU.

Groundwater

No VOCs or SVOCs were detected above the laboratory reporting limits in the groundwater samples collected from the three temporary wells.

### 4.37.4 Conclusions

A few VOCs (acetone, bromoform, chloroform and methylene chloride) and one SVOC (4-methylphenol) were detected in soil at concentrations exceeding the applicable screening criteria. Concentrations of acetone and 4-methylphenol were detected in one subsurface soil sample collected in September 1997 and appeared to be anomalously high. Subsequent resampling in March 2002 indicated that acetone and 4-metylphenol were significantly lower (below the applicable screening criteria) or "not detected". As a result, acetone and 4-methylphenol are not perceived to be COPCs at the SWMU.

All detected VOCs were below USEPA Region IX PRGs and although these concentrations also exceeded NC DENR soil to groundwater criteria, they were not detected in groundwater samples collected at the SWMU.

No VOCs or SVOCs were detected above the laboratory reporting limits in groundwater.

Based on evaluation of the results, COPCs were detected in soil below USEPA Region IX PRGs and were mostly detected in subsurface soils. It is unlikely that the constituents detected at this SWMU would persist in the environment for long at the detected concentrations. Low levels of these COPCs appear to be ubiquitous throughout soils. These COPCs may be attributable to lab-type preparation or cleaning and not likely attributable to SWMU operations. Therefore, no further action is warranted at SWMU 339.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU339-TW01 | 3/20/02 | BAKER | 20.14 | 20.3 | 16 | 15 | 3 | 1 | 5 | 1.7 | 18.4 |
| SWMU339-TW02 | 3/20/02 | BAKER | 20.09 | 20.4 | 15 | 15 | 3 | 1 | 5 | 1.15 | 18.9 |
| SWMU339-TW03 | 3/21/02 | BAKER | 20.51 | 20.8 | 15 | 15 | 3 | 1 | 5.4 | 2.39 | 18.1 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU339

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 339
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU339-IS01-00 09-09-1997 0' - 2' | SWMU339-TW01-00 03-20-2002 0' - 1' | SWMU339-TW02-00 03-20-2002 0' - 1' | SWMU339-TW03-00 03-20-2002 0' - 1' |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | |
| 2-Butanone | 692 | 28000000 | 17 J | ND | ND | 38 J |
| Acetone | 2810 | 6200000 | 300 | 16 J | 70 J | 220 J |
| Carbon disulfide | 4940 | 720000 | ND | ND | ND | 2 J |
| Ethylbenzene | 241 | 230000 | 4.7 J | ND | ND | ND |
| Methylene chloride | 28 (1) | 21000 | ND | 2 J | 18 | 29 |
| Toluene | 7270 | 520000 | 9.7 | ND | ND | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | ND | 62 J | ND | 240 J |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | 38 J | ND | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6572 mg/kg.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 339
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | 692 | 28000000 | 2/4 | 17 J - 38 J | NA | NA | 0 | 0 |
| Acetone | 2810 | 6200000 | 4/4 | 16 J -300 | NA | NA | 0 | 0 |
| Carbon disulfide | 4940 | 720000 | 1/4 | 2 J | NA | NA | 0 | 0 |
| Ethylbenzene | 241 | 230000 | 1/4 | 4.7 J | NA | NA | 0 | 0 |
| Methylene chloride | 28 (1) | 21000 | 3/4 | 2 J - 29 | NA | NA | 1 | 0 |
| Toluene | 7270 | 520000 | 1/4 | 9.7 | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 2/4 | 62 J - 240 J | 0 | 0 | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 1/4 | 38 J | 0 | 0 | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6572 mg/kg.
AOC comparison - AOC 2 Surface Soil
Base comparison - Loam-Silt Surface Soil

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 339
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU339-IS01-01 09-09-1997 2' - 4' | SWMU339-IS01-01 03-20-2002 1' - 3' | SWMU339-TW01-03 03-20-2002 5' - 7' | SWMU339-TW02-06 03-20-2002 11' - 13' |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | |
| 2-Butanone | 692 | 28000000 | ND | 12 J | ND | ND |
| Acetone | 2860 (1) | 6200000 | 3200 | 40 | 9 J | 66 J |
| Bromoform | 3.9 (1) | 310000 | ND | ND | ND | ND |
| Chloroethane | 13600 | 6500 | ND | ND | 18 J | ND |
| Chloroform | 2.1 (1) | 520 | ND | ND | ND | 10 J |
| Ethylbenzene | 241 | 230000 | ND | 23 | ND | ND |
| Methylene chloride | 28 (1) | 21000 | ND | 38 | 3 J | 120 |
| Toluene | 7270 | 520000 | ND | 11 | ND | ND |
| Xylenes (total) | 4960 | 210000 | ND | ND | ND | 9 J |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| 4-Methylphenol | 37 (1) | 4400000 | 2600 | ND | ND | ND |
| Benzaldehyde | NE | 88000000 | NA | 35 J | ND | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | ND | 290 J | 89 J | 820 |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND | 95 J | 43 J | 26 J |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6572 mg/kg.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

8/30/02
SWMU339_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 339
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU339-TW03-02 03-20-2002 3' - 5' |
|---|---|---|---|
| **VOLATILES (ug/kg)** | | | |
| 2-Butanone | 692 | 28000000 | ND |
| Acetone | 2860 (1) | 6200000 | 18 J |
| Bromoform | 3.9 (1) | 310000 | 59 |
| Chloroethane | 13600 | 6500 | ND |
| Chloroform | 2.1 (1) | 520 | ND |
| Ethylbenzene | 241 | 230000 | ND |
| Methylene chloride | 28 (1) | 21000 | 73 |
| Toluene | 7270 | 520000 | ND |
| Xylenes (total) | 4960 | 210000 | ND |
| **SEMIVOLATILES (ug/kg)** | | | |
| 4-Methylphenol | 37 (1) | 4400000 | ND |
| Benzaldehyde | NE | 88000000 | ND |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 160 J |
| Di-n-octyl phthalate | 10000000 | 10000000 | ND |

Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6572 mg/kg.
NA - Not analyzed. Not on the Phase I Target Compound List
ND - Analyte not detected.
NE - Not established

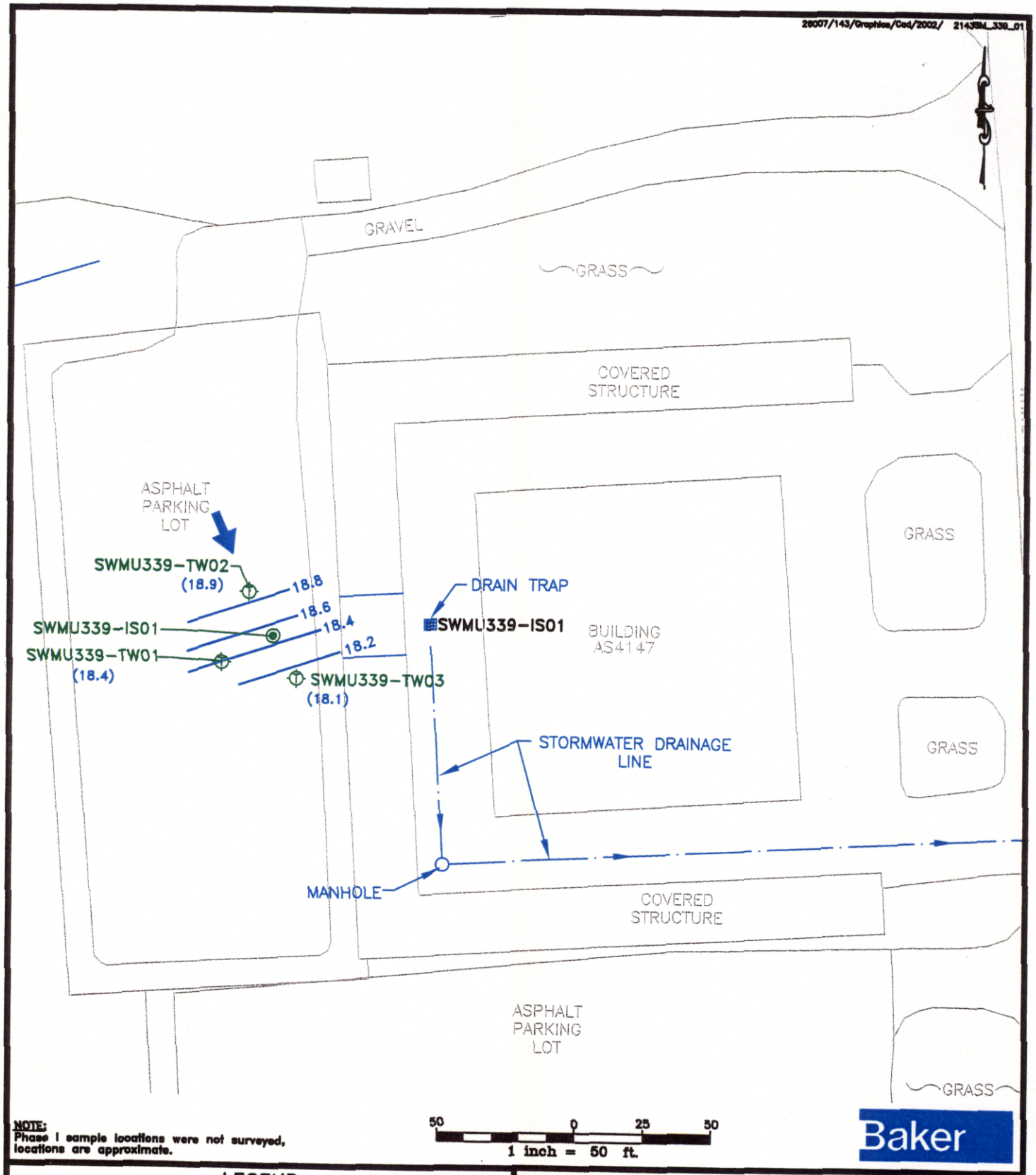
8/30/02
SWMU339_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 339
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | 692 | 28000000 | 1/5 | 12 J | NA | NA | 0 | 0 |
| Acetone | 2860 (1) | 6200000 | 5/5 | 9 J - 3200 | NA | NA | 1 | 0 |
| Bromoform | 3.9 (1) | 310000 | 1/5 | 59 | NA | NA | 1 | 0 |
| Chloroethane | 13600 | 6500 | 1/5 | 18 J | NA | NA | 0 | 0 |
| Chloroform | 2.1 (1) | 520 | 1/5 | 10 J | NA | NA | 1 | 0 |
| Ethylbenzene | 241 | 230000 | 1/5 | 23 | NA | NA | 0 | 0 |
| Methylene chloride | 28 (1) | 21000 | 4/5 | 3 J - 120 | NA | NA | 3 | 0 |
| Toluene | 7270 | 520000 | 1/5 | 11 | NA | NA | 0 | 0 |
| Xylenes (total) | 4960 | 210000 | 1/5 | 9 J | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 4-Methylphenol | 37 (1) | 4400000 | 1/5 | 2600 | NA | NA | 1 | 0 |
| Benzaldehyde | NE | 88000000 | 1/4 | 35 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | 6670 | 180000 | 4/5 | 89 J - 820 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | 10000000 | 10000000 | 3/5 | 26 J - 95 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 6572 mg/kg.
AOC comparison - AOC 2 Subsurface Soil
Base comparison - Silt Subsurface Soil




**NOTE:**
Phase I sample locations were not surveyed, locations are approximate.

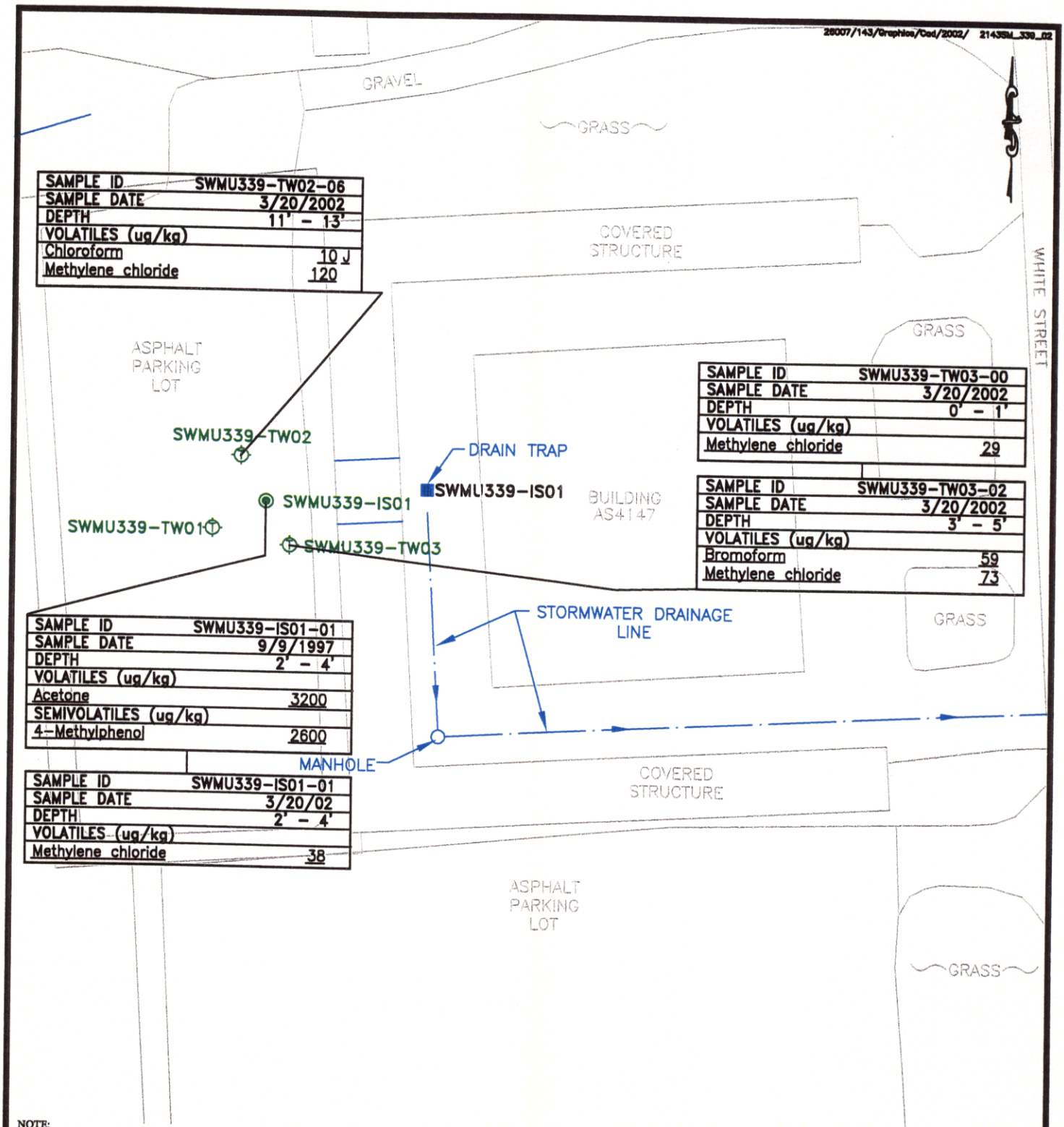
Baker

## LEGEND

- TEMPORARY WELL
- SOIL BORING SAMPLE
- PHASE I SEDIMENT SAMPLE
- GROUNDWATER FLOW DIRECTION
- 18.2 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 339
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




NOTE:
Underlined – Exceeds NC DENR soil to groundwater comparison criteria

Phase I sample locations were not surveyed, locations are approximate.

50 0 25 50
1 inch = 50 ft.

Baker

## LEGEND

- TEMPORARY WELL
- SOIL BORING SAMPLE
- PHASE I SEDIMENT SAMPLE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 339
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.38 SWMU 358 - Sneads Ferry Road Battery Dump

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.38.1 SWMU Description and History

SWMU 358 was discovered on May 8, 2000. The site is located near the intersection of Main Service Road and Sneads Ferry Road and lies northeast of MCB Camp Lejeune's soil borrow pit. The battery dump consists of an area 15' long by 20' wide. Initially, two 55-gallon drums were filled with batteries by the Resource Conservation and Recovery Branch and removed from the site. A RCRA Interim Measure (IM) was conducted by OHM Remediation Services Corp. on July 25, 2001. The final excavation was approximately 20 feet wide by 31 feet long by 6 feet deep. Approximately 28,300 pounds of soil was hauled offsite. No additional batteries were discovered during the excavation activities. Confirmation samples were taken from the area and indicated that residual material from the batteries was removed. Portions of the IM report (OHM, October 2001) including figures and analytical results are presented in Appendix K.

### 4.38.2 Conclusions

A site visit was made by the EMD, CH2Mhill, NC DENR and Baker on April 9, 2002. Based on evaluation of the IM results and the site visit it was confirmed that additional activity at SWMU 358 was not warranted during the Phase II CSI.

## 4.39 SWMU 359 - Lot 201 Battery Dump

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.39.1 SWMU Description and History

SWMU 359 is a former battery dump located at Lot 201 approximately 100 yards west of Piney Green Road. The EMD at the Base was notified of the potential SWMU on December 20, 2000. A subsequent site visit by the Installation Restoration Division confirmed the existence of the battery dump. The SWMU consists of three 30-foot by 30-foot areas where erosion had exposed lithium, magnesium and nickel-cadmium batteries, and communication wire. An interim measure (IM) was performed in July 2001 and included removal of the batteries and associated soil. Eighty-two loads of excavated material were deposited at the base landfill. Nineteen confirmatory samples were collected from the excavations and analyzed for metals including mercury. Subsequent to sampling, the excavations were backfilled with clean borrow. Portions of the IM report (OHM, October 2001) including figures and analytical results from confirmatory sampling are presented in Appendix K. Based on evaluation of the results zinc exceeded the NC DENR soil to groundwater criteria in one or more of the samples. Therefore, it was decided to include the SWMU in the Phase II Confirmatory Sampling Program. A SWMU investigation plan is presented as Figure 1.

### 4.39.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 26 and April 9, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to further evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of past disposal practices at the SWMU. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Subsurface soil sampling at two temporary well borings
- Groundwater sampling at two temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. The water table was measured in the wells at depths of approximately 5 feet below the ground surface. A summary of the groundwater sampling field parameters is included in Appendix D.

### 4.39.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, pesticides, and RCRA metals. A summary of the laboratory analytical results is included in Appendix G.

Soil

The analytical results and statistical summaries for positive detections are presented on Tables 2 and 3 and were compared to the following screening criteria:

- Base background criteria
- Default NC DENR soil to groundwater criteria

- USEPA Region IX industrial PRGs

It should be noted that SWMU 359 is not associated with a specific AOC due to the SWMU's location with respect to the various AOC boundaries. Therefore, the data was not compared to AOC background criteria.

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Methylene chloride was the only VOC detected in the sample set. The concentration detected in sample SWMU359-TW02-02 exceeded the NC DENR soil to groundwater screening criteria.

No SVOCs or pesticides were detected above the laboratory reporting limits in the samples.

Five metals were detected in the sample set, as follows: cadmium, chromium, lead, mercury, and silver. Most of the metals were detected in sample SWMU359-TW01-02. Silver was detected in this sample above the background criteria and the NC DENR soil to groundwater screening criteria. Mercury was detected above the NC DENR soil to groundwater screening criteria but the concentration was below the Base background criteria. Cadmium and lead were detected above the Base background screening criteria, but the concentrations were below the NC DENR soil to groundwater screening criteria and USEPA Region IX industrial PRGs. Chromium did not exceed the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 4 and 5 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX PRGs (for compounds with no 2L standard)

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

No VOCs were detected above the laboratory reporting limits in the samples.

One SVOC (bis(2-Ethylhexyl)phthalate in sample SWMU359-TW01) was detected in the sample set. The concentration was below the 2L standard.

Six pesticides were detected in groundwater samples from one or more of the wells, as follows: 4,4'-DDE, 4,4'-DDD, beta-BHC, delta-BHC, gamma-BHC (lindane), and heptachlor epoxide. Beta-BHC and Heptachlor epoxide exceeded the 2L standards/USEPA Region IX PRGs in both of the samples. None of the other pesticides detected in the samples exceeded the established screening criteria.

Five metals were detected in groundwater samples from one or more of the wells, as follows: barium, cadmium, chromium, lead, and silver. Cadmium and lead exceeded the background screening criteria and the 2L Standards in sample from well SWMU359-TW01. Chromium was detected in the same sample above the Base background screening criteria. However, the concentration was below the 2L standards. None of the other metals detected in the samples exceeded the established screening criteria.

Most of the compounds (except for pesticides) detected in groundwater were detected in soils at the SWMU. It should be noted that the source of the pesticides is unclear because this SWMU has not had a history of accepting pesticide-containing wastes. The pesticides may be attributable to IR Site 6.

### 4.39.4 Conclusions

A few VOCs, pesticides, and metals were detected in soil and/or groundwater at concentrations exceeding applicable screening criteria. Compounds that exceeded both the Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX industrial PRGs in soil were as follows:

- VOCs - methylene chloride
- Metals - silver

Compounds that exceeded the Base background criteria and 2L standards/ USEPA Region IX PRGs in groundwater were as follows:

- Pesticides - beta-BHC and heptachlor epoxide
- Metals- cadmium and lead

It should be noted that the source of the pesticides in groundwater is unclear because this SWMU has not had a history of accepting pesticide-containing wastes. The pesticides may be attributable to IR Site 6. As a result, pesticides are not being considered SWMU-related COPCs. Additional investigations at IR Site 6, including the area of SWMU 359, will evaluate pesticides, cadmium and lead in accordance with state recommendations.

Based on evaluation of the results, no further action is warranted at SWMU 359 because Interim Measures were conducted in July/August 2001 to remove the source of contamination at the SWMU. Low levels of methylene chloride in subsurface soil may be attributable to lab-type preparation/cleaning and not likely attributable to the SWMU. Furthermore, the metals detected in subsurface soil and groundwater were slightly above screening criteria.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | PVC Depth to Groundwater (feet, below top of casing) |
|---|---|---|---|---|---|---|---|---|---|
| SWMU359-TW01 | 3/26/2002 | BAKER | 25.18 | 13 | 13 | 2 | 0 | 3 | 6.04 |
| SWMU359-TW02 | 3/26/2002 | BAKER | 23.77 | 13 | 13 | 2 | 0 | 3 | 5.85 |

Note: The top of PVC well casing was approximately 1-foot above ground surface

Notes:
msl = mean sea level
bgs = below ground surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TABLE 2

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 359
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU359-TW01-02 03-26-2002 3' - 5' | SWMU359-TW02-02 03-26-2002 3' - 5' |
|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | |
| Methylene chloride | NE | 22 | 21000 | ND | 30 |
| **METALS (mg/kg)** | | | | | |
| Cadmium | 0.01 | 2.7 | 810 | **1.9** | ND |
| Chromium | 16 | 27 | 450 | 3.9 | 1.9 |
| Lead | 8.2 | 270 | 750 | **29.6** | ND |
| Mercury | 0.08 | 0.015 | 610 | 0.02 J | ND |
| Silver | 0.09 | 0.22 | 10000 | **0.24** J | ND |

**No SVOCs or pesticides were detected in the samples.**

**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
NA - Not analyzed.
ND - Analyte not detected.
NE - Not established

9/4/02
SWMU359_SOIL.xls

TABLE 3

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 359
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Methylene chloride | NE | 22 | 21000 | 1/1 | 30 | NA | 1 | 0 |
| **METALS (mg/kg)** | | | | | | | | |
| Cadmium | 0.01 | 2.7 | 810 | 1/2 | 1.9 | 1 | 0 | 0 |
| Chromium | 16 | 27 | 450 | 2/2 | 1.9 - 3.9 | 0 | 0 | 0 |
| Lead | 8.2 | 270 | 750 | 1/2 | 29.6 | 1 | 0 | 0 |
| Mercury | 0.08 | 0.015 | 610 | 1/2 | 0.02 J | 0 | 1 | 0 |
| Silver | 0.09 | 0.22 | 10000 | 1/2 | 0.24 J | 1 | 1 | 0 |

**No SVOCs or pesticides were detected in the samples.**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
Base comparison - Sand Subsurface Soil

TABLE 4

DETECTION SUMMARY
GROUNDWATER - SWMU 359
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU359-TW01 04-09-2002 | | SWMU359-TW02 04-09-2002 | |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 2 | J | ND | |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 53.4 | | ND | |
| Cadmium | 0.23 | 5 | 8 | | ND | |
| Chromium | 5.8 | 50 | 7.8 | | 1.9 | J |
| Lead | 3.6 | 15 | 19.4 | | ND | |
| Silver | 0.74 | 18 | ND | | 0.62 | J |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDE | NE | 0.2 (2) | 0.088 | J | 0.093 | J |
| 4,4'-DDT | NE | 0.1 | 0.063 | J | 0.073 | J |
| beta-BHC | NE | 0.037 (2) | **0.38** | J | **0.2** | J |
| delta-BHC | NE | 0.2 | 0.19 | J | 0.071 | J |
| gamma-BHC (Lindane) | NE | 0.2 | 0.061 | J | 0.042 | J |
| Heptachlor epoxide | NE | 0.004 | **0.051** | J | **0.059** | J |

**No VOCs were detected in the samples.**

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

9/4/02
SWMU359_WATER.xls

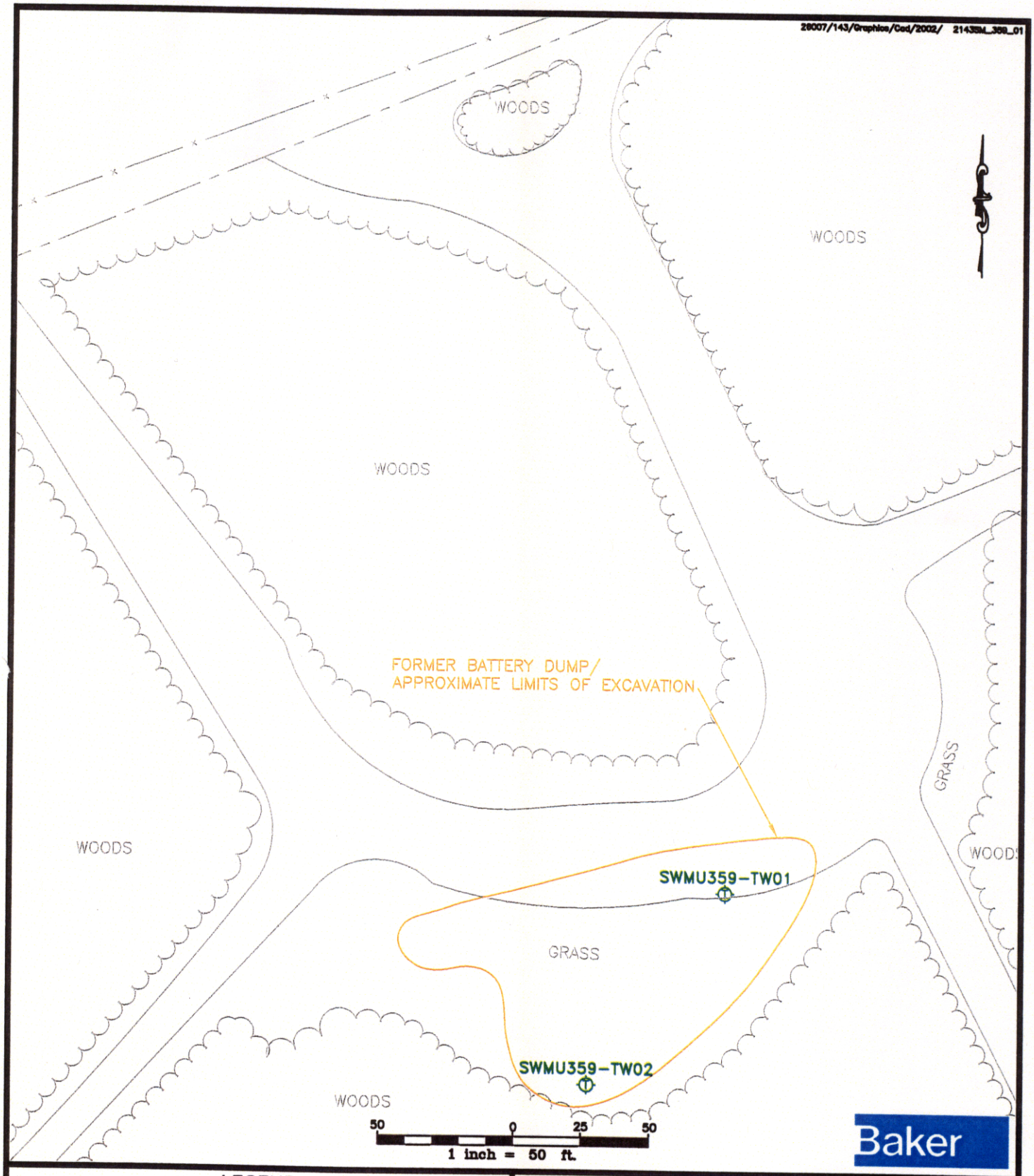
TABLE 5

STATISTICAL SUMMARY
GROUNDWATER - SWMU 359
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/L)** | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 1/2 | 2 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 1/2 | 53.4 | 0 | 0 |
| Cadmium | 0.23 | 5 | 1/2 | 8 | 1 | 1 |
| Chromium | 5.8 | 50 | 2/2 | 1.9 J - 7.8 | 1 | 0 |
| Lead | 3.6 | 15 | 1/2 | 19.4 | 1 | 1 |
| Silver | 0.74 | 18 | 1/2 | 0.62 J | 0 | 0 |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDE | NE | 0.2 (2) | 2/2 | 0.088 J - 0.093 J | NA | 0 |
| 4,4'-DDT | NE | 0.1 | 2/2 | 0.063 J - 0.073 J | NA | 0 |
| beta-BHC | NE | 0.037 (2) | 2/2 | 0.2 J - 0.38 J | NA | 2 |
| delta-BHC | NE | 0.2 | 2/2 | 0.071 J - 0.19 J | NA | 0 |
| gamma-BHC (Lindane) | NE | 0.2 | 2/2 | 0.042 J - 0.061 J | NA | 0 |
| Heptachlor epoxide | NE | 0.004 | 2/2 | 0.051 J - 0.059 J | NA | 2 |

**No VOCs were detected in the samples.**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

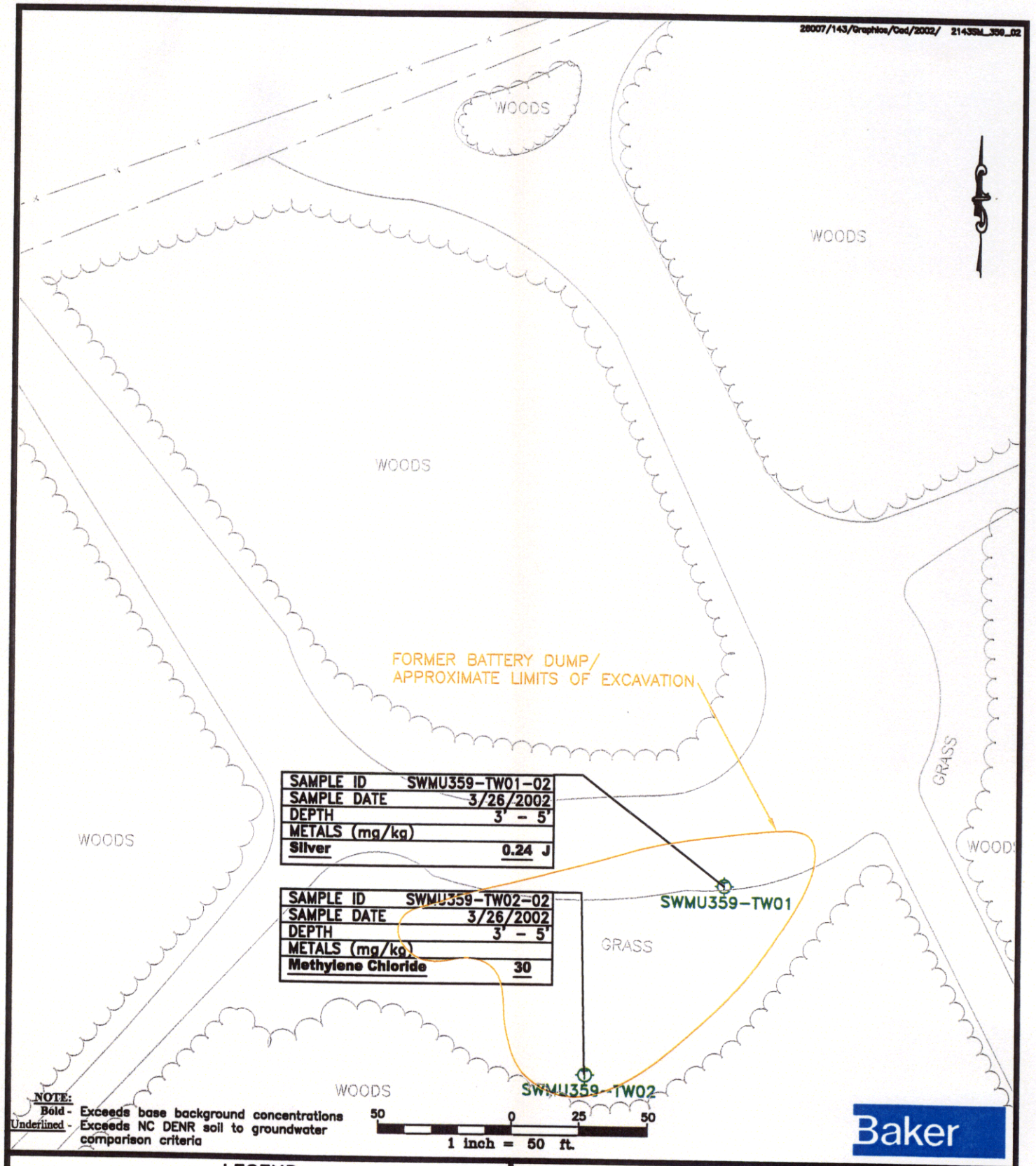



**LEGEND**

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 359
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

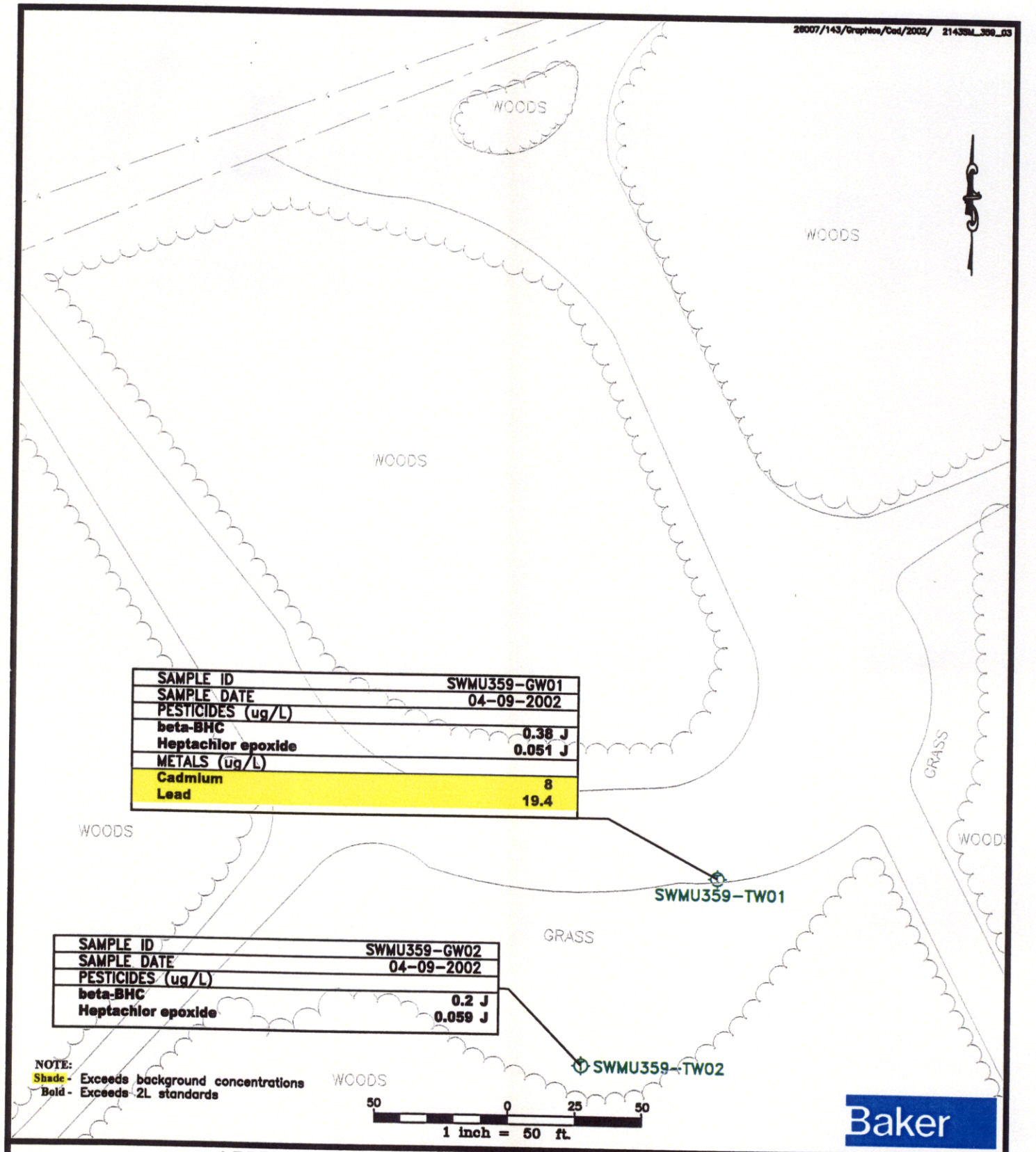



LEGEND

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 359
CTO–143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

⊕ – TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 359
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.40 SWMU 360 - Building 1817/UST

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.40.1 SWMU Description and History

SWMU 360 is a former UST site near warehouse Building 1817. Clean East Associates, Inc. performed a closure of one 300-gallon capacity waste oil UST (July 30, 1997). According to the closure report, results of the confirmatory sampling confirmed that a petroleum release had occurred. Catlin/Law Engineers and Scientists were contracted to perform a limited site assessment to verify the possible release of petroleum constituents (December 1997). The limited site assessment included installing a single well near the former location of the UST. Results of the sampling showed elevated concentrations of chlorinated compounds in the soil and groundwater. Therefore, due to the nature of the contaminants, the site was removed from the UST program and included in the Phase II CSI under the RCRA program. A SWMU investigation plan is presented on Figure 1.

### 4.40.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 25 and April 8 and 9, 2002 in general accordance with Final Project Plans (Baker, 2002). The purpose of the investigation was to evaluate potential impacts to soil at the SWMU and determine if ground water has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at four temporary well borings
- Groundwater sampling at four temporary wells

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 22.3 to 24.4 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 5.3 to 5.5 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow in a radial direction as outward from the SWMU.

### 4.40.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, pesticides and RCRA metals. A summary of the laboratory analytical results is included as Appendix G.

Soil

The analytical results and statistical summaries for positive detections are presented on Tables 2 though 5 and were compared to the following screening criteria:

- AOC background criteria

- Base background criteria
- Default NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

Figure 2 presents the distribution of contaminants that exceed both the regulatory driven criteria and established background/secondary criteria.

Ten VOCs were detected in soil sample set. None of the VOCs exceeded the NC DENR soil to groundwater criteria or the USEPA Region IX residential soil PRGs. Bromoform, methylene chloride and tetrachloroethene exceeded the NC DENR soil to groundwater criteria or the USEPA Region IX residential soil PRGs. Bromoform, methylene chloride and tetrachloroethene exceeded the NC DENR soil to groundwater criteria in one or more of the subsurface soil samples. It should be noted that bromoform and tetrachloroethene were not detected in the surface soil samples. None of the VOCs detected in the subsurface soil sample exceeded the USEPA Region IX residential PRGs.

Five SVOCs were detected in the sample set. None of the reported concentrations exceeded the NC DENR soil to groundwater criteria or the USEPA Region IX residential PRGs.

Thirteen pesticides were detected in the sample set. None of the pesticides detected in the surface soil samples exceeded the NC DENR soil to groundwater criteria or the USEPA Region IX residential PRGs. Dieldrin was detected in subsurface sample SWMU360-TW01-01 at a concentration exceeding the NC DENR soil to groundwater screening value but was below the USEPA Region IX residential soil PRG. None of the other pesticides detected in the subsurface soil samples exceeded the NC DENR soil to groundwater criteria or USEPA Region IX residential PRGs.

Seven metals were detected in the surface soil sample set, as follows, arsenic, barium, cadmium, chromium, lead, mercury and selenium. Arsenic and mercury exceeded the USEPA Region IX residential PRGs and NC DENR soil to groundwater criteria, respectively; however, the concentrations were below the AOC and Base background screening criteria. Cadmium, chromium and lead exceeded the AOC and/or Base background screening criteria; however, the concentrations were below the NC DENR soil to groundwater screening criteria and USEPA Region IX residential PRGs. None of the other metals detected in the surface soil samples exceeded the established screening criteria.

Eight metals were detected in the subsurface soil sample set. Arsenic exceeded both the AOC and Base background criteria and the NC DENR soil to groundwater criteria and USEPA Region IX residential PRG. Mercury exceeded the NC DENR soil to groundwater screening criteria; however, the concentrations were below the AOC and Base background criteria and the USEPA Region IX residential PRG. Barium, cadmium and lead exceeded the AOC and/or Base background criteria; however, the concentrations were below the NC DENR soil to groundwater criteria and Region IX residential PRGs. None of the other metals detected in the subsurface soil samples exceeded the established screening criteria.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX residential PRGs (for compounds that did not have 2L standards)

Figure 3 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Four VOCs were detected in the groundwater samples from one or more of the wells, as follows: 1,2,4-trichlorobenznene; cis-1,2-dichloroethene; tetrachloroethene; and trichloroethene. These VOCs were also detected in the soil samples.

Five SVOCs were detected in the groundwater samples. 4-methylphenol and acetophenone were detected in SWMU360-GW04 at concentrations exceeding the 2L standards. These two SVOCs were not detected in the soil samples. None of the other SVOCs detected in the groundwater samples exceeded the applicable screening criteria.

Eleven pesticides were detected in one or more of the groundwater samples. In the sample from well SWMU360-TW01 seven of the pesticides exceeded the NC 2L standards or the USEPA Region IX PRGs as follows: 4,4'-DDE, 4-4'DDT, aldrin, alpha-chlordane, gamma-chlordane, heptachlor and heptachlor epoxide. Alpha-BHC (SWMU360-TW02), beta-BHC and heptachlor epoxide (SWMU360-TW04) were also detected above the applicable screening criteria. None of the other pesticides detected in the groundwater samples exceeded the applicable screening criteria. 4,4'-DDT; 4-4'-DDT; alpha-chlordane; and beta-BHC were also detected in the soil samples. The remaining pesticides were not detected in the soil samples.

Three metals (arsenic, barium and chromium) were detected in the groundwater samples. Chromium was detected in one sample above the background screening criteria; however, the concentration was below the 2L Standard. None of the other metals detected in the groundwater samples exceeded the applicable screening criteria.

### 4.40.4 Conclusions

Several VOCs, SVOCs, pesticides, and/or metals were detected in soil and/or groundwater at concentrations exceeding applicable screening criteria. Compounds that exceeded both the AOC and Base background screening criteria and NC DENR soil to groundwater screening criteria and/or USEPA Region IX residential PRGs in soil were as follows:

- VOCs- bromoform, methylene chloride and tetrachloroethene
- Pesticides - dieldrin
- Metals- arsenic

Compounds the exceeded the Base background screening criteria and 2L standards or USEPA Region IX residential PRGs in groundwater were as follows:

- VOCs - cis-1,2-dichloroethene, tetrachloroethene, and trichloroethene
- SVOCs - 4-Methylphenol and acetophenone
- Pesticides - 4,4'-DDE, 4-4'DDT, aldrin, alpha-chlordane, gamma-chlordane, heptachlor, heptachlor epoxide, alpha-BHC and beta-BHC

Based on evaluation of the analytical results, additional investigation at SWMU 360 is warranted. The additional activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU360-TW01 | 3/25/02 | BAKER | 28.24 | 26.2 | 28 | 28 | 16 | 14.5 | 18 | 22.95 | 5.3 |
| SWMU360-TW02 | 3/25/02 | BAKER | 27.71 | 26.1 | 28 | 28 | 16 | 14.5 | 18 | 22.25 | 5.5 |
| SWMU360-TW03 | 3/25/02 | BAKER | 29.06 | 26.5 | 28 | 28 | 16 | 14.5 | 18 | 23.75 | 5.3 |
| SWMU360-TW04 | 3/25/02 | BAKER | 29.72 | 27.5 | 28 | 28 | 16 | 14.5 | 18 | 24.35 | 5.4 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU360

TABLE 2
DETECTION SUMMARY
SURFACE SOIL - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU360-TW01-00 03-25-2002 0' - 1' | SWMU360-TW02-00 03-25-2002 0' - 1' | SWMU360-TW03-00 03-25-2002 0' - 1' | SWMU360-TW04-00 03-25-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 1,2,4-Trichlorobenzene | NE | NE | 2610 | 650000 | 3 J | ND | ND | ND |
| Benzene | NE | NE | 5.6 | 650 | ND | 1 J | ND | ND |
| Carbon disulfide | NE | NE | 4940 | 360000 | ND | ND | 6 J | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | ND | ND | 22 J | ND |
| Ethylbenzene | NE | NE | 241 | 230000 | ND | 3 J | ND | ND |
| Methylene chloride | NE | NE | 22 | 8900 | ND | 6 J | 1 J | ND |
| Trichloroethene | NE | NE | 7.4 | 2800 | ND | ND | 2 J | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| 2-Nitroaniline | NE | NE | NE | 3500 | 40 J | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 90 J | 99 J | 410 | 160 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 1200000 | 69 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.7 | 0.88 | 5.24 | 0.39 | 0.35 J | ND | 0.49 J | 0.54 J |
| Barium | 36 | 19 | 848 | 5400 | 10.1 | ND | 12 | 13.1 |
| Cadmium | 2.4 | 0.05 | 2.7 | 37 | **0.56** J | ND | **0.54** | ND |
| Chromium | 27 | 8.9 | 27 | 210 | **10.2** | 2.1 | **9** | 7.4 |
| Lead | 25 | 26 | 270 | 400 | 14.8 | 2.8 | **28** | 4 |
| Mercury | 0.05 | 0.12 | 0.015 | 23 | ND | ND | ND | 0.02 J |
| Selenium | 2.7 | 1.3 | 12 | 390 | ND | ND | ND | 0.52 J |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 2400 | 1.2 J | ND | 3.3 J | ND |
| 4,4'-DDE | NE | NE | NE | 1700 | 2.3 | ND | 0.58 J | ND |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 6.1 J | 1.2 J | 1.7 J | 1 J |
| alpha-BHC | NE | NE | NE | 90 | ND | ND | 6.7 J | ND |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | ND | ND | 0.42 J | ND |
| beta-BHC | NE | NE | NE | 320 | ND | ND | 6.4 J | ND |
| delta-BHC | NE | NE | 6.2 | 440 | ND | ND | 0.31 J | ND |
| Endosulfan II | NE | NE | 1970 (2) | 370000 | ND | ND | ND | 3.9 J |
| Endosulfan sulfate | NE | NE | NE | 370000 | 4.2 J | ND | ND | ND |
| Endrin (1) | NE | NE | 440 | 18000 | 1.2 J | ND | ND | ND |
| gamma-BHC (Lindane) | NE | NE | 6.2 | 440 | ND | ND | 0.62 J | ND |
| gamma-Chlordane | NE | NE | 27.8 | 1600 | ND | ND | 0.63 J | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Endrin, endrin aldehyde and endrin keytone (total)
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg which is the same concentration used to calculate the default criteria
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3
STATISTICAL SUMMARY
SURFACE SOIL - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | NE | NE | 2610 | 650000 | 1/4 | 3 J | NA | NA | 0 | 0 |
| Benzene | NE | NE | 5.6 | 650 | 1/4 | 1 J | NA | NA | 0 | 0 |
| Carbon disulfide | NE | NE | 4940 | 360000 | 1/4 | 6 J | NA | NA | 0 | 0 |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 1/4 | 22 J | NA | NA | 0 | 0 |
| Ethylbenzene | NE | NE | 241 | 230000 | 1/4 | 3 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 22 | 8900 | 2/4 | 1 J - 6 J | NA | NA | 0 | 0 |
| Trichloroethene | NE | NE | 7.4 | 2800 | 1/4 | 2 J | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| 2-Nitroaniline | NE | NE | NE | 3500 | 1/4 | 40 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 4/4 | 90 J - 410 | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 1200000 | 1/4 | 69 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 2.7 | 0.88 | 5.24 | 0.39 | 3/4 | 0.35 J - 0.54 J | 0 | 0 | 0 | 2 |
| Barium | 36 | 19 | 848 | 5400 | 3/4 | 10.1 - 13.1 | 0 | 0 | 0 | 0 |
| Cadmium | 2.4 | 0.05 | 2.7 | 37 | 2/4 | 0.54 - 0.56 J | 0 | 2 | 0 | 0 |
| Chromium | 27 | 8.9 | 27 | 210 | 4/4 | 2.1 - 10.2 | 0 | 2 | 0 | 0 |
| Lead | 25 | 26 | 270 | 400 | 4/4 | 2.8 - 28 | 1 | 1 | 0 | 0 |
| Mercury | 0.05 | 0.12 | 0.015 | 23 | 1/4 | 0.02 J | 0 | 0 | 1 | 0 |
| Selenium | 2.7 | 1.3 | 12 | 390 | 1/4 | 0.52 J | 0 | 0 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 2400 | 2/4 | 1.2 J - 3.3 J | NA | NA | 0 | 0 |
| 4,4'-DDE | NE | NE | NE | 1700 | 2/4 | 0.58 J - 2.3 | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 4/4 | 1 J - 6.1 J | NA | NA | 0 | 0 |
| alpha-BHC | NE | NE | NE | 90 | 1/4 | 6.7 J | NA | NA | 0 | 0 |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | 1/4 | 0.42 J | NA | NA | 0 | 0 |
| beta-BHC | NE | NE | NE | 320 | 1/4 | 6.4 J | NA | NA | 0 | 0 |
| delta-BHC | NE | NE | 6.2 | 440 | 1/4 | 0.31 J | NA | NA | 0 | 0 |
| Endosulfan II | NE | NE | 1970 (2) | 370000 | 1/4 | 3.9 J | NA | NA | 0 | 0 |
| Endosulfan sulfate | NE | NE | NE | 370000 | 1/4 | 4.2 J | NA | NA | 0 | 0 |
| Endrin (1) | NE | NE | 440 | 18000 | 1/4 | 1.2 J | NA | NA | 0 | 0 |
| gamma-BHC (Lindane) | NE | NE | 6.2 | 440 | 1/4 | 0.62 J | NA | NA | 0 | 0 |
| gamma-Chlordane | NE | NE | 27.8 | 1600 | 1/4 | 0.63 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Endrin, endrin aldehyde and endrin keytone (total)
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg which is the same concentration used to calculate the default criteria

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU360-TW01-01 03-25-2002 1' - 3' | SWMU360-TW01A-10 04-08-2002 19' - 21' | SWMU360-TW02-02 03-25-2002 3' - 5' | SWMU360-TW02A-10 04-08-2002 19' - 21' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Bromoform | NE | NE | 1.25 (1) | 62000 | ND | 28 | ND | 29 |
| Carbon disulfide | NE | NE | 4940 | 360000 | 3 J | ND | 5 J | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | ND | 8 | 3 J | 2 J |
| Methyl-t-Butyl Ether | NE | NE | 916 | NE | ND | ND | ND | ND |
| Methylene chloride | NE | NE | 22 (1) | 8900 | 6 J | 20 | 2 J | 18 |
| Tetrachloroethene | NE | NE | 7.42 (1) | 5700 | ND | 60 | ND | ND |
| Trichloroethene | NE | NE | 18 | 2800 | ND | 7 | ND | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Atrazine | NE | NE | 24 | 2200 | ND | ND | 11 J | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 180 J | ND | 82 J | 74 J |
| Di-n-octyl phthalate | NE | NE | 10000000 | 1200000 | 27 J | ND | 23 J | ND |
| Fluoranthene | NE | NE | 276000 | 2600000 | 25 J | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 0.39 | ND | ND | ND | ND |
| Barium | 19 | 22 | 848 | 5400 | 8.8 | 9.9 J | 10.6 | 3.7 J |
| Cadmium | 0.87 | 0.01 | 2.7 | 37 | ND | ND | ND | ND |
| Chromium | 27 | 16 | 27 | 210 | 12.3 | 7 J | 5.2 | 2.3 J |
| Lead | 15 | 8.2 | 270 | 400 | 30.9 | 1.8 J | 6.3 | 1.5 J |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | 0.07 J | ND | ND | ND |
| Selenium | 0.67 | 0.69 | 12 | 390 | ND | ND | ND | ND |
| Silver | 0.18 | 0.09 | 0.22 | 390 | ND | 0.06 J | ND | ND |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 2400 | 49 J | ND | 0.76 J | ND |
| 4,4'-DDE | NE | NE | NE | 1700 | 6.4 J | ND | 0.5 J | ND |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 3.3 J | ND | 1.6 J | ND |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | ND | ND | 0.29 J | ND |
| beta-BHC | NE | NE | NE | 320 | ND | ND | ND | ND |
| Dieldrin | NE | NE | 1.1 | 30 | 4.1 J | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg which is the same concentration used to calculate the default criteria
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

10/7/02
SWMU360_SOIL.xls

TABLE 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU360-TW03-02 03-25-2002 3' - 5' | SWMU360-TW03A-10 04-08-2002 19' - 21' | SWMU360-TW04-06 03-25-2002 11' - 13' | SWMU360-TW04A-11 04-08-2002 21' - 23' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Bromoform | NE | NE | 1.25 (1) | 62000 | ND | 31 | ND | ND |
| Carbon disulfide | NE | NE | 4940 | 360000 | ND | ND | ND | ND |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 20 J | ND | ND | 11 |
| Methyl-t-Butyl Ether | NE | NE | 916 | NE | ND | ND | ND | 2 J |
| Methylene chloride | NE | NE | 22 (1) | 8900 | 2 J | 27 | ND | 32 |
| Tetrachloroethene | NE | NE | 7.42 (1) | 5700 | 5 J | ND | 10 | 25 |
| Trichloroethene | NE | NE | 18 | 2800 | 2 J | ND | ND | 2 J |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Atrazine | NE | NE | 24 | 2200 | ND | ND | ND | ND |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 66 J | 51 J | 110 J | ND |
| Di-n-octyl phthalate | NE | NE | 10000000 | 1200000 | ND | 28 J | ND | ND |
| Fluoranthene | NE | NE | 276000 | 2600000 | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 0.39 | 0.39 J | ND | 0.93 J | 7.3 J |
| Barium | 19 | 22 | 848 | 5400 | 9 | 5.4 J | ND | 50.4 J |
| Cadmium | 0.87 | 0.01 | 2.7 | 37 | ND | ND | ND | **0.5** J |
| Chromium | 27 | 16 | 27 | 210 | 6.4 | 3.8 J | 4.5 | 11 J |
| Lead | 15 | 8.2 | 270 | 400 | 4.5 | 1.7 J | ND | 3.6 J |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | 0.03 J | ND | ND | ND |
| Selenium | 0.67 | 0.69 | 12 | 390 | ND | ND | ND | 0.91 J |
| Silver | 0.18 | 0.09 | 0.22 | 390 | ND | 0.06 J | ND | ND |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 2400 | ND | ND | ND | ND |
| 4,4'-DDE | NE | NE | NE | 1700 | ND | ND | ND | ND |
| 4,4'-DDT | NE | NE | 1360 | 1700 | ND | ND | ND | ND |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | ND | ND | ND | ND |
| beta-BHC | NE | NE | NE | 320 | ND | ND | 1.4 J | ND |
| Dieldrin | NE | NE | 1.1 | 30 | ND | ND | ND | ND |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg which is the same concentration used to calculate the default criteria
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE -

10/7/02
SWMU360_SOIL.xls

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| Bromoform | NE | NE | 1.25 (1) | 62000 | 3/8 | 28 - 31 | NA | NA | 3 | 0 |
| Carbon disulfide | NE | NE | 4940 | 360000 | 2/8 | 3 J - 5 J | NA | NA | 0 | 0 |
| cis-1,2-Dichloroethene | NE | NE | 350 | 43000 | 5/8 | 2 J - 20 J | NA | NA | 0 | 0 |
| Methyl-t-Butyl Ether | NE | NE | 916 | NE | 1/8 | 2 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 22 (1) | 8900 | 7/8 | 2 J - 32 | NA | NA | 2 | 0 |
| Tetrachloroethene | NE | NE | 7.42 (1) | 5700 | 4/8 | 5 J - 60 | NA | NA | 3 | 0 |
| Trichloroethene | NE | NE | 18 | 2800 | 3/8 | 2 J - 7 | NA | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Atrazine | NE | NE | 24 | 2200 | 1/8 | 11 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 6/8 | 51 J - 180 J | NA | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | NE | 10000000 | 1200000 | 3/8 | 23 J - 28 J | NA | NA | 0 | 0 |
| Fluoranthene | NE | NE | 276000 | 2600000 | 1/8 | 25 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Arsenic | 2.9 | 1.6 | 5.24 | 0.39 | 3/8 | 0.39 J - 7.3 J | 1 | 1 | 1 | 2 |
| Barium | 19 | 22 | 848 | 5400 | 7/8 | 3.7 J - 50.4 J | 1 | 1 | 0 | 0 |
| Cadmium | 0.87 | 0.01 | 2.7 | 37 | 1/8 | 0.5 J | 0 | 1 | 0 | 0 |
| Chromium | 27 | 16 | 27 | 210 | 8/8 | 2.3 J - 12.3 | 0 | 0 | 0 | 0 |
| Lead | 15 | 8.2 | 270 | 400 | 7/8 | 1.5 J - 30.9 | 1 | 1 | 0 | 0 |
| Mercury | 0.08 | 0.08 | 0.015 | 23 | 2/8 | 0.03 J - 0.07 J | 0 | 0 | 2 | 0 |
| Selenium | 0.67 | 0.69 | 12 | 390 | 1/8 | 0.91 J | 1 | 1 | 0 | 0 |
| Silver | 0.18 | 0.09 | 0.22 | 390 | 2/8 | 0.06 J | 0 | 0 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 129 | 2400 | 2/8 | 0.76 J - 49 J | NA | NA | 0 | 0 |
| 4,4'-DDE | NE | NE | NE | 1700 | 2/8 | 0.5 J - 6.4 J | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 2/8 | 1.6 J - 3.3 J | NA | NA | 0 | 0 |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | 1/8 | 0.29 J | NA | NA | 0 | 0 |
| beta-BHC | NE | NE | NE | 320 | 1/8 | 1.4 J | NA | NA | 0 | 0 |
| Dieldrin | NE | NE | 1.1 | 30 | 1/8 | 4.1 J | NA | NA | 1 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg which is the same concentration used to calculate the default criteria
AOC comparison - AOC 7 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU360-TW01 04-09-2002 | | SWMU360-TW02 04-09-2002 | | SWMU360-TW03 04-09-2002 | | SWMU360-TW04 04-09-2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | NE | 70 | ND | | ND | | 2 | J | ND | |
| cis-1,2-Dichloroethene | NE | 70 | 48 | | 23 | | 29 | | **120** | |
| Tetrachloroethene | NE | 0.7 | **89** | | ND | | **27** | | **800** | |
| Trichloroethene | NE | 2.8 | **24** | | **5** | | **6** | | **75** | |
| **SEMIVOLATILES (ug/L)** | | | | | | | | | | |
| 2-Methylphenol | NE | 35 | ND | | ND | | ND | | 1 | J |
| 4-Methylphenol | NE | 3.5 | 2 | J | ND | | ND | | **4** | J |
| Acetophenone | NE | 0.042 (2) | ND | | ND | | ND | | **1** | J |
| Fluorene | NE | 280 | ND | | ND | | ND | | 0.9 | J |
| Phenanthrene | NE | 210 | 0.9 | J | ND | | ND | | 4 | J |
| **METALS (ug/L)** | | | | | | | | | | |
| Arsenic | 12 | 10 | ND | | 2.6 | J | ND | | ND | |
| Barium | 145 | 2000 | 60.8 | | 42.1 | | 48.9 | | 53.3 | |
| Chromium | 5.8 | 50 | 1.3 | J | 7.6 | | ND | | ND | |
| **PESTICIDES (ug/L)** | | | | | | | | | | |
| 4,4'-DDE | NE | 0.2 (2) | **0.24** | J | ND | | ND | | ND | |
| 4,4'-DDT | NE | 0.1 | **0.11** | J | ND | | ND | | ND | |
| Aldrin | NE | 0.004 (2) | **0.14** | J | ND | | ND | | ND | |
| alpha-BHC | NE | 0.011 (2) | ND | | **0.015** | J | ND | | ND | |
| alpha-Chlordane | NE | 0.027 | **0.088** | J | ND | | ND | | ND | |
| beta-BHC | NE | 0.037 (2) | ND | | ND | | ND | | **1.6** | J |
| delta-BHC | NE | 0.2 | 0.19 | J | ND | | ND | | 0.18 | J |
| gamma-BHC (Lindane) | NE | 0.2 | 0.1 | J | ND | | ND | | ND | |
| gamma-chlordane | NE | 0.027 | **0.1** | J | ND | | ND | | ND | |
| Heptachlor | NE | 0.008 | **0.088** | J | ND | | ND | | ND | |
| Heptachlor epoxide | NE | 0.004 | **0.13** | J | ND | | ND | | **0.45** | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)

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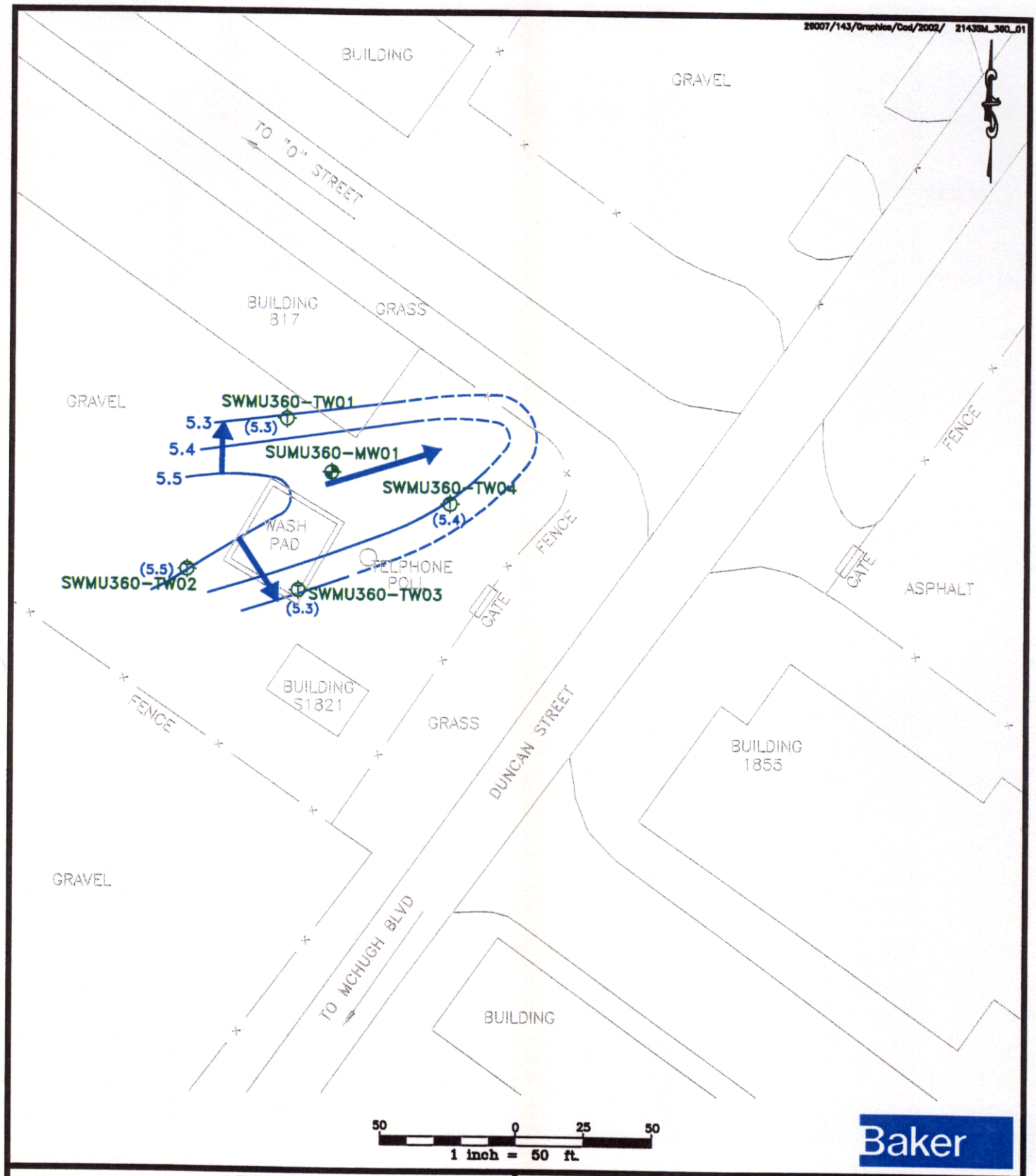
SWMU360_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 360
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 1,2,4-Trichlorobenzene | NE | 70 | 1/4 | 2 J | NA | 0 |
| cis-1,2-Dichloroethene | NE | 70 | 4/4 | 23 - 120 | NA | 1 |
| Tetrachloroethene | NE | 0.7 | 3/4 | 27 - 89 | NA | 3 |
| Trichloroethene | NE | 2.8 | 4/4 | 5 - 75 | NA | 4 |
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 2-Methylphenol | NE | 35 | 1/4 | 1 J | NA | 0 |
| 4-Methylphenol | NE | 3.5 | 2/4 | 2 J - 4 J | NA | 1 |
| Acetophenone | NE | 0.042 (2) | 1/4 | 1 J | NA | 1 |
| Fluorene | NE | 280 | 1/4 | 0.9 J | NA | 0 |
| Phenanthrene | NE | 210 | 2/4 | 0.9 J - 4 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Arsenic | 12 | 10 | 1/4 | 2.6 J | 0 | 0 |
| Barium | 145 | 2000 | 4/4 | 42.1 - 60.8 | 0 | 0 |
| Chromium | 5.8 | 50 | 2/4 | 1.3 J - 7.6 | 1 | 0 |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDE | NE | 0.2 (2) | 1/4 | 0.24 J | NA | 1 |
| 4,4'-DDT | NE | 0.1 | 1/4 | 0.11 J | NA | 1 |
| Aldrin | NE | 0.004 (2) | 1/4 | 0.14 J | NA | 1 |
| alpha-BHC | NE | 0.011 (2) | 1/4 | 0.015 J | NA | 1 |
| alpha-Chlordane | NE | 0.027 | 1/4 | 0.088 J | NA | 1 |
| beta-BHC | NE | 0.037 (2) | 1/4 | 1.6 J | NA | 1 |
| delta-BHC | NE | 0.2 | 2/4 | 0.18 J - 0.19 J | NA | 0 |
| gamma-BHC (Lindane) | NE | 0.2 | 1/4 | 0.1 J | NA | 0 |
| gamma-chlordane | NE | 0.027 | 1/4 | 0.1 J | NA | 1 |
| Heptachlor | NE | 0.008 | 1/4 | 0.088 J | NA | 1 |
| Heptachlor epoxide | NE | 0.004 | 2/4 | 0.13 J - 0.45 J | NA | 2 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Region IX Preliminary Remediation Goal (PRG)



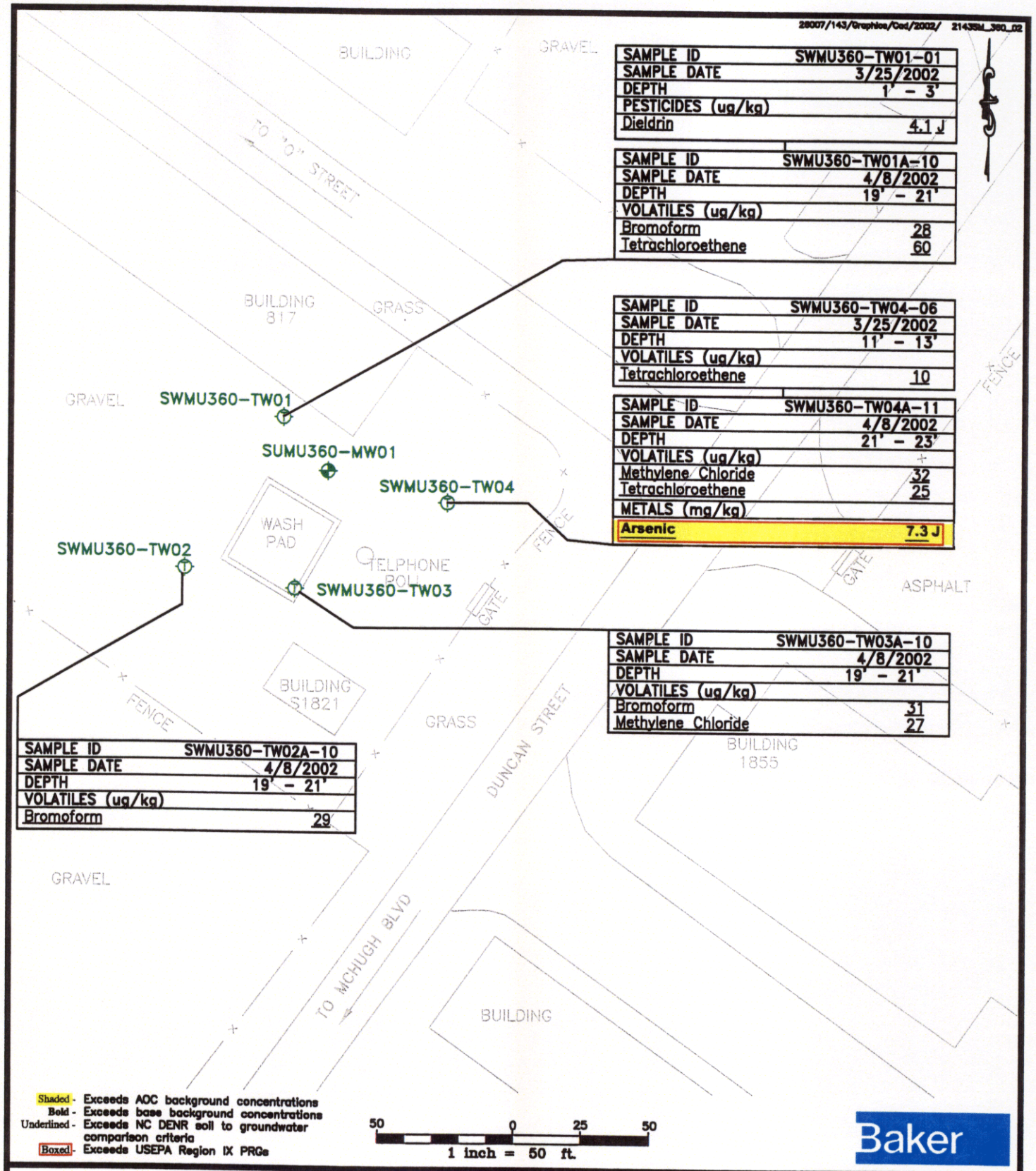

**LEGEND**

- TEMPORARY WELL
- MONITORING WELL SAMPLE
- GROUNDWATER FLOW DIRECTION
- 5.4 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 360
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

037538 BHX




| SAMPLE ID | SWMU360-TW01-01 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 1' - 3' |
| PESTICIDES (ug/kg) | |
| Dieldrin | 4.1 J |

| SAMPLE ID | SWMU360-TW01A-10 |
|---|---|
| SAMPLE DATE | 4/8/2002 |
| DEPTH | 19' - 21' |
| VOLATILES (ug/kg) | |
| Bromoform | 28 |
| Tetrachloroethene | 60 |

| SAMPLE ID | SWMU360-TW04-06 |
|---|---|
| SAMPLE DATE | 3/25/2002 |
| DEPTH | 11' - 13' |
| VOLATILES (ug/kg) | |
| Tetrachloroethene | 10 |

| SAMPLE ID | SWMU360-TW04A-11 |
|---|---|
| SAMPLE DATE | 4/8/2002 |
| DEPTH | 21' - 23' |
| VOLATILES (ug/kg) | |
| Methylene Chloride | 32 |
| Tetrachloroethene | 25 |
| METALS (mg/kg) | |
| **Arsenic** | 7.3 J |

| SAMPLE ID | SWMU360-TW03A-10 |
|---|---|
| SAMPLE DATE | 4/8/2002 |
| DEPTH | 19' - 21' |
| VOLATILES (ug/kg) | |
| Bromoform | 31 |
| Methylene Chloride | 27 |

| SAMPLE ID | SWMU360-TW02A-10 |
|---|---|
| SAMPLE DATE | 4/8/2002 |
| DEPTH | 19' - 21' |
| VOLATILES (ug/kg) | |
| Bromoform | 29 |

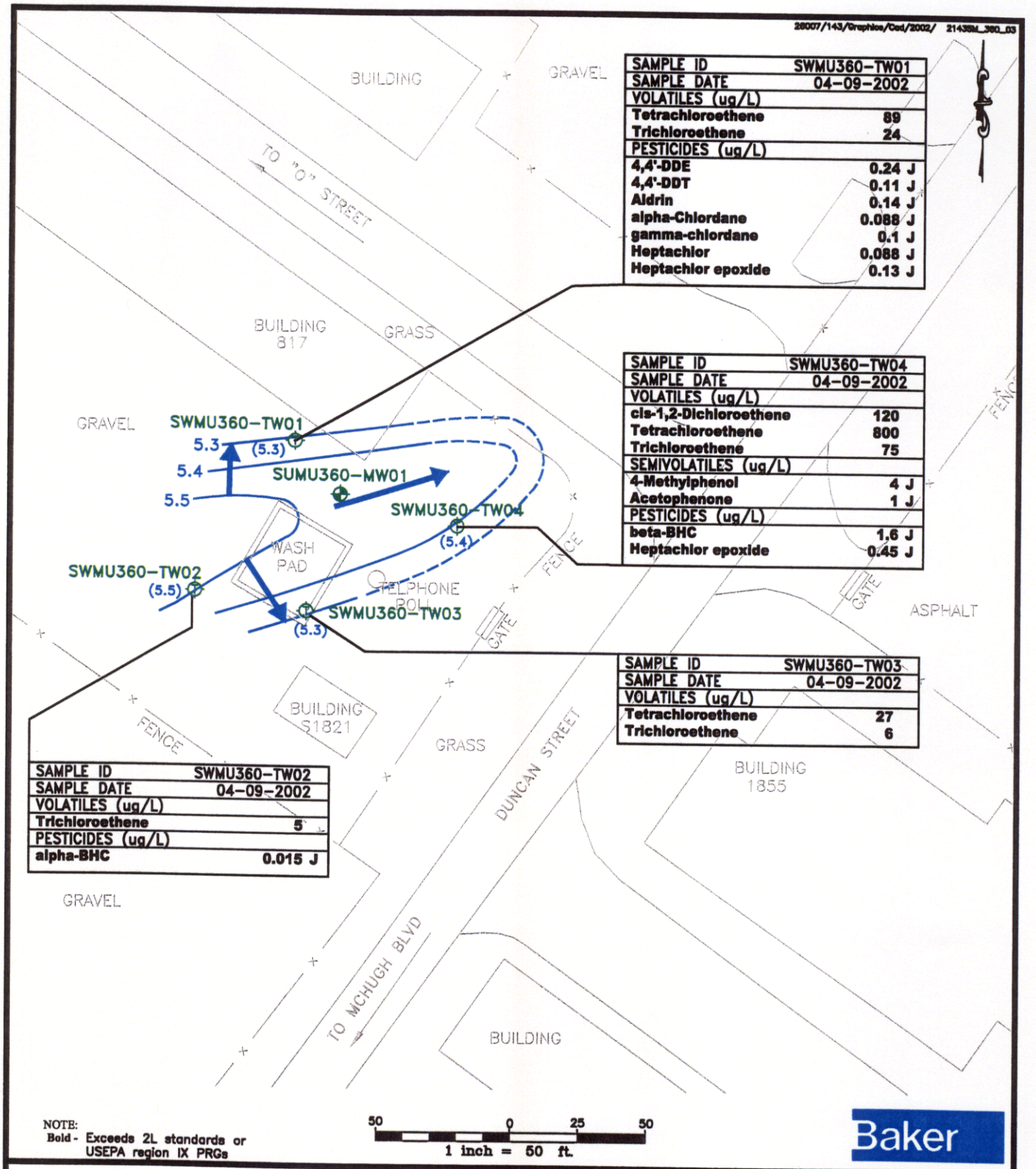
## LEGEND

- TEMPORARY WELL
- MONITORING WELL SAMPLE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 360
## CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




| SAMPLE ID | SWMU360-TW01 |
|---|---|
| SAMPLE DATE | 04-09-2002 |
| VOLATILES (ug/L) | |
| **Tetrachloroethene** | **89** |
| **Trichloroethene** | **24** |
| PESTICIDES (ug/L) | |
| **4,4'-DDE** | **0.24 J** |
| **4,4'-DDT** | **0.11 J** |
| **Aldrin** | **0.14 J** |
| **alpha-Chlordane** | **0.088 J** |
| **gamma-chlordane** | **0.1 J** |
| **Heptachlor** | **0.088 J** |
| **Heptachlor epoxide** | **0.13 J** |

| SAMPLE ID | SWMU360-TW04 |
|---|---|
| SAMPLE DATE | 04-09-2002 |
| VOLATILES (ug/L) | |
| **cis-1,2-Dichloroethene** | **120** |
| **Tetrachloroethene** | **800** |
| **Trichloroethene** | **75** |
| SEMIVOLATILES (ug/L) | |
| **4-Methylphenol** | **4 J** |
| **Acetophenone** | **1 J** |
| PESTICIDES (ug/L) | |
| **beta-BHC** | **1.6 J** |
| **Heptachlor epoxide** | **0.45 J** |

| SAMPLE ID | SWMU360-TW03 |
|---|---|
| SAMPLE DATE | 04-09-2002 |
| VOLATILES (ug/L) | |
| **Tetrachloroethene** | **27** |
| **Trichloroethene** | **6** |

| SAMPLE ID | SWMU360-TW02 |
|---|---|
| SAMPLE DATE | 04-09-2002 |
| VOLATILES (ug/L) | |
| **Trichloroethene** | **5** |
| PESTICIDES (ug/L) | |
| **alpha-BHC** | **0.015 J** |

NOTE:
**Bold** - Exceeds 2L standards or USEPA region IX PRGs

Baker

## LEGEND

- TEMPORARY WELL
- MONITORING WELL SAMPLE
- GROUNDWATER FLOW DIRECTION
- 5.4 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 3
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER SWMU 360

CTO-143

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.41 SWMU 361 - UST Site 333-C

The following sections present the SWMU description and history, the activities conducted during the Phase II and supplemental CSI investigations, the investigation findings, and conclusions.

### 4.41.1 SWMU Description and History

SWMU 361 is a former UST located near Building 333. The building is currently utilized as an office and classroom building and is located on the west side of "H" Street. A 550-gallon UST was installed in 1942 and utilized to store kerosene for heat production. The UST was removed on March 8, 1993. During the tank removal, the presence of volatile organic vapors was reported at levels generally less than 200 ppm. Confirmatory soil samples collected from the tank pit were tested and found oil and grease at concentrations in excess of state action levels. As a result, Law Engineering and Environmental Services, Inc conducted a site assessment. The first phase of the site assessment involved the advancement of twelve Geoprobe® (March 26 and 27, 1996) and five Hydropunch™ borings (March 17 and 24, 1996) to collect soil and groundwater samples. The second phase of the site assessment involved the advancement of seven soil borings into which five monitoring wells were installed (March 17 through March 25, 1996) and the collection of soil and groundwater samples. Results of sampling showed elevated concentrations of chlorinated compounds in the soil and groundwater. Therefore, due to the nature of the contaminants, the site was removed from the UST program and included in the Phase II CSIs under the RCRA program. The Phase II CSI plan is presented as Figure 1.

### 4.41.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 24 and April 7, 2002 in general accordance with the Final Project Plans (Baker, 2002). Additional samples were collected during a supplemental CSI conducted in June 2003. The purpose of the Phase II CSI was to evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The supplemental Phase II CSI was conducted to determine if the elevated pesticides detected in the soil and groundwater during the Phase II CSI were SWMU related. A total of five temporary wells were installed during these investigations and sampled for pesticides and metals. Existing monitoring wells MW02, MW03, MW04, MW05 and MW06 (installed during the UST investigation) were also sampled to augment the data collected as part of the UST investigation. The sample locations are shown on Figure 1 and were selected based on the results of previous investigations. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at five soil borings and five temporary well boring
- Groundwater sampling at five existing monitoring wells and five temporary well

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

Groundwater elevations determined from static water levels measured in the five permanent monitoring wells and one temporary well ranged from approximately 6.1 to 6.6 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in

the vicinity of the SWMU appears to flow in a radial direction outward from the eastern edge of the site.

### 4.41.3 Investigation Findings

The Phase II CSI soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, pesticides and RCRA metals. Soil and groundwater samples from the additional sampling were submitted to Chemtech Laboratory and analyzed for pesticides and RCRA metals. The discussions of soil and groundwater below include all analytical data that has been collected for the SWMU in March 2002 and June 2003. A summary of the laboratory analytical results is included as Appendix G.

Soil

The analytical results and statistical summaries for positive detections are presented on Tables 2 though 5 and were compared to the following screening criteria:

- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX residential PRGs

It should be noted that SWMU 361 is not associated with a specific AOC due to its location with respect to the various AOC boundaries. Therefore, the data was not compared to AOC background criteria.

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Five VOCs were detected in the soil sample set, as follows: 4-Methyl-2-pentanone, acetone, methylene chloride, cis-1,2-Dichloroethene and trichloroethene. Methylene chloride exceeded the NC DENR soil to groundwater criteria in surface soil sample SWMU361-SB02-00 (at 32 μg/kg). Methylene chloride is a common laboratory contaminant, but was detected at low concentrations (2J μg/L) in two QA/QC samples. Although the concentration of methylene chloride was detected at a higher concentration than ten times the level detected in any blank (RAGS Part D), this compound is not likely to exist in surface soils under the environmental conditions at MCB, Camp Lejeune. Therefore, it is not likely that this compound is related to site conditions, but rather laboratory conditions. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

Two SVOCs [bis(2-Ethylhexyl)phthalate and Di-n-octyl phthalate] were detected in the soil sample set. None of the reported concentrations exceeded the established screening criteria.

Eleven pesticides were detected in the soil sample set. The majority of pesticides were detected in the surface and subsurface soil samples from boring SWMU316-TW01. Alpha-chlordane and gamma-chlordane exceeded the NC DENR soil to groundwater criteria and USEPA Region IX residential PRGs in subsurface soil sample SWMU361-SB06-05. Alpha-chlordane and gamma-chlordane exceeded the USEPA Region IX residential PRGs in subsurface soil sample SWMU361-TW01-02. None of the other pesticides detected in the surface and subsurface soil samples exceeded the applicable screening criteria.

Six metals were detected in the soil sample set, as follows: arsenic, barium, chromium, lead, mercury and selenium. All of these metals except mercury exceeded the Base background criteria in one or more of the samples. Mercury exceeded the NC DENR soil to groundwater criteria in one sample (SWMU 361-SB04-00); however, the concentration was below the Base background criteria and USEPA Region IX residential PRGs. Arsenic exceeded the Base background screening criteria and the USEPA Region IX residential PRG in four surface soil samples (Figure 2). In subsurface sample SWMU361-TW01-02, arsenic exceeded the USEPA Region IX residential PRG, but was below the Base background concentration. None of the remaining metals detected in the samples exceeded the Base background criteria and the NC DENR soil to groundwater criteria and/or USEPA Region IX residential PRGs.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards
- USEPA Region IX Tap Water PRGs (as a secondary comparison)

Figure 3 presents the distribution of contaminants that exceed the regulatory driven criteria and established background/secondary criteria.

Five VOCs were detected in the groundwater sample set, as follows: acetone, ethylbenzene, isopropylbenzene, methylcyclohexane and xylenes (total). Most of the VOCs were detected in the groundwater sample from well SWMU361-MW04. None of the VOCs detected in the samples exceeded the applicable screening criteria.

Four SVOCs were detected in groundwater samples from one or more of the wells, as follows: 1,1-Biphenyl, 2-methylnapthalene, bis(2-ethylhexyl)phthalate, and naphthalene. Most of the SVOCs were detected in groundwater samples from wells SWMU361-MW03 and SWMU361-MW04. Naphthalene was detected in sample SWMU361-MW04 above the USEPA Region IX Tap Water PRG. 2-Methylnaphthalene was detected in sample SWMU361-MW04 above the NC DENR 2L Standard. None of the other SVOCs detected in the samples exceeded the applicable screening criteria.

Four pesticides were detected in the groundwater sample set, as follows: 4,4'-DDE, alpha-chlordane, gamma-chlordane and heptachlor epoxide. These four pesticides exceeded the NC DENR 2L standards or USEPA Region IX Tap Water PRGs in groundwater samples from well SWMU361-MW06. Alpha-chlordane and gamma-chlordane also exceeded the screening criteria in the subsurface soil sample from this well. Heptachlor epoxide also exceeded the NC DENR 2L standard in the groundwater sample from well SWMU361-MW02. No pesticides were detected in the samples from wells TW01 through TW05 and MW03 through MW05.

Five metals were detected in groundwater samples from one or more of the wells, as follows: barium, chromium, lead, selenium, and silver. Lead and selenium exceeded the background criteria; however, the concentrations were below the NC DENR 2L standards and USEPA Region IX tap water screening criteria. None of the other metals detected in the sample exceeded any of the applicable screening criteria.

Most of the VOCs and SVOCs detected in groundwater were not detected in the soils at the SWMU. Most of the pesticides and metals detected in groundwater were also detected in soils at the SWMU.

### 4.41.4 Conclusions

Several compounds were detected in soil and/or groundwater at concentrations exceeding the applicable screening criteria. Compounds that exceeded both the AOC and Base background criteria (metals only) and the NC DENR soil to groundwater criteria and/or the USEPA Region IX residential PRG in soil included the following:

- VOCs - methylene chloride
- Pesticides - alpha-chlordane and gamma-chlordane
- Metals - arsenic

Compounds that exceeded both the established background criteria (metals only) and NC DENR 2L standards in groundwater include the following:

- Semivolatiles – Naphthalene and 2-Methylnaphthalene
- Pesticides - 4,4'-DDE, alpha-chlordane, gamma-chlordane and heptachlor epoxide

For the following discussion, contamination is defined as exceedences of base background (metals only) and state and federal screening criteria.

Surface and subsurface soil contamination in the vicinity of SWMU 361 is primarily related to organic pesticides (i.e., alpha-chlordane and gamma-chlordane) and inorganic pesticides (i.e., arsenic). Borings located in landscaped areas and near paved areas tended to exhibit the highest levels of pesticides. The variety of pesticides detected and locations are consistent with historical pest control application and are not likely related to SWMU 361 operation (petroleum UST).

Groundwater contamination in the vicinity of SWMU 361 is related to organic pesticides and fuel. The presence of pesticides (alpha-chlordane, gamma-chlordane, and heptachlor epoxide) in the groundwater sample from well SWMU361-MW06 seems to be related to the soil contamination. The detection of heptachlor epoxide in the groundwater sample from well SWMU361-MW02 does not have a clear soil correlation. Naphthalene and 2-methylnaphthalene contamination in the one groundwater sample from well SWMU361-MW04 is likely related to SWMU 361. Both these SVOCs are fuel-related. Kerosene mainly contains the larger carbon molecules (ranging from C10 to C15), which would include naphthalene ($C_{10}H_8$) and 2-methylnaphthalene ($C_{11}H_{10}$). The other VOCs detected during the UST investigation (ethylbenzene, isopropylbenzene, methylcyclohexane and total xylenes) are also fuel-related. Kerosene also contains these lighter carbon molecules, but in lesser amounts.

Based on evaluation of the results, additional action at SWMU 361 is warranted. The additional activities are presented in Section 5.0.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU361-TW01 | 3/24/2002 | BAKER | 16.36 | 16.2 | 13 | 13 | 1 | 0 | 3 | 10.27 | 6.09 |
| SWMU361-TW02 | 6/22/2003 | BAKER | NR | NR | 18 | 18 | 6 | 5 | 8-18 | 16 | NR |
| SWMU361-TW03 | 6/22/2003 | BAKER | NR | NR | 17 | 17 | 5 | 4 | 7-17 | 9 | NR |
| SWMU361-TW04 | 6/18/2003 | BAKER | NR | NR | 17 | 17 | 4.8 | 4.6 | 7-17 | 2.7 | NR |
| SWMU361-TW05 | 6/18/2003 | BAKER | NR | NR | 24 | 24 | 5 | 4 | 7-17 | 16.8 | NR |
| SWMU361-MW02 | 4/17/1996 | LAW | 16.948 | 17.235 | 17 | 17 | 4 | 1.5 | 7 | 10.8 | 6.15 |
| SWMU361-MW03 | 4/18/1996 | LAW | 18.343 | 18.683 | 17 | 17 | 4.5 | 2 | 7 | 12.12 | 6.22 |
| SWMU361-MW04 | 4/24/1996 | LAW | 19.862 | 20.232 | 17 | 17 | 4 | 2.5 | 7 | 13.79 | 6.07 |
| SWMU361-MW05 | 4/24/1996 | LAW | 17.028 | 17.312 | 17 | 17 | 4 | 2.5 | 7 | 10.94 | 6.09 |
| SWMU361-MW06 | 4/25/1996 | LAW | 19.959 | 20.247 | 17 | 17 | 5 | 2 | 7 | 13.41 | 6.55 |

Notes:
msl = Mean Sea Level
bgs = Below Ground Surface
PVC = Polyvinyl chloride
NR = Not reported

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | **Base Background Criteria Surface-F. Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU361-SB02-00<br>03-24-2002<br>0' - 1' | SWMU361-SB03-00<br>03-24-2002<br>0' - 1' | SWMU361-SB04-00<br>03-24-2002<br>0' - 1' | SWMU361-SB05-00<br>03-24-2002<br>0' - 1' | SWMU361-SB06-00<br>03-24-2002<br>0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 4-Methyl-2-Pentanone | NE | 2280 | 790000 | 3 J | ND | ND | ND | ND |
| Acetone | NE | 2810 | 1600000 | 6 J | 6 J | ND | 35 | 30 J |
| Methylene Chloride | NE | 22 (1) | 9100 | 32 J | ND | 1 J | 1 J | 1 J |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 8110 (1) | 35000 | ND | ND | 7600 | ND | ND |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | 91 J | 98 J | ND | 41 J | ND |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | ND | ND | ND | 4.4 | ND |
| 4,4-DDE | NE | NE | 1700 | ND | ND | ND | ND | ND |
| 4,4-DDT | NE | 1360 | 1700 | ND | ND | ND | ND | ND |
| beta-BHC | NE | NE | 320 | ND | ND | 4.3 J | 4.1 J | ND |
| delta-BHC | NE | NE | NE | ND | ND | 0.64 J | ND | ND |
| gamma-BHC | NE | 6.2 | 440 | ND | ND | ND | ND | ND |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.671 | 5.24 | 0.39 | ND | **0.81** J | 0.25 J | ND | **1.8** |
| Barium | 16.8 | 848 | 5400 | 7 | 16.6 | 15.7 | 12.2 | **26.6** |
| Chromium | 15.2 | 27.2 | 210 | 6.1 | 13.8 | 5.5 | 4.7 | **15.9** |
| Lead | 20.9 | 270 | 400 | 3.5 | 6.3 | 4.5 | 11.4 | 6.4 |
| Mercury | 0.100 | 0.0154 | 23 | ND | ND | 0.04 | ND | ND |
| Selenium | 0.463 | 12.2 | 390 | ND | 0.26 J | 0.39 J | 0.33 J | **0.55** J |

Notes:
Bold - Exceeds Base background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 1216 mg/kg.
ND - Not Detected
NE - Not established
NA- Not analyzed

**TABLE 2**

**DETECTION SUMMARY**
**SURFACE SOIL - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | **Base Background Criteria Surface-F. Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU361-TW01-00<br>03-24-2002<br>0' - 1' | SWMU361-TW02-00<br>06-22-2003<br>0-1 | SWMU361-TW03-00<br>06-22-2003<br>0-1 | SWMU361-TW04-00<br>06-18-2003<br>0-1 | SWMU361-TW05-00<br>06-18-2003<br>0-1 |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 4-Methyl-2-Pentanone | NE | 2280 | 790000 | ND | NA | NA | NA | NA |
| Acetone | NE | 2810 | 1600000 | ND | NA | NA | NA | NA |
| Methylene Chloride | NE | 22 (1) | 9100 | 12 | NA | NA | NA | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 8110 (1) | 35000 | ND | NA | NA | NA | NA |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | ND | NA | NA | NA | NA |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | 1.9 J | ND | ND | NA | NA |
| 4,4-DDE | NE | NE | 1700 | 2.2 J | ND | ND | NA | NA |
| 4,4-DDT | NE | 1360 | 1700 | 3.2 J | ND | ND | NA | NA |
| beta-BHC | NE | NE | 320 | ND | ND | ND | NA | NA |
| delta-BHC | NE | NE | NE | ND | ND | ND | NA | NA |
| gamma-BHC | NE | 6.2 | 440 | 0.87 J | ND | ND | NA | NA |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.671 | 5.24 | 0.39 | 0.64 J | ND | ND | **0.92** J | **0.85** J |
| Barium | 16.8 | 848 | 5400 | 10.1 | 4.6 J | 10.1 J | **17.2** J | **19.8** J |
| Chromium | 15.2 | 27.2 | 210 | 8 | ND | ND | 4.9 | 7.2 |
| Lead | 20.9 | 270 | 400 | 7.1 | 1.9 | 4 | 15.5 J | 3.7 J |
| Mercury | 0.100 | 0.0154 | 23 | ND | ND | ND | ND | ND |
| Selenium | 0.463 | 12.2 | 390 | 0.31 J | 0.66 R | 0.7 R | ND | ND |

Notes:
Bold - Exceeds Base background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specifi
ND - Not Detected
NE - Not established
NA- Not analyzed

**TABLE 3**

**STATISTICAL SUMMARY**
**SURFACE SOIL - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Base Background Criteria Surface-F. Sand | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detections | Number of Exceedances: Base Background Criteria Surface-F. Sand | Number of Exceedances: North Carolina Soil to Groundwater Stds(1) ug/kg | Number of Exceedances: USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 4-Methyl-2-Pentanone | NE | 2280 | 790000 | 1/6 | 3 J - 3 J | NA | 0 | 0 |
| Acetone | NE | 2810 | 1600000 | 4/6 | 6 J - 35 | NA | 0 | 0 |
| Methylene Chloride | NE | 22 (1) | 9100 | 5/6 | 1 J - 32 J | NA | 1 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 8110 (1) | 35000 | 1/6 | 7600 - 7600 | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | 3/6 | 41 J - 98 J | NA | 0 | 0 |
| **Pesticides (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | 2/8 | 1.9 J - 4.4 | NA | 0 | 0 |
| 4,4-DDE | NE | NE | 1700 | 1/8 | 2.2 J - 2.2 J | NA | NA | 0 |
| 4,4-DDT | NE | 1360 | 1700 | 1/8 | 3.2 J - 3.2 J | NA | 0 | 0 |
| beta-BHC | NE | NE | 320 | 2/8 | 4.1 J - 4.3 J | NA | NA | 0 |
| delta-BHC | NE | NE | NE | 1/8 | 0.64 J - 0.64 J | NA | NA | NA |
| gamma-BHC | NE | 6.2 | 440 | 1/8 | 0.87 J - 0.87 J | NA | 0 | 0 |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 0.671 | 5.24 | 0.39 | 6/10 | 0.25 J - 1.8 | 4 | 0 | 5 |
| Barium | 16.8 | 848 | 5400 | 10/10 | 4.6 J - 26.6 | 3 | 0 | 0 |
| Chromium | 15.2 | 27.2 | 210 | 8/10 | 4.7 - 15.9 | 1 | 0 | 0 |
| Lead | 20.9 | 270 | 400 | 10/10 | 1.9 - 15.5 J | 0 | 0 | 0 |
| Mercury | 0.100 | 0.0154 | 23 | 1/10 | 0.04 - 0.04 | 0 | 1 | 0 |
| Selenium | 0.463 | 12.2 | 390 | 5/8 | 0.26 J - 0.55 J | 1 | 0 | 0 |

Notes:
Bold - Exceeds Base background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Surface Soil
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 1216 mg/kg.
ND - Not Detected
NE - Not established
NA- Not analyzed

T. 4

# DETECTIONS SUMMARY
## SUBSURFACE SOILS - SWMU 361
## SWMU CONFIRMATORY SAMPLING (CTO-0143)
## MCB, CAMP LEJEUNE, NORTH CAROLINA

| Site Sample I.D.<br>Sample Date<br>Depth Range | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU361-SB02-06<br>03-24-2002<br>11' - 13' | SWMU361-SB03-05<br>03-24-2002<br>9' - 11' | SWMU361-SB04-06<br>03-24-2002<br>11' - 13' | SWMU361-SB05-06<br>03-24-2002<br>11' - 13' | SWMU361-SB06-05<br>03-24-2002<br>9' - 11' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Acetone | NE | 2810 | 1600000 | 6 J | 4 J | 3 J | ND | ND |
| cis-1,2-Dichloroethene | NE | 350 | 43000 | ND | ND | ND | ND | ND |
| Methylene Chloride | NE | 22 | 9100 | 18 | 16 | ND | 19 | 1 J |
| Trichloroethene | NE | 18.3 | 53 | ND | ND | ND | ND | ND |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 6670 | 35000 | ND | ND | ND | ND | 1800 |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | ND | ND | ND | 37 J | ND |
| **Pesticides (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | ND | ND | ND | 3.1 J | 20 J |
| 4,4-DDE | NE | NE | 1700 | ND | ND | ND | ND | ND |
| 4,4-DDT | NE | 1360 | 1700 | ND | 0.53 J | ND | ND | ND |
| Aldrin | NE | NE | 29 | ND | ND | ND | ND | ND |
| alpha-Chlordane | NE | 34 (1) | 0.19(2) | ND | ND | ND | ND | 140 J |
| beta-BHC | NE | NE | 320 | 3.6 J | ND | ND | ND | ND |
| delta-BHC | NE | NE | NE | ND | 0.27 J | ND | ND | ND |
| Endosulfan Sulfate | NE | NE | 370000(3) | ND | ND | ND | ND | ND |
| gamma-BHC | NE | 6.2 | 440 | ND | ND | 0.77 J | 1.4 J | ND |
| gamma-Chlordane | NE | 34(1) | 0.19(2) | ND | ND | ND | ND | 37 |
| Heptachlor epoxide | NE | 6.67 | 53 | ND | ND | ND | ND | ND |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.62 | 5.24 | 0.39 | 0.39 J | ND | ND | 0.38 J | ND |
| Barium | 22.0 | 848 | 5400 | **29** | 12.4 | 12.3 | 14.9 | 14.6 |
| Chromium | 16.3 | 27.2 | 210 | **22.3** | 8.5 | **17.5** | 4.9 | 3.8 |
| Lead | 8.16 | 270 | 400 | **9.2** | 5.7 | **9.5** | 3.8 | 4.8 |
| Selenium | 0.687 | 12.2 | 390 | ND | ND | 0.41 J | ND | ND |

Notes:
Bold - Exceeds Base Background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Subsurface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 1216 mg/kg.
J - Analyte detected. Report value is estimated.
(2) Chlordane values were used for allpha-chlordane and gamma-chlordane
(3) Endosulfan I value used for Endosulfan II and Endosulfan Sulfate.
ND - Not Detected
NE - Not established
NA- Not analyzed

**DETECTIONS SUMMARY**
**SUBSURFACE SOILS - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date<br>Depth Range | **Base Background Criteria Subsurface-Sand** | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | SWMU361-TW01-02<br>03-24-2002<br>3' - 5' | SWMU361-TW02-05<br>06-22-2003<br>9-11 | SWMU361-TW03-06<br>06-22-2003<br>5-7 | SWMU361-TW04-06<br>06-18-2003<br>7-9 | SWMU361-TW05-08<br>06-18-2003<br>15-17 |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Acetone | NE | 2810 | 1600000 | ND | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NE | 350 | 43000 | 1 J | NA | NA | NA | NA |
| Methylene Chloride | NE | 22 | 9100 | 8 | NA | NA | NA | NA |
| Trichloroethene | NE | 18.3 | 53 | 10 | NA | NA | NA | NA |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl)phthalate | NE | 6670 | 35000 | ND | NA | NA | NA | NA |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | ND | NA | NA | NA | NA |
| **Pesticides (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | 2.2 J | ND | ND | NA | NA |
| 4,4-DDE | NE | NE | 1700 | 10 J | ND | ND | NA | NA |
| 4,4-DDT | NE | 1360 | 1700 | 12 J | ND | ND | NA | NA |
| Aldrin | NE | NE | 29 | 1.5 J | ND | ND | NA | NA |
| alpha-Chlordane | NE | 34 (1) | 0.19(2) | 9.9 J | ND | ND | NA | NA |
| beta-BHC | NE | NE | 320 | 5.6 | ND | ND | NA | NA |
| delta-BHC | NE | NE | NE | ND | ND | ND | NA | NA |
| Endosulfan Sulfate | NE | NE | 370000(3) | 2 J | ND | ND | NA | NA |
| gamma-BHC | NE | 6.2 | 440 | 0.9 J | ND | ND | NA | NA |
| gamma-Chlordane | NE | 34(1) | 0.19(2) | 3.2 J | ND | ND | NA | NA |
| Heptachlor epoxide | NE | 6.67 | 53 | 1.4 | ND | ND | NA | NA |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.62 | 5.24 | 0.39 | 1 J | ND | ND | ND | ND |
| Barium | 22.0 | 848 | 5400 | 4.9 | 8.2 J | 10 J | 7.6 J | 7.4 J |
| Chromium | 16.3 | 27.2 | 210 | 4.5 | ND | ND | 4 | 5.5 |
| Lead | 8.16 | 270 | 400 | 2.9 | 1.2 | 3.8 | 3.9 J | 4.6 J |
| Selenium | 0.687 | 12.2 | 390 | 0.25 J | **0.82** J | 0.69 R | ND | ND |

Notes:
Bold - Exceeds Base Background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Subsurface Soil
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specifi
J - Analyte detected. Report value is estimated.
(2) Chlordane values were used for allpha-chlordane and gamma-chlordane
(3) Endosulfan I value used for Endosulfan II and Endosulfan Sulfate.
ND - Not Detected
NE - Not established
NA- Not analyzed

**TABLE 5**

**SUBSURFACE SOILS STATISTICAL SUMMARY**
**SWMU 361**
**RCRA INVESTIGATION - CTO-0143**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Base Background Criteria Subsurface-Sand | North Carolina Soil to Groundwater Stds | USEPA Region IX PRGs Residential Soils | Frequency of Detection | Range of Positive Detections | Number of Exceedances: Base Background Criteria Subsurface-Sand | Number of Exceedances: North Carolina Soil to Groundwater Stds | Number of Exceedances: USEPA Region IX PRGs Residential Soils |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Acetone | NE | 2810 | 1600000 | 3/6 | 3 J - 6 J | NA | 0 | 0 |
| cis-1,2-Dichloroethene | NE | 350 | 43000 | 1/6 | 1 J - 1 J | NA | 0 | 0 |
| Methylene Chloride | NE | 22 | 9100 | 5/6 | 1 J - 19 | NA | 0 | 0 |
| Trichloroethene | NE | 18.3 | 53 | 1/6 | 10 - 10 | NA | 0 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| bis(2-Ethylhexyl) phthalate | NE | 6670 | 35000 | 1/6 | 1800 - 1800 | NA | 0 | 0 |
| Di-n-octyl phthalate | NE | 10000000 | 24000000 | 1/6 | 37 J - 37 J | NA | 0 | 0 |
| **Pesticides (ug/kg)** | | | | | | | | |
| 4,4-DDD | NE | 129 | 2400 | 3/8 | 2.2 J - 20 J | NA | 0 | 0 |
| 4,4-DDE | NE | NE | 1700 | 1/8 | 10 J - 10 J | NA | NA | 0 |
| 4,4-DDT | NE | 1360 | 1700 | 2/8 | 0.53 J - 12 J | NA | 0 | 0 |
| Aldrin | NE | NE | 29 | 1/8 | 1.5 J - 1.5 J | NA | NA | 0 |
| alpha-Chlordane | NE | 34 (1) | 0.19(2) | 2/8 | 9.9 J - 140 J | NA | 1 | 2 |
| beta-BHC | NE | NE | 320 | 2/8 | 3.6 J - 5.6 | NA | NA | 0 |
| delta-BHC | NE | NE | NE | 1/8 | 0.27 J - 0.27 J | NA | NA | NA |
| Endosulfan Sulfate | NE | NE | 370000(3) | 1/8 | 2 J - 2 J | NA | NA | 0 |
| gamma-BHC | NE | 6.2 | 440 | 3/8 | 0.77 J - 1.4 J | NA | 0 | 0 |
| gamma-Chlordane | NE | 34(1) | 0.19(2) | 2/8 | 3.2 J - 37 | NA | 1 | 2 |
| Heptachlor epoxide | NE | 6.67 | 53 | 1/8 | 1.4 - 1.4 | NA | 0 | 0 |
| **Metals (mg/kg)** | | | | | | | | |
| Arsenic | 1.62 | 5.24 | 0.39 | 3/10 | 0.38 J - 1 J | 0 | 0 | 1 |
| Barium | 22.0 | 848 | 5400 | 10/10 | 4.9 - 29 | 1 | 0 | 0 |
| Chromium | 16.3 | 27.2 | 210 | 8/10 | 3.8 - 2.3 | 2 | 0 | 0 |
| Lead | 8.16 | 270 | 400 | 10/10 | 1.2 - 9.5 | 2 | 0 | 0 |
| Selenium | 0.687 | 12.2 | 390 | 3/9 | 0.25 J - 0.82 J | 1 | 0 | 0 |

Notes:
Bold - Exceeds Base background criteria
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
Base comparison - Fine Sand Data Set for Surface and Subsurface Soil
J - Analyte detected. Report value is estimated.
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 1216 mg/kg.
(2) Chlordane values were used for allpha-chlordane and gamma-chlordane
(3) Endosulfan I value used for Endosulfan II and Endosulfan Sulfate.
ND - Not Detected
NE - Not established
NA- Not analyzed

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date | Base Background Criteria Groundwater | **NC 2L Standards** | USEPA Region IX Tap Water PRGs | SWMU361-GW01<br>04-07-2002 | SWMU361-MW02<br>04-07-2002 | SWMU361-MW03<br>04-07-2002 | SWMU361-MW04<br>04-07-2002 | SWMU361-MW05<br>04-07-2002 |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | | |
| Acetone | NE | 700 | 1600 | 6 J | ND | ND | 4 J | 4 J |
| Ethyl Benzene | NE | 29 | 2.9 | ND | ND | ND | 1 J | ND |
| Isopropylbenzene | NE | 70 | 660 | ND | ND | ND | 3 J | ND |
| Methylcyclohexane | NE | NE | 5200 | ND | ND | ND | 1 J | ND |
| Xylene (Total) | NE | 530 | 210 | ND | ND | ND | 52 | ND |
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | ND | ND | 1 J | 5 J | ND |
| 2-Methylnaphthalene | NE | 14 | NE | ND | ND | 2 J | 27 | ND |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | 1 J | ND | ND | ND | 1 J |
| Naphthalene | NE | 21 | 6.2 | ND | ND | 4 J | 16 | ND |
| **PESTICIDES (ug/L)** | | | | | | | | |
| 4,4-DDE | NE | NE | 0.2 | ND | ND | ND | ND | ND |
| alpha-Chlordane | NE | 0.027[1] | 0.19[1] | ND | ND | ND | ND | ND |
| gamma-Chlordane | NE | 0.027[1] | 0.19[1] | ND | ND | ND | ND | ND |
| Heptachlor epoxide | NE | 0.004 | 0.0074 | ND | **0.023** J | ND | ND | ND |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 37.31 | 2000 | 2600 | ND | 105 | 60.3 | 89.3 | 69.8 |
| Chromium | 5.76 | 50 | NE | 1.8 J | ND | ND | ND | ND |
| Lead | 3.61 | 15 | NE | 10.4 | ND | ND | ND | ND |
| Selenium | NE | 50 | 180 | 2.5 J | ND | ND | ND | ND |
| Silver | NE | 18 | 180 | ND | ND | ND | 0.52 J | ND |

Notes:
Shaded - Exceeds Base background screening criteria for groundwater
Bold - Exceeds NC 2L Standards
Underlined - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
[1] Chlordane values were used for alpha-chlordane and gamma-Chlordane
ND - Not Detected
NE - Not established
NA - Not analyzed

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date | Base Background Criteria Groundwater | NC 2L Standards | USEPA Region IX Tap Water PRGs | SWMU361-MW06<br>04-07-2002 | SWMU361-MW02<br>06-26-2003 | SWMU361-MW06<br>06-26-2003 | SWMU361-MW06D<br>06-26-2003 | SWMU361-TW02<br>06-26-2003 |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | | |
| Acetone | NE | 700 | 1600 | ND | NA | NA | NA | NA |
| Ethyl Benzene | NE | 29 | 2.9 | ND | NA | NA | NA | NA |
| Isopropylbenzene | NE | 70 | 660 | ND | NA | NA | NA | NA |
| Methylcyclohexane | NE | NE | 5200 | ND | NA | NA | NA | NA |
| Xylene (Total) | NE | 530 | 210 | ND | NA | NA | NA | NA |
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | ND | NA | NA | NA | NA |
| 2-Methylnaphthalene | NE | 14 | NE | ND | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | ND | NA | NA | NA | NA |
| Naphthalene | NE | 21 | 6.2 | ND | NA | NA | NA | NA |
| **PESTICIDES (ug/L)** | | | | | | | | |
| 4,4-DDE | NE | NE | 0.2 | 0.84 J | ND | ND | ND | ND |
| alpha-Chlordane | NE | 0.027[1] | 0.19[1] | **5.8** J | ND | **1.1** J | **1.2** J | ND |
| gamma-Chlordane | NE | 0.027[1] | 0.19[1] | **1.9** J | ND | **1.5** J | **1.2** J | ND |
| Heptachlor epoxide | NE | 0.004 | 0.0074 | **3.3** J | ND | ND | ND | ND |
| **METALS (ug/L)** | | | | | | | | |
| Barium | 37.31 | 2000 | 2600 | 84.8 | 138 J | 84.9 J | 91.8 J | 52.8 J |
| Chromium | 5.76 | 50 | NE | ND | ND | ND | ND | ND |
| Lead | 3.61 | 15 | NE | ND | ND | ND | ND | ND |
| Selenium | NE | 50 | 180 | 4.6 J | ND | 3.5 J | 4 J | ND |
| Silver | NE | 18 | 180 | ND | ND | ND | ND | ND |

Notes:
Shaded - Exceeds Base background screening criteria for groundwater
Bold - Exceeds NC 2L Standards
Underlined - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
[1] Chlordane values were used for alpha-chlordane and gamma-Chlordane
ND - Not Detected
NE - Not established
NA - Not analyzed

**TABLE 6**

**DETECTION SUMMARY**
**GROUNDWATER - SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| Site Sample I.D.<br>Sample Date | Base Background Criteria Groundwater | **NC 2L Standards** | USEPA Region IX Tap Water PRGs | SWMU361-TW03<br>06-26-2003 | SWMU361-TW04<br>06-26-2003 | SWMU361-TW05<br>06-26-2003 |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| Acetone | NE | 700 | 1600 | NA | NA | NA |
| Ethyl Benzene | NE | 29 | 2.9 | NA | NA | NA |
| Isopropylbenzene | NE | 70 | 660 | NA | NA | NA |
| Methylcyclohexane | NE | NE | 5200 | NA | NA | NA |
| Xylene (Total) | NE | 530 | 210 | NA | NA | NA |
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | NA | NA | NA |
| 2-Methylnaphthalene | NE | 14 | NE | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | NA | NA | NA |
| Naphthalene | NE | 21 | 6.2 | NA | NA | NA |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4-DDE | NE | NE | 0.2 | ND | ND | ND |
| alpha-Chlordane | NE | 0.027[1] | 0.19[1] | ND | ND | ND |
| gamma-Chlordane | NE | 0.027[1] | 0.19[1] | ND | ND | ND |
| Heptachlor epoxide | NE | 0.004 | 0.0074 | ND | ND | ND |
| **METALS (ug/L)** | | | | | | |
| Barium | 37.31 | 2000 | 2600 | 44.3 J | 18.5 J | 57.4 J |
| Chromium | 5.76 | 50 | NE | ND | ND | ND |
| Lead | 3.61 | 15 | NE | ND | ND | ND |
| Selenium | NE | 50 | 180 | ND | ND | ND |
| Silver | NE | 18 | 180 | ND | ND | ND |

Notes:
Shaded - Exceeds Base background screening criteria for groundwater
Bold - Exceeds NC 2L Standards
Underlined - Exceeds USEPA Region IX PRGs
J - Analyte detected. Report value is estimated.
[1] Chlordane values were used for alpha-chlordane and gamma-Chlordane
ND - Not Detected
NE - Not established
NA - Not analyzed

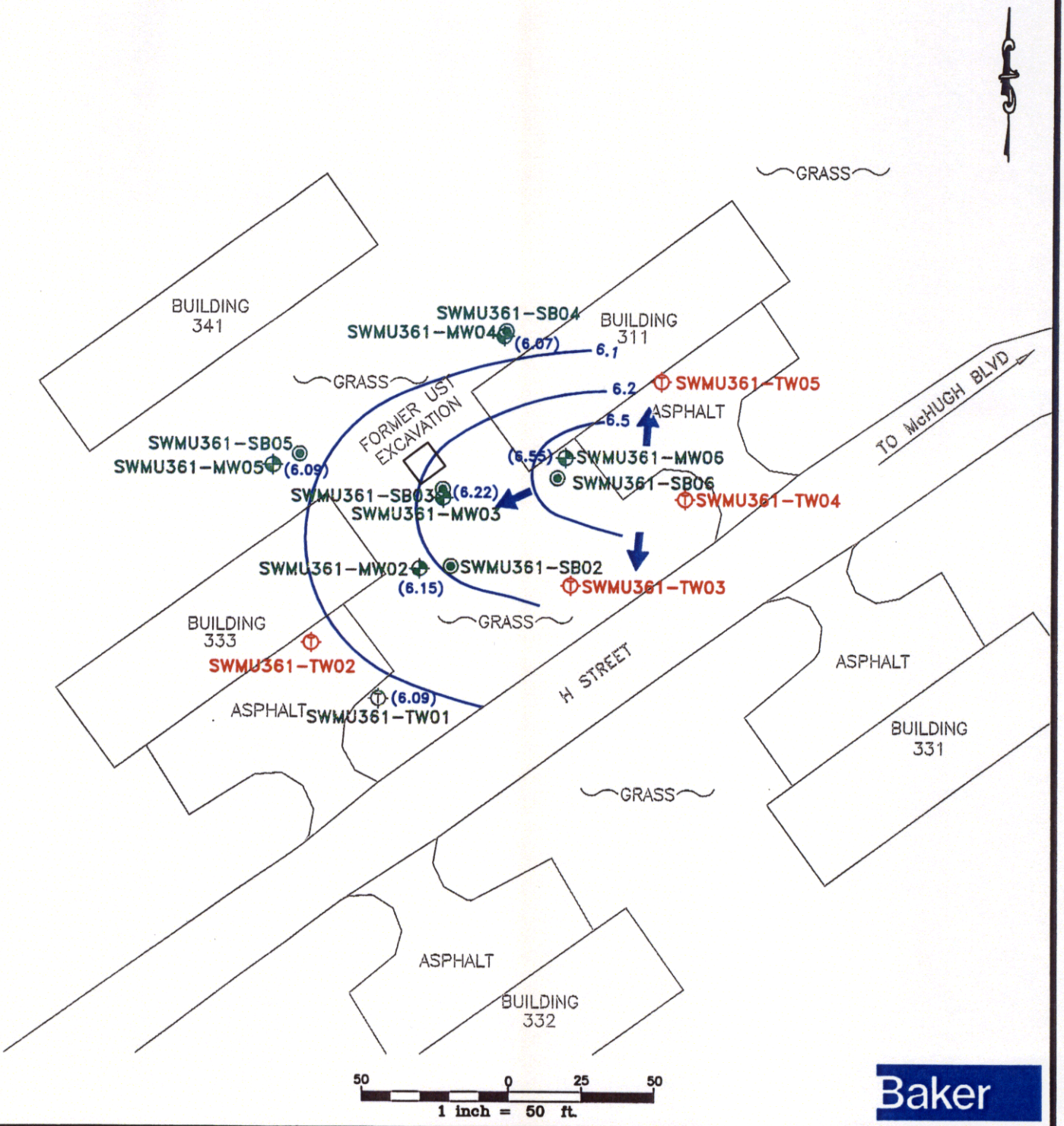
**TABLE 7**

**STATISTICAL SUMMARY**
**GROUNDWATER -SWMU 361**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| | Base Background Criteria Groundwater | NC 2L Standards | USEPA Region IX Tap Water PRGs | Frequency of Detection | Range of Positive Detections | Number of exceedances: Base Background Criteria Groundwater | Number of exceedances: NC 2L Standards | Number of exceedances: USEPA Region IX Tap Water PRGs |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | | | |
| Acetone | NE | 700 | 1600 | 3/6 | 4 J - 6 J | NA | 0 | 0 |
| Ethylbenzene | NE | 29 | 2.9 | 1/6 | 1 J - 1 J | NA | 0 | 0 |
| Isopropylbenzene | NE | 70 | 660 | 1/6 | 3 J - 3 J | NA | 0 | 0 |
| Methylcyclohexane | NE | NE | 5200 | 1/6 | 1 J - 1 J | NA | NA | 0 |
| Xylene (Total) | NE | 530 | 210 | 1/6 | 52 - 52 | NA | 0 | 0 |
| **SEMIVOLATILES (ug/L)** | | | | | | | | |
| 1,1-Biphenyl | NE | 350 | 300 | 2/6 | 1 J - 5 J | NA | 0 | 0 |
| 2-Methylnaphthalene | NE | 14 | NE | 2/6 | 2 J - 27 | NA | 1 | NA |
| bis(2-Ethylhexyl)phthalate | NE | 3 | 4.8 | 2/6 | 1 J - 1 J | NA | 0 | 0 |
| Naphthalene | NE | 21 | 6.2 | 2/6 | 4 J - 16 | NA | 0 | 1 |
| **Pesticides (ug/L)** | | | | | | | | |
| 4,4-DDE | NE | NE | 0.2 | 1/13 | 0.84 J - 0.84 J | NA | 0 | 1 |
| alpha-Chlordane | NE | 0.027[1] | 0.19[1] | 3/13 | 1.1 J - 5.8 J | NA | 3 | 3 |
| gamma-Chlordane | NE | 0.027[1] | 0.19[1] | 3/13 | 1.2 J - 1.9 J | NA | 3 | 3 |
| Heptachlor epoxide | NE | 0.004 | 0.0074 | 2/13 | 0.023 J - 3.3 J | NA | 2 | 2 |
| **Metals (ug/L)** | | | | | | | | |
| Barium | 37.31 | 2000 | 2600 | 12/13 | 18.5 J - 138 J | 11 | 0 | 0 |
| Chromium | 5.76 | 50 | NE | 1/13 | 1.8 J - 1.8 J | 0 | 0 | NA |
| Lead | 3.61 | 15 | NE | 1/13 | 10.4 - 10.4 | 1 | 0 | NA |
| Selenium | NE | 50 | 180 | 4/13 | 2.5 J - 4.6 J | NA | 0 | 0 |
| Silver | NE | 18 | 180 | 1/13 | 0.52 J - 0.52 J | NA | 0 | 0 |

Notes:
[1] Chlordane values were used for alpha-chlordane and gamma-Chlordane
J - Analyte detected. Report value is estimated.
NE - Not established
NA - Not analyzed

26007/143/Graphics/Cad/additional Sampling2003/2143ASM_361_01

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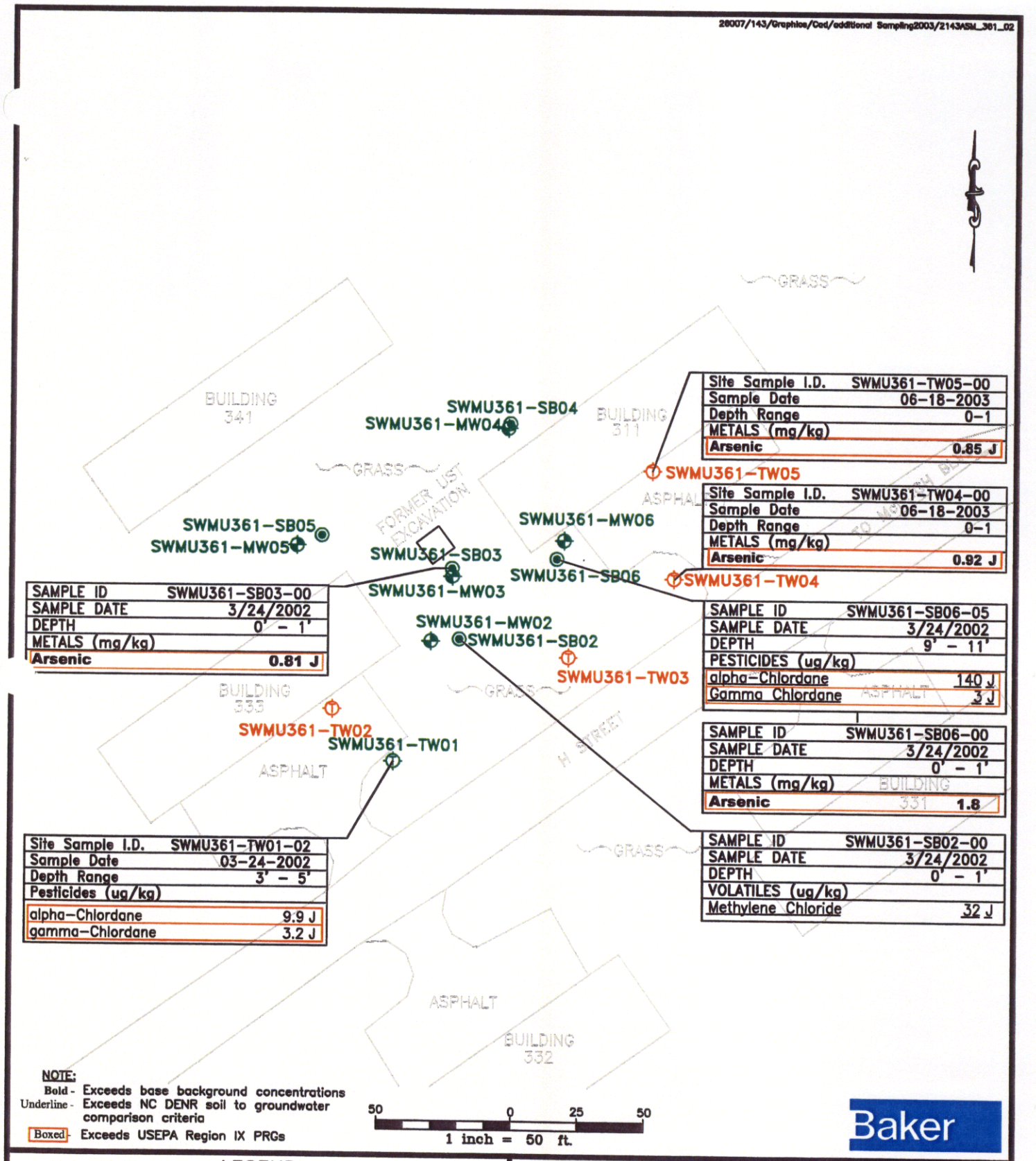
## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- SOIL BORING
- EXISTING MONITORING WELL
- GROUNDWATER FLOW DIRECTION
- 13.0 – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY SAMPLING INVESTIGATION
SWMU 361
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753EB42Y




| Site Sample I.D. | SWMU361-TW05-00 |
|---|---|
| Sample Date | 06-18-2003 |
| Depth Range | 0-1 |
| METALS (mg/kg) | |
| **Arsenic** | **0.85 J** |

| Site Sample I.D. | SWMU361-TW04-00 |
|---|---|
| Sample Date | 06-18-2003 |
| Depth Range | 0-1 |
| METALS (mg/kg) | |
| **Arsenic** | **0.92 J** |

| SAMPLE ID | SWMU361-SB03-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Arsenic** | **0.81 J** |

| SAMPLE ID | SWMU361-SB06-05 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 9' - 11' |
| PESTICIDES (ug/kg) | |
| alpha-Chlordane | 140 J |
| Gamma Chlordane | 3 J |

| SAMPLE ID | SWMU361-SB06-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| METALS (mg/kg) | |
| **Arsenic** | **1.8** |

| Site Sample I.D. | SWMU361-TW01-02 |
|---|---|
| Sample Date | 03-24-2002 |
| Depth Range | 3' - 5' |
| Pesticides (ug/kg) | |
| alpha-Chlordane | 9.9 J |
| gamma-Chlordane | 3.2 J |

| SAMPLE ID | SWMU361-SB02-00 |
|---|---|
| SAMPLE DATE | 3/24/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Methylene Chloride | 32 J |

NOTE:
**Bold** - Exceeds base background concentrations
Underline - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs

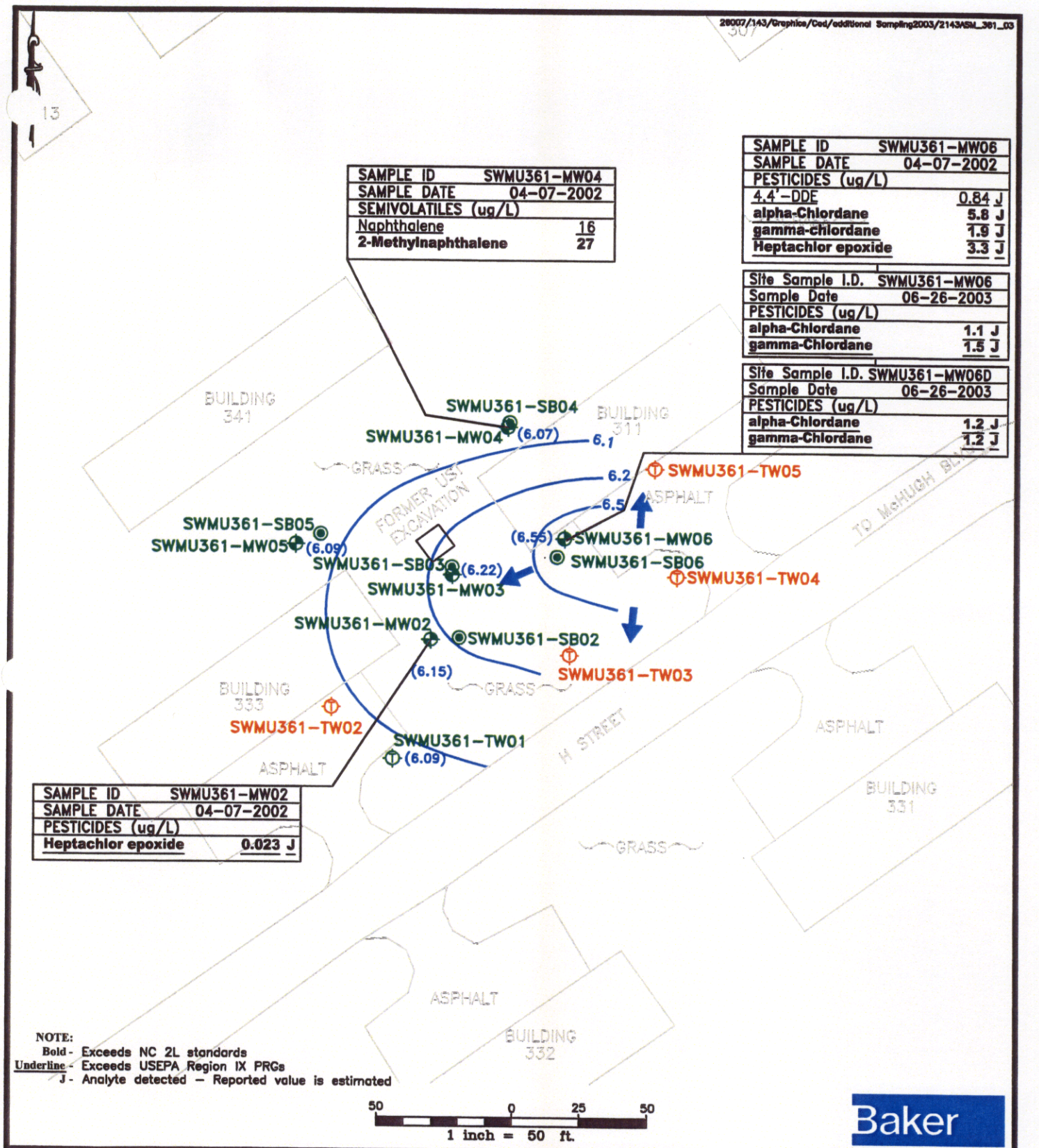
Baker

## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- SOIL BORING
- EXISTING MONITORING WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

# FIGURE 2
## PHASE II CONFIRMATORY INVESTIGATION CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
## SWMU 361
## CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- PHASE II TEMPORARY WELL
- ADDITIONAL PHASE II TEMPORARY WELL
- SOIL BORING
- EXISTING MONITORING WELL
- GROUNDWATER FLOW DIRECTION
- 6.1 — GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 361
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.42 SWMU 362 - Dog 11 Area

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI and supplemental investigation, investigation findings, and conclusions.

### 4.42.1 SWMU Description and History

SWMU 362 is an area referred to as Dog 11 Area behind the 2nd Tank Battalion's staging area. An unnamed tributary flows through the central portion of the SWMU. The Installation Restoration Branch (IRB) was notified of a potential SWMU, and requested to conduct a site visit to identify any evidence of improper disposal of hydraulic fluid and/or used oil in the Dog 11 area. The Environmental Compliance Branch ECB and the IRB conducted a site visit on August 2, 2001. ECB and IRB representatives confirmed the improper disposal of hydraulic fluid and noted a large amount of solid waste in the area, including an area along the bank of the unnamed tributary. As a result, the 2nd Tank Battalion performed a "Clean Sweep" to remove the solid wastes from the area. In addition, the SWMU was included in the Phase II to evaluate potential impacts to soil and surface water/sediment due to past disposal practices. A SWMU investigation plan is presented as Figure 1.

### 4.42.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 26 and April 9 and 10, 2002 in general accordance with the Final Project Plans (Baker, 2002). As a result of the detections of pesticides in sediment during the Phase II CSI, additional sediment and surface water sampling was conducted on July 15, 2003 as a part of a supplemental investigation. The purposes of these investigations were to evaluate potential impacts to soil, surface water, and sediment at the SWMU. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at one soil boring
- Surface soil sampling at three locations
- Surface water and sediment sampling at five locations from the unnamed tributary

It should be noted that groundwater was not evaluated as part of this investigation because past disposal practices reported at the SWMU were surficial in nature.

In addition, the confirmatory sampling was considered a "Phase I-type" investigation and, if necessary, groundwater would be evaluated in a subsequent phase. This was agreed to by NC DENR during a telephone conference call with Baker, the Base, and LANTDIV in March 2002.

### 4.42.3 Investigation Findings

The soil and surface water samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, RCRA metals and pesticides. A summary of the laboratory analytical results is included in Appendix G.

Soil

The analytical results and statistical summaries for positive detections are presented on Tables 1 through 4 and were compared to the following screening criteria:

- AOC background criteria
- Base background criteria
- Default and site specific NC DENR soil to groundwater criteria
- USEPA Region IX Residential PRGs

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Two VOCs (isopropyl benzene and methylene chloride) were detected in one or more of the surface soil samples. Methylene chloride exceeded the NC DENR soil to groundwater screening criteria in surface soil sample SWMU362-SS02-00 (Figure 2). It should be noted that low levels of methylene chloride were detected in all surface soil samples at similar concentrations, and may be attributable to lab-type preparation/cleaning. No VOCs were detected above the laboratory reporting limits in the subsurface soil sample.

Seven SVOCs were detected in the sample set. None of the SVOCs detected in the samples exceeded the applicable screening criteria.

Five RCRA metals were detected in the sample set, as follows: barium, cadmium, chromium, lead and mercury. Mercury exceeded the NC DENR soil to groundwater screening criteria in two surface soil samples; however, concentrations were below the AOC and Base background screening criteria. Cadmium and lead exceeded the Base background screening criteria; however, the concentrations were below the AOC background screening criteria, USEPA Region IX residential PRGs, and NC DENR soil to groundwater screening criteria. None of the other metals detected in the samples exceeded the applicable screening criteria.

Eleven pesticides were detected in the soil sample set. None of the pesticides detected in the samples exceeded the applicable screening criteria.

Surface Water

The analytical results and statistical summary for positive detections are presented on Tables 5 and 6 and were compared to USEPA Region IV Surface Water Screening Values (Chronic Screening Values) and NCAC 2B Surface Water Quality Standards.

No VOCs, SVOCs, or metals were detected above the laboratory reporting limits in the surface water samples.

One pesticide (alpha-BHC) was detected in surface water sample SWMU362-SW01. The concentration was below the established screening criteria. None of the other pesticides were detected above the laboratory reporting limits.

Sediment

The analytical results and statistical summary for the sediment samples are presented on Tables 7 and 8 and were compared to USEPA Region IV Ecological Sediment Screening criteria where applicable.

It should be noted that the following constituents were detected in one or more of the sediment samples and did not have USEPA Region IV sediment screening criteria established: barium, benzene, bromoform, butyl benzyl phthalate, carbon disulfide, cyclohexane, ethylbenzene, methylene chloride, and toluene. As a result, the following literature sources were reviewed to determine if toxicological benchmarks have been established for these nine constituents:


- Buchman, M.F. 1999. NOAA screening quick reference tables. NOAA HAZMAT Report 99-1. National Oceanic and Atmospheric Administration, Seattle, WA. 12 pp.

- Environment Canada. Canadian sediment quality Guidelines. http://www.ec.gc.ca/ceqg-rcqe/English/Pdf/sediment_summary_table.htm

- Jones, D.S., G.W. Suter II, and R.N. Hull.1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-95/R4.

- Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environ. Management. 19(1):81-97.

- Long, E.R. and L.G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration, Seattle, WA. NOAA Technical memorandum NOS OMA 52.

- MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters: Volume 1 - Development and Evaluation of Sediment Quality Assessment Guidelines. Florida Department of Environmental Protection, Tallahassee, Fl.

- Persaud, D, R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of the Environment (OMOE).

- USEPA. 1996a. Ecotox thresholds. EPA 540/F-95/038. Office of Solid Waste and Emergency Response, Washington, D.C.

- USEPA. 1996b. Calculation and Evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius*. EPA 905-R96-008. Great Lakes National Program office, Chicago, Ill.

A summary of the toxicological benchmarks available from the literature sources listed above for the nine detected constituents lacking USEPA Region IV screening criteria is presented in Table 9. With the exception of cyclohexane, one or more toxicological benchmarks were identified from the literature for all constituents. The specific literature values selected as sediment screening criteria for this investigation are identified in Table 9 with shading and bold print. Since sediment samples were collected from freshwater habitat, freshwater toxicological benchmarks were preferenced over marine values. When more than one freshwater value was available from the literature for a given constituent, the minimum value was selected as the screening criteria. A marine toxicological benchmark was selected as the sediment screening value only if a freshwater criteria was not available from the literature

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria.

Seven VOCs were detected in one or more of the sediment samples. None of the VOCs detected in the samples exceeded the established screening criteria.

Two SVOCs [bis(2-Ethylhexyl)phthalate and butyl benzyl phthalate] were detected in one or more of the sediment samples. None of the SVOCs detected in the samples exceeded the established screening criteria.

Three pesticides (4'4-DDD, 4,4'-DDE and alpha-chlordane) were detected in one or more of the sediment samples. 4,4'-DDD was detected above the Region IV sediment screening criteria in samples SWMU362-SD01 and SWMU362-SD02. These two samples were collected from the unnamed tributary adjacent to the area of solid waste disposal along the bank (see Figure 2). None of the other pesticides detected in the samples exceeded the established screening criteria.

Four metals were detected in one or more of the sediment samples, as follows: barium, cadmium, chromium and lead. None of the metals detected in the samples exceeded the established screening criteria.

### 4.42.4 Conclusions

Methylene chloride was detected above the NC DENR soil to groundwater screening criteria in surface soil, and 4,4'-DDD was detected above the Region IV sediment screening criteria in sediment.

It should be noted that low levels of methylene chloride appear to be ubiquitous in the surface soil and may be attributable to lab-type preparation/cleaning.

Based on evaluation of the analytical results, no further action is recommended for SWMU 362 The presence of methylene chloride is likely non-site related. The presence of 4,4'-DDD at relatively low levels is indicative of routine, base-wide pesticide application.

TA 1

DETECTION SUMMARY
SURFACE SOIL - SWMU 362
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU362-SB01-00 03-26-2002 0' - 1' | SWMU362-SS01-00 03-26-2002 0' - 1' | SWMU362-SS02-00 03-26-2002 0' - 1' | SWMU362-SS03-00 03-26-2002 0' - 1' |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| Isopropylbenzene | NE | NE | NE | 160000 | ND | ND | ND | 6 J |
| Methylene chloride | NE | NE | 35 (2) | 8900 | 34 | 31 | 36 | 27 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | |
| Benzaldehyde | NE | NE | NE | 88000000 | ND | 41 J | ND | 76 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 190 J | 170 J | ND | ND |
| Caprolactam | NE | NE | NE | 31000000 | ND | ND | ND | 29 J |
| **METALS (mg/kg)** | | | | | | | | |
| Barium | 36 | 23 | 848 | 5400 | 9.3 | 10.4 | ND | ND |
| Cadmium | 2.4 | 0.04 | 2.7 | 37 | **0.62** | **1.2** | ND | ND |
| Chromium | 27 | 12 | 27 | 210 | 6.2 | 7.7 | 2.5 | 4 |
| Lead | 25 | 26 | 270 | 400 | 8.6 | 14.5 | 4.1 | 8.8 |
| Mercury | 0.05 | 0.13 | 0.015 | 23 | 0.04 J | ND | ND | 0.02 J |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| 4,4'-DDD | NE | NE | 130 | 2400 | 0.89 J | ND | ND | ND |
| 4,4'-DDE | NE | NE | NE | 1700 | 0.86 J | 0.46 J | ND | ND |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 4.4 J | 1.5 J | 3 J | 16 J |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | ND | 0.54 J | ND | ND |
| beta-BHC | NE | NE | NE | 320 | 0.75 J | 0.93 J | 1.7 J | 2 J |
| Dieldrin | NE | NE | 1.1 | 30 | ND | ND | 0.61 J | ND |
| Endosulfan II | NE | NE | 24741 (3) | 370000 | ND | 0.72 J | ND | 18 J |
| Endosulfan sulfate | NE | NE | NE | 370000 | ND | 0.47 J | 3 J | ND |
| Endrin (1) | NE | NE | 440 | 18000 | ND | ND | ND | 32 J |
| Heptachlor | NE | NE | 2.4 | 110 | ND | ND | ND | 2.2 J |
| Methoxychlor | NE | NE | 56100 | 310000 | ND | 9 J | ND | 58 J |

Shaded - Exceeds AOC background concentrations
**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater comparison criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Endrin, endrin aldehyde and endrin keytone (total)
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria. Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 13670 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 13670mg/kg.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 362
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | Soil to Groundwater Values | PRGs Residential Soil | Detects No. of Samples | of Positive Detections | Above AOC Background | Above Base Background | Above NC DENR Soil to Groundwater | USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | |
| Isopropylbenzene | NE | NE | NE | 160000 | 1/4 | 6 J | NA | NA | 0 | 0 |
| Methylene chloride | NE | NE | 35 (2) | 8900 | 4/4 | 27 - 36 | NA | NA | 1 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Benzaldehyde | NE | NE | NE | 88000000 | 2/4 | 41 J - 76 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 2/4 | 170 J - 190 J | NA | NA | 0 | 0 |
| Caprolactam | NE | NE | NE | 31000000 | 1/4 | 29 J | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Barium | 36 | 23 | 848 | 5400 | 2/4 | 9.3 - 10.4 | 0 | 0 | 0 | 0 |
| Cadmium | 2.4 | 0.04 | 2.7 | 37 | 2/4 | 0.62 - 1.2 | 0 | 2 | 0 | 0 |
| Chromium | 27 | 12 | 27 | 210 | 4/4 | 2.5 - 7.7 | 0 | 0 | 0 | 0 |
| Lead | 25 | 26 | 270 | 400 | 4/4 | 4.1 - 14.5 | 0 | 0 | 0 | 0 |
| Mercury | 0.05 | 0.13 | 0.015 | 23 | 2/4 | 0.02 J - 0.04 J | 0 | 0 | 2 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 130 | 2400 | 1/4 | 0.89 J | NA | NA | 0 | 0 |
| 4,4'-DDE | NE | NE | NE | 1700 | 2/4 | 0.46 J - 0.86 J | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 4/4 | 1.5 J - 16 J | NA | NA | 0 | 0 |
| alpha-Chlordane | NE | NE | 27.8 | 1600 | 1/4 | 0.54 J | NA | NA | 0 | 0 |
| beta-BHC | NE | NE | NE | 320 | 1/4 | 0.75 J | NA | NA | 0 | 0 |
| Dieldrin | NE | NE | 1.1 | 30 | 1/4 | 0.61 J | NA | NA | 0 | 0 |
| Endosulfan II | NE | NE | 24800 (3) | 370000 | 2/4 | 0.72 J - 18 J | NA | NA | 0 | 0 |
| Endosulfan sulfate | NE | NE | NE | 370000 | 2/4 | 0.47 J - 3 J | NA | NA | 0 | 0 |
| Endrin (1) | NE | NE | 440 | 18000 | 1/4 | 32 J | NA | NA | 0 | 0 |
| Heptachlor | NE | NE | 2.4 | 110 | 1/4 | 2.2 J | NA | NA | 0 | 0 |
| Methoxychlor | NE | NE | 56100 | 310000 | 2/4 | 9 J - 58 J | NA | NA | 0 | 0 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Endrin, endrin aldehyde and endrin keytone (total)
(2) - Detected concentrations exceed NC DENR generic soil-to-water criteria.
Therefore, site-specific critieria were calculated using a 2L or interim 2L standard and TOC of 13670 mg/kg.
(3) - Site-specific criteria calculated with interim 2L and TOC of 13670mg/kg.
AOC comparison - AOC 7 Surface Soil
Base comparison - Loam-Silt Surface Soil

# DETECTION SUMMARY
## SUBSURFACE SOIL - SWMU 362
## SWMU CONFIRMATORY SAMPLING (CTO-0143)
## MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | SWMU362-SB01-01 03-26-2002 1' - 3' |
|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | |
| Acenaphthene | NE | NE | 8160 | 3700000 | 540 J |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 310 J |
| Dibenzofuran | NE | NE | 62400 (1) | 290000 | 1100 J |
| Fluorene | NE | NE | 44300 | 2600000 | 1400 |
| Phenanthrene | NE | NE | 59600 | NE | 1800 |
| **METALS (mg/kg)** | | | | | |
| Chromium | 27 | 16 | 27 | 210 | 3.3 |
| Lead | 15 | 8.2 | 270 | 400 | **8.3** |
| **PESTICIDES (ug/kg)** | | | | | |
| 4,4'-DDD | NE | NE | 130 | 2400 | 1.3 J |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 1.5 J |
| beta-BHC | NE | NE | NE | 320 | 1.2 J |

**No VOCs were detected in the samples**

Shaded - Exceeds AOC background concentrations

**Bold** - Exceeds base background concentrations

Underlined - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

(1) - Site-specific criteria calculated with interim 2L and TOC of 13670mg/kg.

J - Analyte detected. Report value is estimated.

NE - Not established

4/15/2004
SWMU362_SOIL.xls

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 362
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | AOC Background (1) | Base Background (1) | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Residential Soil | No. of Positive Detects / No. of Samples | Range of Positive Detections | Positive Detects Above AOC Background | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Residential Soil |
|---|---|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (ug/kg)** | | | | | | | | | | |
| Acenaphthene | NE | NE | 8160 | 3700000 | 1/1 | 540 J | NA | NA | 0 | 0 |
| bis(2-Ethylhexyl) phthalate | NE | NE | 6670 | 35000 | 1/1 | 310 J | NA | NA | 0 | 0 |
| Dibenzofuran | NE | NE | 62400 (2) | 290000 | 1/1 | 1100 J | NA | NA | 0 | 0 |
| Fluorene | NE | NE | 44300 | 2600000 | 1/1 | 1400 | NA | NA | 0 | 0 |
| Phenanthrene | NE | NE | 59600 | NE | 1/1 | 1800 | NA | NA | 0 | 0 |
| **METALS (mg/kg)** | | | | | | | | | | |
| Chromium | 27 | 16 | 27 | 210 | 1/1 | 3.3 | 0 | 0 | 0 | 0 |
| Lead | 15 | 8.2 | 270 | 400 | 1/1 | 8.3 | 0 | 1 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | | | |
| 4,4'-DDD | NE | NE | 130 | 2400 | 1/1 | 1.3 J | NA | NA | 0 | 0 |
| 4,4'-DDT | NE | NE | 1360 | 1700 | 1/1 | 1.5 J | NA | NA | 0 | 0 |
| beta-BHC | NE | NE | NE | 320 | 1/1 | 1.2 J | NA | NA | 0 | 0 |

**No VOCs were detected in the samples**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Background concentrations were collected for inorganics
(2) - Site-specific criteria calculated with interim 2L and TOC of 13670mg/kg.
AOC comparison - AOC 7 Subsurface Soil
Base comparison - Sand Subsurface Soil

TABLE 5

Revised: June 2005

**DETECTION SUMMARY**
**SURFACE WATER - SWMU 362**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | **USEPA Region IV Surface Water Screening Value (1)** | **NCAC 2B Surface Water Quality Standards** | SWMU362-SW01<br>04-10-2002 | SWMU362-SW02<br>04-10-2002 | SWMU362-SW03<br>04-10-2002 | SWMU362-SW04<br>07-15-2003 | SWMU362-SW05<br>07-15-2003 |
|---|---|---|---|---|---|---|---|
| **PESTICIDES (ug/L)** | | | | | | | |
| alpha-BHC | 500 | NE | 0.024 J | 0.05 UJ | 0.05 UJ | 0.051 UJ | 0.052 UJ |

Notes:
No VOC, SVOCs, or Metals were detected
Shaded - Exceeds base background concentrations
J - Analyte detected. Report value is estimated.
U - Not Detected
NE - Not Established

**TABLE 6**

**STATISTICAL SUMMARY**
**SURFACE WATER- SWMU 362**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | USEPA Region IV Surface Water Sceening Value (1) | Minimum Detected | Maximum Detected | Frequency of Detection | USEPA Region IV Surface Water Sceening Value (1) |
|---|---|---|---|---|---|
| **PESTICIDES (ug/L)** | | | | | |
| alpha-BHC | 500 | 0.024 J | 0.024 J | 1/5 | 0 |

**No VOCs, SVOCs, or metals were detected in the samples**

Shaded - Exceeds USEPA USEPA Region IV Surface Water Sceening Value
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
(1) - Based on Region IV Water Management Division, Water Quality Standards Unit's Screening List

TABLE 7

**DETECTION SUMMARY**
**SEDIMENT - SWMU 362**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | Region IV Ecological Screening Values for Sediment | SWMU362-SD01<br>04-09-2002 | | SWMU362-SD02<br>04-09-2002 | | SWMU362-SD03<br>04-09-2002 | | SWMU362-SD04<br>07-15-2003 | | SWMU362-SD05<br>07-15-2003 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | | | | |
| Benzene | 57 (2) | 2 | J | 7 | U | 6 | U | NA | | NA | |
| Bromoform | 650 (2) | 28 | | 27 | | 37 | | NA | | NA | |
| Carbon disulfide | 850 (3) | 2 | J | 2 | J | 6 | U | NA | | NA | |
| Cyclohexane | NE | 3 | J | 2 | J | 6 | U | NA | | NA | |
| Ethylbenzene | 89 (3) | 2 | J | 7 | U | 6 | U | NA | | NA | |
| Methylene chloride | 370 (3) | 22 | | 30 | | 38 | | NA | | NA | |
| Toluene | 500 (3) | 3 | J | 7 | U | 6 | U | NA | | NA | |
| **SEMIVOLATILES (ug/kg)** | | | | | | | | NA | | NA | |
| bis(2-Ethylhexyl)phthalate | 182 | 180 | J | 410 | U | 75 | J | NA | | NA | |
| Butyl benzyl phthalate | 11000 (2) | 92 | J | 410 | U | 420 | U | NA | | NA | |
| **PESTICIDES (ug/kg)** | | | | | | | | | | | |
| 4,4'-DDD | 3.3 | 35 | J | 3.9 | J | 4.2 | U | 4.4 | U | 4.9 | U |
| 4,4'-DDE | 3.3 | 3 | J | 0.8 | J | 1.3 | J | 4.4 | U | 4.9 | U |
| alpha-Chlordane | 1.7 (1) | 1.5 | J | 2.1 | U | 2.2 | U | 23 | U | 25 | U |
| **METALS (mg/kg)** | | | | | | | | | | | |
| Barium | 48 (4) | 3.9 | J | 5.1 | J | 3.9 | J | NA | | NA | |
| Cadmium | 1 | 0.23 | J | 0.31 | J | 0.43 | J | NA | | NA | |
| Chromium | 52.3 | 2.9 | J | 17.4 | J | 2.5 | J | NA | | NA | |
| Lead | 30.2 | 6.6 | J | 6.9 | J | 4.3 | J | NA | | NA | |

Notes:

Shaded - Exceeds Region IV Ecological Screening Values for Sediment
J - Analyte detected. Report value is estimated.
ND - Not detected
NE - Not established
(1) - Screening level for chlrodane used
(2) - USEPA Sediment Quality Benchmark (Freshwater Sediment Benchmark)
(3) - Oak Ridge National Library Sediment Quality Benchmark (Freshwater Sediment Benchmark)
(4) - Washington Apparent Effects Threshold (values taken from Buchman 1999 - Marine Sediment Benchmark)

**STATISTICAL SUMMARY**
**SEDIMENT -SWMU 362**
**SWMU CONFIRMATORY SAMPLING (CTO-0143)**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

| SAMPLE ID<br>SAMPLE DATE | Region IV Ecological Screening Values for Sediment | Minimum Detected | Maximum Detected | Frequency of Detection | Number of exceedances Region IV Ecological Screening Values for Sediment |
|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | |
| Benzene | 57 (2) | 2 J | 2 J | 1/3 | 0 |
| Bromoform | 650 (2) | 27 | 37 | 3/3 | 0 |
| Carbon disulfide | 850 (3) | 2 J | 2 J | 2/3 | 0 |
| Cyclohexane | NE | 2 J | 3 J | 2/3 | 0 |
| Ethylbenzene | 89 (3) | 2 J | 2 J | 1/3 | 0 |
| Methylene chloride | 370 (3) | 22 | 38 | 3/3 | 0 |
| Toluene | 500 (3) | 3 J | 3 J | 1/3 | 0 |
| **SEMIVOLATILES (ug/kg)** | | | | | 0 |
| bis(2-Ethylhexyl)phthalate | 182 | 75 J | 180 J | 2/3 | 0 |
| Butyl benzyl phthalate | 11000 (2) | 92 J | 92 J | 1/3 | 0 |
| **PESTICIDES (ug/kg)** | | | | | 0 |
| 4,4'-DDD | 3.3 | 3.9 J | 35 J | 2/5 | 2 |
| 4,4'-DDE | 3.3 | 0.8 J | 3 J | 3/5 | 0 |
| alpha-Chlordane | 1.7 (1) | 1.5 J | 1.5 J | 1/5 | 0 |
| **METALS (mg/kg)** | | | | | 0 |
| Barium | 48 (4) | 3.9 J | 5.1 J | 3/3 | 0 |
| Cadmium | 1 | 0.23 J | 0.43 J | 3/3 | 0 |
| Chromium | 52.3 | 2.5 J | 17.4 J | 3/3 | 0 |
| Lead | 30.2 | 4.3 J | 6.9 J | 3/3 | 0 |

Notes:

Shaded - Exceeds Region IV Ecological Screening Values for Sediment
J - Analyte detected. Report value is estimated.
ND - Not detected
NE - Not established
(1) - Screening level for chlrodane used
(2) - USEPA Sediment Quality Benchmark (Freshwater Sediemnt Bechmark)
(3) - Oak Ridge National Library Sediment Quality Benchmark (Freshwater Sediemnt Bechmark)
(4) - Washington Apparent Effects Threshold (values taken from Buchman 1999 - Marine Sediment Benchmark)

TABLE 9

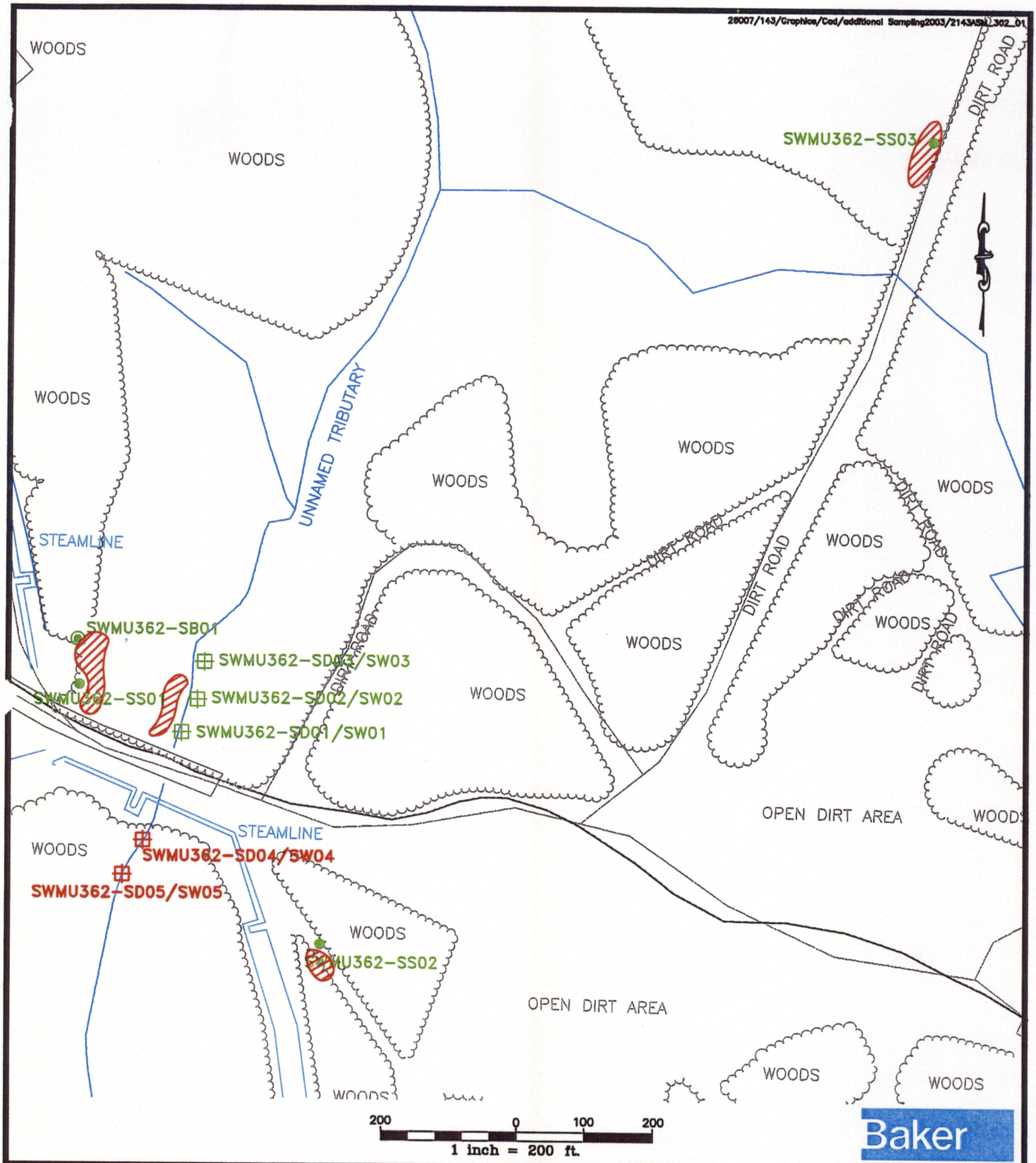
SUMMARY OF LITERATURE-BASED SEDIMENT TOXICOLOGICAL BENCHMARKS
FOR DETECTED CHEMICALS LACKING USEPA REGION 4 SEDIMENT SCREENING CRITERIA
SWMU CONFIRMATORY SAMPLING (CTO-143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| Chemical | Freshwater Sediment Benchmarks | | | | | | | | | | Marine Sediment Benchmarks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Canadian SQGs | | Ontario Provincial SQGs | | | USEPA SECs | | | ORNL | USEPA | NOAA SQGs | | FDEP SQAGs | | Washington |
| | ISQG (mg/kg) | PEL (mg/kg) | NEL (mg/kg) | LEL (mg/kg) | SEL (mg/kg) | TEL (mg/kg) | PEL (mg/kg) | NEC (mg/kg) | SQBs (mg/kg) | SQBs (mg/kg) | ER-L (mg/kg) | ER-M (mg/kg) | TEL (mg/kg) | PEL (mg/kg) | AETs (mg/kg) |
| Barium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 48 |
| Benzene | --- | --- | --- | --- | --- | --- | --- | --- | 0.16 | 0.057 | --- | --- | --- | --- | --- |
| Bromoform | --- | --- | --- | --- | --- | --- | --- | --- | 0.65 | 0.65 | --- | --- | --- | --- | --- |
| Butyl benzyl phthlate | --- | --- | --- | --- | --- | --- | --- | --- | 11 | 11 | --- | --- | --- | --- | 0.063 |
| Carbon disulfide | --- | --- | --- | --- | --- | --- | --- | --- | 0.85 | --- | --- | --- | --- | --- | --- |
| Cyclohexane | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ethylbenzene | --- | --- | --- | --- | --- | --- | --- | --- | 0.089 | 3.6 | --- | --- | --- | --- | 0.004 |
| Methylene chloride | --- | --- | --- | --- | --- | --- | --- | --- | 0.37 | --- | --- | --- | --- | --- | --- |
| Toluene | --- | --- | --- | --- | --- | --- | --- | --- | 0.5 | 0.67 | --- | --- | --- | --- | --- |

Bolded and shaded values represent the literature-based toxicological benchmarks selected as sediment screening values.

Notes:

AET = Apparent Effects Threshold (values taken from Buchman 1999)
ER-L = Effects Rnage Low (values taken from Long and Morgan 1991 and Long et al. 1995)
ER-M = Effects Range-Median (values taken from Long and Morgan 1991 and Long et al. 1995)
FDEP = Florida Department of Environmental Protection
ISQG = Interim Sediment Quality Guideline (Values taken from Environment Canada 2002)
LEL = Lowest effect level (Values taken from Persaud 1993)
NEC = No Effect Concentration (values take from USEPA 1996b)
NEL = No Effect Level (Values take from Persaud et al. 1993)
NOAA - National Oceanic and Atmospheric Administration
ORNL = Oak Ridge National Laboratory
PEL = Probable Effect level (Canadian PEL values taken from Environment Canada 2002; USEPA PELs taken from USEPA 1996b; FDEP PELs taken from MacDonald 1994))
SQB = Sediment Quality Benchmark
SQG = Sediment Quality Guideline (ORNL values take froom Jones et al. 1997; USEPA SQB
SQAG = sedimen quality assessment Guideline
TEL = Threshold Effect Level (Values taken from MacDonald 1994)
USEPA = Environmental Protection Agency

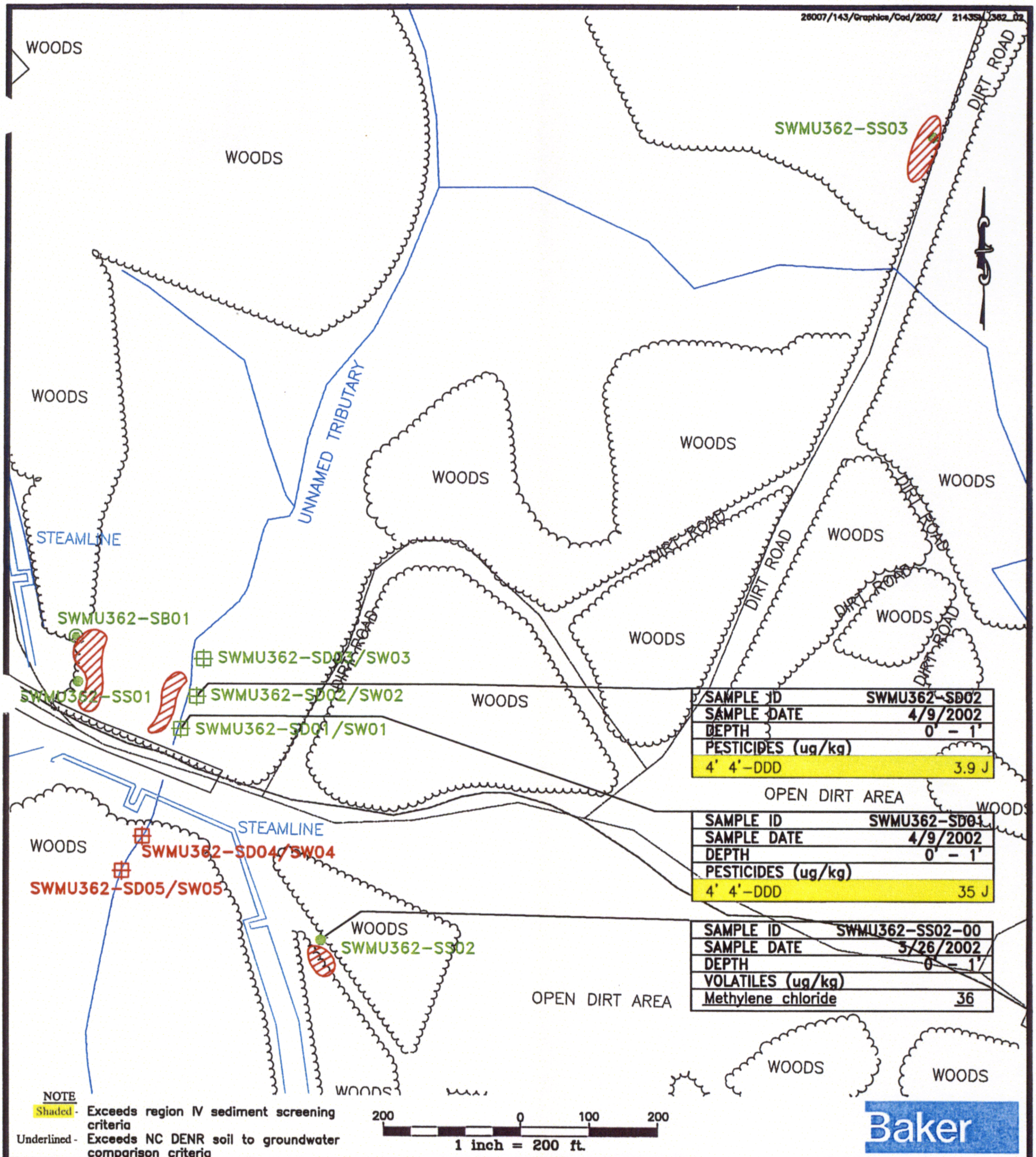



## LEGEND

- SOIL BORING
- SURFACE SOIL SAMPLE
- SEDIMENT/SURFACE WATER SAMPLE
- APPROXIMATE LOCATION OF FORMER DEBRIS
- ADDITIONAL SEDIMENT/SURFACE WATER SAMPLE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 362
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- ◎ – SOIL BORING
- ● – SURFACE SOIL SAMPLE
- ⊞ – SEDIMENT/SURFACE WATER
- – APPROXIMATE LOCATION OF FORMER DEBRIS
- ⊞ – ADDITIONAL SEDIMENT/SURFACE WATER SAMPLE

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL AND SEDIMENT
SWMU 362
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 4.43 SWMU 363 - M-21 Arresting Gear

The following sections present the SWMU description and history, the investigation activities conducted during the Phase II CSI, investigation findings, and conclusions.

### 4.43.1 SWMU Description and History

SWMU 363 is the M-21 Arresting Gear located adjacent to the Runway 05 at the MCAS. The SWMU consists of two square areas approximately 20 by 20 feet, which are used for placement of the arresting gear. Representatives from the Environmental Quality Branch (EQB) conducted site visit on October 5, 2001. Stained soil was identified within the two areas and confirmed that the operation of the M-21 arresting gear has resulted in the release of potentially hazardous materials. As a result, this SWMU was included in the Phase II CSIs under the RCRA program. A SWMU investigation plan is presented as Figure 1.

### 4.43.2 Confirmatory Investigation Activities

The Phase II CSI was conducted on March 23 and April 3, 2002 in general accordance with the Final Project Plans (Baker, 2002). The purpose of the investigation was to evaluate potential impacts to soil at the SWMU and determine if groundwater has been impacted as a result of a release(s) from the SWMU. The sample locations are shown on Figure 1. Detailed procedures used to collect and analyze the samples are described in Section 3.0.

The field investigation included the following:

- Surface and subsurface soil sampling at two temporary well borings
- Groundwater sampling at two temporary wells
- Installation of third temporary well to help in determining the direction of groundwater flow in the vicinity of the SWMUs

Table 1 provides a summary of the temporary well construction details and static groundwater level measurements. A summary of the groundwater sampling field parameters is included in Appendix D.

The water table was measured in the wells at depths ranging from approximately 5.1 to 6.6 feet below the ground surface. Groundwater elevations in the wells ranged from approximately 14.8 to 15.1 feet above MSL. An interpretive groundwater contour map is provided as Figure 1 and shows that groundwater in the vicinity of the SWMU appears to flow west.

### 4.43.3 Investigation Findings

The soil and groundwater samples were submitted to CompuChem Laboratories and analyzed for VOCs, SVOCs, pesticides, and RCRA metals. A summary of the analytical results is included in Appendix G.

Soil

The analytical results and statistical summaries for positive detections are presented on Tables 2 through 5 and were compared to the following screening criteria:

- Base background criteria
- Default NC DENR soil to groundwater criteria

- USEPA Region IX industrial PRGs

It should be noted that SWMU 363 is not associated with a specific AOC due to the SWMU's location with respect to the various AOC boundaries. Therefore, the data was not compared to AOC background criteria. In addition, site-specific NC DENR soil to groundwater criteria were not calculated because the site-specific TOC was 1000 mg/kg, which is the same value used to calculate the default criteria.

Figure 2 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

Seven VOCs were detected in the sample set. Bromoform and methylene chloride exceeded the NC DENR soil to groundwater screening criteria in the surface and subsurface soil samples taken from borings SWMU363-TW01 and SWMU363-TW02. None of the other VOCs detected in the samples exceeded the applicable screening criteria.

No SVOCs were detected in the soil samples above the laboratory reporting limits.

No pesticides were detected in the surface soil sample set. However, two pesticides (alpha-BHC and aldrin) were detected in the subsurface sample set. None of the concentrations exceeded the established screening criteria.

Five RCRA metals were detected in the sample set, as follows: arsenic, barium, chromium, lead and selenium. Barium was the only metal detected above the Base background screening criteria (surface soil sample SWMU363 TW02-00). There were no detections above the NC DENR soil to groundwater criteria or USEPA Region IX industrial PRGs.

Groundwater

The analytical results and statistical summary for positive detections are presented on Tables 6 and 7 and were compared to the following screening criteria:

- Base background criteria
- North Carolina 2L standards

Figure 3 presents the distribution of contaminants that exceeded the regulatory driven criteria and established background/secondary criteria.

One VOC (2-butanone) and one SVOC (4-methylphenol) were detected in the sample set. The concentrations were below the applicable screening criteria.

Six pesticides were detected in the sample set, as follows: 4,4'-DDD, 4,4'-DDT, endrin aldehyde, gamma-BHC, heptaclor, and heptaclor epoxide. Most of the pesticides were detected in the groundwater sample from well SWMU363-TW01. Heptaclor and heptaclor epoxide exceeded the 2L Standards in the sample from wells SWMU363-TW01 and SWMU363-TW02, respectively. None of the other pesticides detected in the samples exceeded the applicable screening criteria.

Three metals were detected in the sample set, as follows: barium, chromium, and lead. Chromium was the only metal that exceeded the background criteria (sample from well SWMU363-TW01). None of the metals detected in the samples exceeded the 2L Standards.

### 4.43.4 Conclusions

Two VOCs (Bromoform and methylene chloride) were detected above the NC DENR soil to groundwater screening criteria in soils.

Two pesticides (heptachlor and heptachlor epoxide) were detected above the 2L standards in groundwater.

The detections of bromoform and methylene chloride in the soils are suspected to be the result of laboratory contamination from cleaning and sample preparation activities. The detection of these compounds does not appear to be SWMU-related.

The pesticides detected in groundwater at concentrations above the 2L standard may be the result of base-wide pesticide application. These compounds do not appear to be related to the activities and/or operations associated with the arresting gear. Therefore, no further action is recommended for this SWMU.

**TABLE 1**
**SUMMARY OF PHASE II CONFIRMATORY SAMPLING**
**TEMPORARY WELL CONSTRUCTION DETAILS AND GROUNDWATER LEVEL MEASUREMENTS**
**RCRA CONFIRMATORY SAMPLING INVESTIGATION**
**MCB, CAMP LEJEUNE, NORTH CAROLINA**
**CTO-0143**

| Well No. | Date Installed | Consultant Supervising Well Installation | Top of PVC Casing Elevation (feet, above msl) | Ground Surface Elevation (feet, above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Depth to Sand Pack (feet, bgs) | Depth to Bentonite (feet, bgs) | Screen Interval Depth (feet, bgs) | Depth to Groundwater (feet, below top of casing) | Groundwater Elevation (feet, bgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SWMU363-TW01 | 3/23/02 | BAKER | 21.40 | 21.5 | 17 | 17 | 5 | 3 | 7 | 6.3 | 15.1 |
| SWMU363-TW02 | 3/23/02 | BAKER | 21.44 | 21.5 | 17 | 17 | 5 | 3 | 7 | 6.6 | 14.8 |
| SWMU363-TW03 | 4/3/02 | BAKER | 20.03 | 19.88 | 15 | 15 | 3 | 0 | 5 | 5.08 | 15.0 |

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface

N/A = Not Applicable
PVC = Polyvinyl chloride

TempWells.xls
SWMU363

TABLE 2

DETECTION SUMMARY
SURFACE SOIL - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU363-TW01-00 03-23-2002 0' - 1' | SWMU363-TW02-00 03-23-2002 0' - 1' |
|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | |
| 2-Butanone | NE | 692 | 28000000 | 7 J | 60 |
| 4-Methyl-2-pentanone | NE | 2280 | 2900000 | ND | 1 J |
| Acetone | NE | 2810 | 6200000 | 20 | 1000 J |
| Bromoform | NE | 1.2 (1) | 310000 | 19 | 27 |
| Carbon disulfide | NE | 4940 | 720000 | 1 J | 2 J |
| Methyl acetate | NE | NE | 96000000 | ND | 12 |
| Methylene chloride | NE | 22 (1) | 21000 | 30 | 25 |
| **METALS (mg/kg)** | | | | | |
| Arsenic | 0.67 | 5.24 | 2.7 | ND | 0.53 J |
| Barium | 17 | 848 | 100000 | 9.9 | **23.5** |
| Chromium | 15 | 27 | 450 | 4.1 | 6.6 |
| Lead | 21 | 270 | 750 | 3.5 | 7.1 |
| Selenium | 0.46 | 12 | 10000 | ND | 0.29 J |

**No SVOCs or pesticides were detected in the samples**

**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

TABLE 3

STATISTICAL SUMMARY
SURFACE SOIL - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | NE | 692 | 28000000 | 2/2 | 7 J - 60 | NA | 0 | 0 |
| 4-Methyl-2-pentanone | NE | 2280 | 2900000 | 1/2 | 1 J | NA | 0 | 0 |
| Acetone | NE | 2810 | 6200000 | 2/2 | 20 - 1000 J | NA | 0 | 0 |
| Bromoform | NE | 1.2 (1) | 310000 | 2/2 | 19 - 27 | NA | 2 | 0 |
| Carbon disulfide | NE | 4940 | 720000 | 2/2 | 1 J - 2 J | NA | 0 | 0 |
| Methyl acetate | NE | NE | 96000000 | 1/2 | 12 | NA | 0 | 0 |
| Methylene chloride | NE | 22 (1) | 21000 | 2/2 | 25 - 30 | NA | 2 | 0 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 0.67 | 5.24 | 2.7 | 1/2 | 0.53 J | 0 | 0 | 0 |
| Barium | 17 | 848 | 100000 | 2/2 | 9.9 - 23.5 | 1 | 0 | 0 |
| Chromium | 15 | 27 | 450 | 2/2 | 4.1 - 6.6 | 0 | 0 | 0 |
| Lead | 21 | 270 | 750 | 2/2 | 3.5 - 7.1 | 0 | 0 | 0 |
| Selenium | 0.46 | 12 | 10000 | 1/2 | 0.29 J | 0 | 0 | 0 |

**No SVOCs or pesticides were detected in the samples**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
Base comparison - Fine Sand Surface Soil

TAB 4

DETECTION SUMMARY
SUBSURFACE SOIL - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | SWMU363-TW01-05 03-23-2002 9' - 11' | | SWMU363-TW02-05 03-23-2002 9' - 11' | |
|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | |
| 2-Butanone | NE | 692 | 28000000 | ND | | 5 | J |
| Acetone | NE | 2810 | 6200000 | 320 | | 2 | J |
| Bromoform | NE | 1.2 (1) | 310000 | 22 | | 22 | |
| Carbon disulfide | NE | 4940 | 720000 | ND | | 4 | J |
| Methyl acetate | NE | NE | 96000000 | 15 | | ND | |
| Methylene chloride | NE | 22 (1) | 21000 | 27 | | 27 | |
| **METALS (mg/kg)** | | | | | | | |
| Arsenic | 5.3 | 5.24 | 2.7 | ND | | 1 | J |
| Barium | 37 | 848 | 100000 | 20.4 | | ND | |
| Chromium | 31 | 27 | 450 | 12.1 | | 7.1 | |
| Lead | 13 | 270 | 750 | 5.1 | | 4.6 | |
| **PESTICIDES (ug/kg)** | | | | | | | |
| alpha-BHC | NE | NE | 590 | 5.2 | J | ND | |
| Aldrin | NE | NE | 150 | 11 | | ND | |

**No SVOCs were detected in the samples**

**Bold** - Exceeds base background concentrations
Underlined - Exceeds NC DENR soil to groundwater criteria
Boxed - Exceeds USEPA Region IX PRGs
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not established

11/15/2002
SWMU363_SOIL

TABLE 5

STATISTICAL SUMMARY
SUBSURFACE SOIL - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Base Background | NC DENR Soil to Groundwater Values | USEPA Region IX PRGs Industrial Soil | No. of Positive Detects No. of Samples | Range of Positive Detections | Positive Detects Above Base Background | Positive Detects Above NC DENR Soil to Groundwater | Positive Detects USEPA Region IX Industrial Soil |
|---|---|---|---|---|---|---|---|---|
| **VOLATILES (ug/kg)** | | | | | | | | |
| 2-Butanone | NE | 692 | 28000000 | 1/2 | 5 J | NA | 0 | 0 |
| Acetone | NE | 2810 | 6200000 | 2/2 | 2 J - 320 | NA | 0 | 0 |
| Bromoform | NE | 1.2 (1) | 310000 | 2/2 | 22 | NA | 2 | 0 |
| Carbon disulfide | NE | 4940 | 720000 | 1/2 | 4 J | NA | 0 | 0 |
| Methyl acetate | NE | NE | 96000000 | 1/2 | 15 | NA | 0 | 0 |
| Methylene chloride | NE | 22 (1) | 21000 | 2/2 | 27 | NA | 2 | 0 |
| **METALS (mg/kg)** | | | | | | | | |
| Arsenic | 5.3 | 5.24 | 2.7 | 1/2 | 1 J | 0 | 0 | 0 |
| Barium | 37 | 848 | 100000 | 1/2 | 20.4 | 0 | 0 | 0 |
| Chromium | 31 | 27 | 450 | 2/2 | 7.1 - 12.1 | 0 | 0 | 0 |
| Lead | 13 | 270 | 750 | 2/2 | 4.6 - 5.1 | 0 | 0 | 0 |
| **PESTICIDES (ug/kg)** | | | | | | | | |
| alpha-BHC | NE | NE | 590 | 1/2 | 5.2 J | NA | 0 | 0 |
| Aldrin | NE | NE | 150 | 1/2 | 11 | NA | 0 | 0 |

**No SVOCs were detected in the samples**

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - Detected concentrations exceed NC DENR generic soil-to-water criteria. However, site-specific critieria were not calculated because the TOC was 1000 mg/kg, which is the same concentration used to calculate the default criteria.
Base comparison - Combined Subsurface Soil

TABLE 6

DETECTION SUMMARY
GROUNDWATER - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | SWMU363-TW01 04-03-2002 | | SWMU363-TW02 04-03-2002 | |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 2-Butanone | NE | 170 | 100 | | ND | |
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 4-Methylphenol | NE | 3.5 | 3 | J | ND | |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 108 | J | 46.8 | J |
| Chromium | 5.8 | 50 | 9 | J | 3.5 | J |
| Lead | 3.6 | 15 | 2.5 | J | 2.3 | J |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDD | NE | 0.14 | 0.052 | J | ND | |
| 4,4'-DDT | NE | 0.1 | 0.029 | J | ND | |
| Endrin aldehyde | NE | 2.1 | 0.025 | J | ND | |
| gamma-BHC (Lindane) | NE | 0.2 | 0.0097 | J | ND | |
| Heptachlor | NE | 0.008 | **0.05** | J | ND | |
| Heptachlor epoxide | NE | 0.004 | ND | | **3.6** | J |

Shaded - Exceeds background concentrations
**Bold** - Exceeds 2L standards.
J - Analyte detected. Report value is estimated.
ND - Analyte not detected.
NE - Not estimated
(1) - If NC 2L Standard not available, Interim Standard was used.

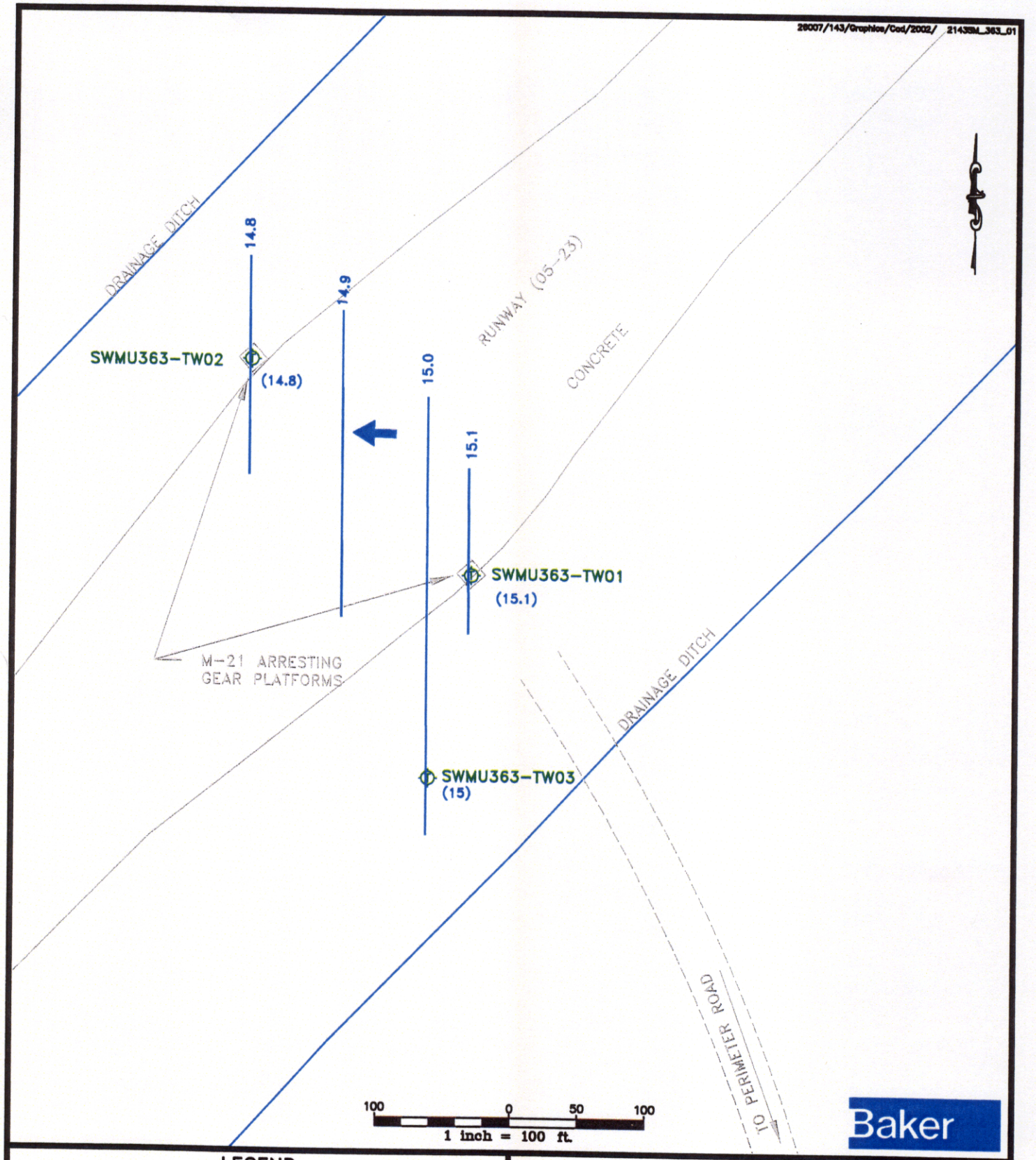
9/11/02
SWMU363_WATER.xls

TABLE 7

STATISTICAL SUMMARY
GROUNDWATER - SWMU 363
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

| | Background Concentrations | NC 2L Standards (1) | No. of Positive Detects/No. of Samples | Range of Positive Detections | Positive Detects above Background | Positive Detects above 2L Standard |
|---|---|---|---|---|---|---|
| **VOLATILES (ug/L)** | | | | | | |
| 2-Butanone | NE | 170 | 1/2 | 100 | NA | 0 |
| **SEMIVOLATILES (ug/L)** | | | | | | |
| 4-Methylphenol | NE | 3.5 | 1/2 | 3 J | NA | 0 |
| **METALS (ug/L)** | | | | | | |
| Barium | 145 | 2000 | 2/2 | 46.8 J - 108 J | 0 | 0 |
| Chromium | 5.8 | 50 | 2/2 | 3.5 J - 9 J | 1 | 0 |
| Lead | 3.6 | 15 | 2/2 | 2.3 J - 2.5 J | 0 | 0 |
| **PESTICIDES (ug/L)** | | | | | | |
| 4,4'-DDD | NE | 0.14 | 1/2 | 0.052 J | NA | 0 |
| 4,4'-DDT | NE | 0.1 | 1/2 | 0.029 J | NA | 0 |
| Endrin (2) | NE | 2.1 | 1/2 | 0.025 J | NA | 0 |
| gamma-BHC (Lindane) | NE | 0.2 | 1/2 | 0.0097 J | NA | 0 |
| Heptachlor | NE | 0.008 | 1/2 | 0.05 J | NA | 1 |
| Heptachlor epoxide | NE | 0.004 | 1/2 | 3.6 J | NA | 1 |

J - Analyte detected. Report value is estimated.
NA - Not applicable
NE - Not established
(1) - If NC 2L Standard not available, Interim Standard was used.
(2) - Endrin, endrin aldehyde and endrin keytone (total)



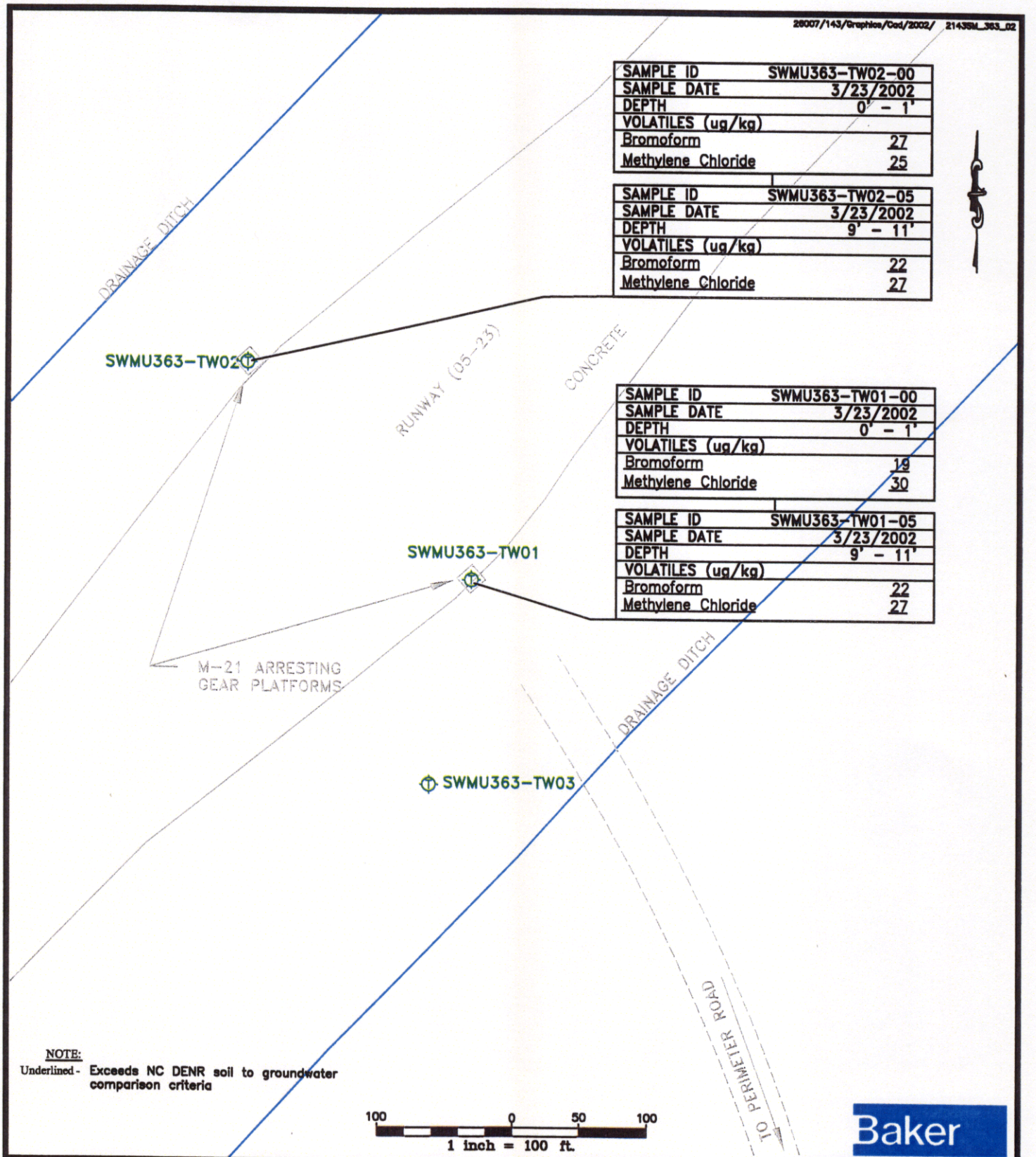

**LEGEND**

- ⊕ – TEMPORARY WELL
- → – GROUNDWATER FLOW DIRECTION
- –14.8– – GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 1
PHASE II CONFIRMATORY
SAMPLING INVESTIGATION
SWMU 363
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03753 EBHV




| SAMPLE ID | SWMU363-TW02-00 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 27 |
| Methylene Chloride | 25 |

| SAMPLE ID | SWMU363-TW02-05 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 9' - 11' |
| VOLATILES (ug/kg) | |
| Bromoform | 22 |
| Methylene Chloride | 27 |

| SAMPLE ID | SWMU363-TW01-00 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 0' - 1' |
| VOLATILES (ug/kg) | |
| Bromoform | 19 |
| Methylene Chloride | 30 |

| SAMPLE ID | SWMU363-TW01-05 |
|---|---|
| SAMPLE DATE | 3/23/2002 |
| DEPTH | 9' - 11' |
| VOLATILES (ug/kg) | |
| Bromoform | 22 |
| Methylene Chloride | 27 |

NOTE:
Underlined - Exceeds NC DENR soil to groundwater comparison criteria

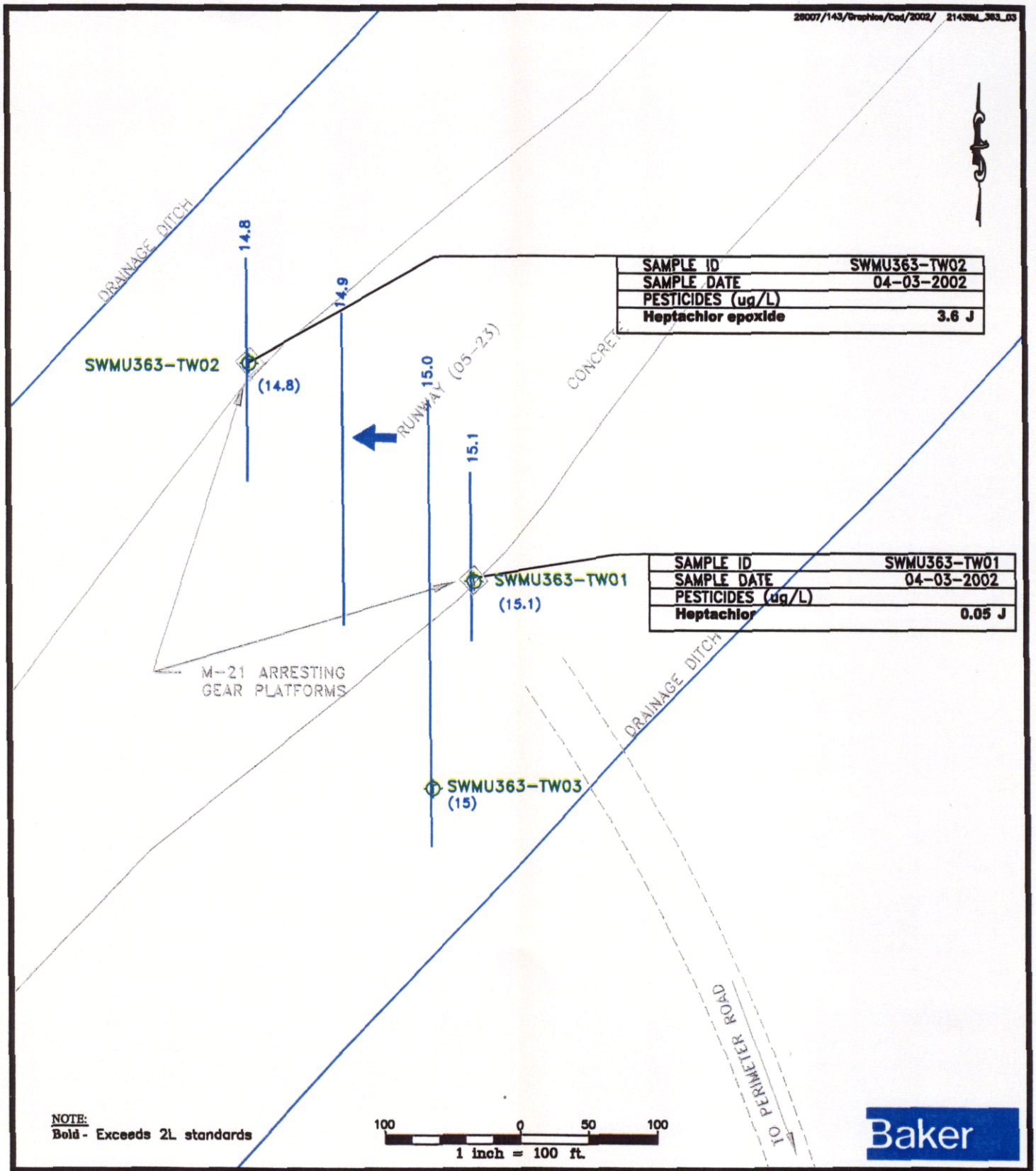
Baker

LEGEND

- TEMPORARY WELL

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 2
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN SOIL
SWMU 363
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA




## LEGEND

- TEMPORARY WELL
- GROUNDWATER FLOW DIRECTION
- 14.8 - GROUNDWATER CONTOUR

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 3
PHASE II CONFIRMATORY INVESTIGATION
CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER
SWMU 363
CTO-143
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

## 5.0 SUMMARY AND RECOMMENDATIONS

Baker conducted a Phase II CSI at 47 SWMUs located at MCB, Camp Lejeune. The focus of this investigation was to determine which units need additional action/investigation and which require no further action. The recommendations included one or more of the following:

- RCRA Facility Investigation (RFI) - This investigation differs from the CSI. A CSI determines if the soils, sediment, surface water, and/or groundwater in the vicinity of the SWMU have been impacted by contaminants that may have originated from operations or activities associated with the SWMU. A RFI would determine the extent and effect of this contamination on the environment, and whether these constituents have the potential to cause risk to humans or ecology.

- Additional Confirmatory Sampling - This investigation is similar to the Phase II CSI except that more data is needed at a particular SWMU to determine if the site warrants a RFI. Data collected during this type of investigation would be used to: (1) determine if the Phase II CSI had truly identified the extent of any contamination at a particular site; (2) determine if contamination detected at a SWMU was actually entering the site from an off-site source unrelated to the SWMU; or (3) fill data gaps needed to make recommendations for a particular SWMU. If a SWMU is related to a UST or AST system and can be placed into an on-going investigation, it may be recommended to do exactly this in leu of a Phase III CSI, if appropriate.

- Interim Measures (IM) - IM would be recommended for sites where it appears that the environment has been negatively impacted; however, the contamination has been delineated based on the results of the Phase I and II CSI.

- No Further Action (NFA) - NFA would be proposed for those SWMUs that possessed enough evidence indicating that operations and/or activities associated with the SWMU were not negatively impacting the environment and/or those SWMUs that contain anomalous detections.

Of the 47 SWMUs, it is recommended that 29 SWMUs require no further action, 5 require additional confirmatory sampling, 3 require Interim Measures, 2 require additional confirmatory/Interim Measures, and 8 require RFIs. The analytical results for each SWMU are discussed in detail in Section 4.0 of this report and the recommendations are summarized on Table 5-1.

Common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene and phthalate esters were observed in some of the samples collected during the Phase I/Phase II CSIs. In most cases, the concentrations observed in the samples were below the applicable screening. In a few cases, one or more of these compounds exceed the screening criteria. If the compound was detected at a concentration exceeding the screening criteria, the exceedence was noted and was evaluated as to its relevance given the SWMUs operation and waste stream. For instance, if toluene was detected at levels exceeding comparison criteria at an oil/water separator, it is likely that the contamination is the result of operations at the SWMU because the unit is expected to handle petroleum-based waste. However, if acetone was detected in the vicinity of a concrete coal storage pad at levels exceeding the screening criteria, it would be reasoned that the presence of acetone was not SWMU-related since the compound is not used in the operations conducted at the unit. In cases where non-SWMU related compounds were the only compounds that exceeded the screening criteria, additional investigation activities were not proposed.

# TABLES

# TABLE 5-1

## SUMMARY OF PROPOSED RECOMMENDATIONS
## PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143
## MCB CAMP LEJEUNE, NORTH CAROLINA

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 43 - Pest Control Shop | SVOCs<br><br>Pesticides<br><br><br><br><br><br>Metals | Benzo(a)anthracene<br>Benzo(a)pyrene<br>alpha-/gamma-Chlordane<br>4,4'-DDD<br>4,4'-DDT<br>Dieldrin<br>Heptachlor Epoxide<br>Arsenic<br>Chromium | RCRA facility Investigation | |
| SWMU 46 - Montford Point Dump Site | Metals | Arsenic<br>Cadmium<br>Chromium<br>Lead<br>Mercury<br>Silver | RCRA Facility Investigation | • Additional geophysical survey to be included in investigation to further define limits of landfill |
| SWMU 53 - Coal Storage Area | SVOCs<br><br>Metals | Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Arsenic<br>Mercury | No further Action | • SWMU located in industrial setting<br>• COPCs appear to be ubiquitous in surface soil<br>• COPCs likely related to combustion/storage of coal as indicated by detections only in surface soil<br>• COPCs not detected in groundwater<br>• Steam plant is a permitted facility - not prudent to cleanup these constituents due to ongoing operations of steam plant |
| SWMU 253 - 1205 AST | Metals | Arsenic | No Further Action | • Anomalous detect in subsurface soil that does not exceed NC DENR soil to groundwater screening criteria; concentration slightly above background<br>• COPC not detected in groundwater |
| SWMU 254 - 1408 Dumpster | SVOCs | Benzo(a)anthracene<br>Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Dibenz(a,h)anthracene<br>Indeno(1,2,3-cd)pyrene | Interim Measures | • COPCs limited to surface soils<br>• Interim Measures to include limited surface soil sampling (to confirm/delineate contamination) and removal |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 255 - 1502 O/W-1 | SVOC | Pentachlorophenol | No Further Action | • COPC detected in surface soil sample collected from concrete-lined drainage ditch during Phase I CSI in 1997<br>• Concrete-lined drainage ditch appeared to be "cleaned out" prior to the Phase II CSI<br>• COPC not detected in soil or groundwater in vicinity of SWMU (i.e., pentachlorophenol detected in drainage ditch; not SWMU-related) |
| SWMU 256/257 - 1700 O/W-1 & 2 | See SWMU 53 for description of COPCs, recommendations, and additional notes/comments | | | |
| SWMU 258 - S1745 O/W | Metals | Arsenic<br>Cadmium<br>Chromium<br>Lead<br>Mercury | Interim Measures | • COPCs limited to surface soils<br>• Interim Measures to include limited surface soil sampling (to confirm/delineate contamination) and removal<br>• Arsenic was only COPC detected in groundwater; reported concentration essentially background |
| SWMU 261 - 1780 UST-1 | Metals | Arsenic<br>Barium<br>Cadmium<br>Chromium<br>Lead<br>Mercury | RCRA Facility Investigation | |
| SWMU 264 - 2611 Container | SVOCs<br>VOCs | Pentachlorophenol<br>Arsenic | No Further Action | • Pentachlorophenol detected in surface soil sample collected during Phase I CSI in 1997<br>• Samples collected adjacent to location during Phase II - could not duplicate Phase I Results<br>• Pentachlorophenol not detected in groundwater<br>• Arsenic detected in surface soil sample collected during Phase I CSI - concentration slightly above background<br>• No exposure - below asphalt pavement |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 265 - 2615 O/W | SVOCs | Benzo(a)pyrene | No Further Action | • Isolated, anomalous detect in surface soil sample collected during Phase I CSI in 1997<br>• COPC not detected in groundwater |
| SWMU 269 - 816 O/W | VOCs<br><br><br><br><br><br><br><br>SVOCs<br><br>Metals | Benzene<br>Ethylbenzene<br>Cis-1,2-dichloroethene<br>1,1-dichloroethene<br>Trichloroethene<br>Vinyl Chloride<br>Xylenes<br>2-Methylnaphthalene<br>Naphthalene<br>Arsenic<br>Lead (groundwater only) | RCRA Facility Investigation | • RFI to delineate groundwater contamination<br>• Soil contamination is bounded and located in the former O/W separator and wash rack area<br>• Isolated, anomalous detect of silver and arsenic in soil, and lead in groundwater. |
| SWMU 272 - AS137 O/W | SVOCs<br><br><br><br>Metals | Benzo(a)pyrene<br>2-Chlorophenol<br>4-chloro-3-Methylphenol<br>Pentachlorophenol<br>Arsenic<br>Mercury | No Further Action | • Metals detected in surface/subsurface soils at concentrations slightly above screening criteria<br>• Phenols not associated with fuel farm or oil/water separator<br>• COPCs not detected in Groundwater<br>• SWMU is not accessible and likely received intended waste only<br>• COPCs not indicative of SWMU failure or release |
| SWMU 279 - FC200 O/W | SVOCs | Benzo(a)pyrene | No Further Action | • Isolated, anomalous detect in subsurface soil that does not exceed NC DENR soil to groundwater screening criteria<br>• COPC not detected in groundwater |
| SWMU 285 - S947 O/W | SVOCs | Benzo(a)anthracene<br>Benzo(a)pyrene<br>Dibenz(a,h)anthracene | No Further Action | • Isolated, anomalous detects in surface soil sample collected during Phase I CSI in 1997<br>• Soil/groundwater samples collected adjacent to detects during Phase II - no exceedances of screening criteria<br>• COPCs not detected in groundwater |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 291 - 034 Ditch | Metals | Arsenic<br>Chromium | No Further Action | • SWMU located in industrial setting<br>• Distribution of COPCs appears to be limited<br>• Arsenic and chromium in subsurface soil isolated, anomalous detects reported during Phase I in 1997<br>• The SWMU was the former drainage ditch - surface soil contamination would be expected if there was a release from the SWMU<br>• The ditch emptied in a ponded area (former excavated area) - contaminants would be expected to accumulate here - possible source of groundwater contamination at well TW03<br>• IM conducted in January 2001 to remove contaminated soil/sediment (i.e., source removed) |
| SWMU 293 - 1106/1107 O/W | Metals | Lead (surface soil)<br>Arsenic (groundwater) | Interim Measures | • Lead is prevalent in surface/subsurface soil<br>• Lead exceedance isolated and limited to surface soils<br>• Interim measures to include soil removal and confirmatory sampling<br>• Arsenic in groundwater not attributable to SWMU - not detected in soils; detected in groundwater upgradient of SWMU |
| SWMU 294 - 1203 O/W | SVOCs<br><br>Metals | Benzo(a)pyrene<br>Bis(2-ethylhexyl)phthalate<br>Mercury | No Further Action | • Distribution of COPCs delineated<br>• COPCs not indicative of SWMU failure or release |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 295 - 1601 AST | Metals | Arsenic (subsurface soil) | No Further Action | • COPC detected in surface soil below screening criteria<br>• COPC detected in subsurface soil below NC DENR soil to groundwater criteria; concentrations slightly above background<br>• COPC not detected in groundwater<br>• COPCs not indicative of SWMU failure or release<br>• Building 1601 (Site 78 South) being addressed under the IR Program |
| SWMU 296 - 1700 Basin B | See SWMU 53 for description of COPCs, recommendations, and additional notes/comments | | | |
| SWMU 297 - 1780 O/W-2 | See SWMU 261 for description of COPCs, recommendations, and additional notes/comments | | | |
| SWMU 299 - AS114 AST | SVOCs | Benzo(a)anthracene<br>Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Benzo(k)fluoranthene<br>Dibenz(a,h)anthracene<br>Indeno(1,2,3-cd)pyrene<br>Isophorone<br>2-Methylnaphthalene<br>Naphthalene (groundwater only) | Interim Measures | • Interim Measures to remove soil contamination associated with the SWMU activities<br>• Naphthalene isolated, anomalous detection in groundwater<br>• Silver detections in additional samples are located relatively far from the SWMU and appear to be randomly distributed |
| | Metals | Arsenic<br>Cadmium<br>Chromium<br>Lead<br>Silver | | |
| SWMU 300 - AS118 AST | SVOCs | Benzo(a)pyrene<br>Benzo(b)fluoranthene | No Further Action | • Isolated, anomalous detects in surface soil sample collected beneath asphalt during Phase I CSI in 1997<br>• COPCs are PAHs similar to asphalt-like material<br>• COPCs not detected in groundwater |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
**PHASE II CONFIRMATORY SAMPLING REPORT, CTO-0143**
**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 302 - AS504 AST | SVOCs<br>Metals | Benzo(a)pyrene<br>Arsenic (groundwater only)<br>Cadmium<br>Mercury | No Further Action | • Few isolated detections in soil and groundwater slightly above screening criteria<br>• COPCs not typical petroleum-related compounds<br>• COPCs not indicative of SWMU failure or release |
| SWMU 303 - AS515 AST-E | SVOCs<br><br>Metals | Benzo(a)pyrene<br>4-Methylphenol<br>Naphthalene<br>Arsenic<br>Chromium<br>Lead | RCRA Facility Investigation | • To be included with SWMU 318 - AS515 O/W (near Helicopter Wash Pad) |
| SWMU 305 - BB224 Pile | Metals | Arsenic | No Further Action | • SWMU was a soil pile that no longer exists<br>• Concentrations slightly above background |
| SWMU 306 - FC230 O/W-1 | Metals | Silver | No Further Action | • Isolated, anomalous detect in subsurface soil sample collected during Phase I CSI in 1997<br>• COPC not detected in groundwater |
| SWMU 307 - G649 Rack | Metals | Arsenic<br>Barium<br>Chromium<br>Lead (groundwater only)<br>Mercury | RCRA Facility Investigation | • COPCs detected in groundwater (except lead) below 2L standards<br>• Evaluation of Human Health and ecological risk should be conducted for soils to determine need for interim measures<br>• Elevated concentrations of lead in groundwater.<br>• Limited RFI focused on metals in groundwater. |
| SWMU 308 - GP-19 O/W | SVOCs | Bis(2-chloroethyl)ether | No Further Action | • Isolated, anomalous detect in surface soil sample collected during Phase I CSI in 1997<br>• COPC not detected in groundwater |

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**MCB CAMP LEJEUNE, NORTH CAROLINA**

| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 311 - S1619 O/W | VOCs<br><br><br><br><br><br><br>Metals | Benzene<br>Bromoform<br>Chlorobenzene<br>Chloroform<br>Methylene Chloride<br>Tetrachlorethene<br>Trichloroethene<br>Cadmium<br>Chromium<br>Lead | RCRA Facility Investigation | |
| SWMU 312 - S1735 O/W | SVOCs<br>Metals | Benzo(a)pyrene<br>Arsenic<br>Chromium | No Further Action | • COPCs detected in surface soils<br>• COPCs in groundwater not detected or below 2L standards<br>• COPCs not indicative of SWMU failure or release<br>• Benzo(a)pyrene may be related to coal residue or asphalt paving operations; SWMU is located adjacent to steam plant |
| SWMU 313 - S1753 O/W & AST | Metals | Silver | No Further Action | • Isolated, anomalous detect in surface soil sample collected during Phase I CSI in 1997<br>• COPC not detected in groundwater |
| SWMU 314 - SM187 O/W | SVOCs<br><br><br>Metals | Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Dibenz(a,h)anthracene<br>Arsenic<br>Lead (groundwater only) | Interim Measures | • Interim Measures to remove surface soil contamination adjacent to wash pad<br>• Permanent well installed during the supplemental investigation confirmed that Lead in groundwater was attributable to turbidity |

**SUMMARY OF PROPOSED RECOMMENDATIONS**
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|---|---|---|---|---|
| SWMU 315 - SM269 O/W | SVOCs<br>Metals | Acetaphenone (groundwater only)<br>Pentachlorophenol<br>Arsenic<br>Mercury<br>Silver | No Further Action | • Acetaphenone and pentachlorophenol isolated, anomalous detects in groundwater and soil, respectively<br>• Metals appear to be ubiquitous in soil<br>• Concentrations of metals detected in surface soil slightly above background<br>• COPCs not indicative of SWMU failure or release<br>• More compounds likely would have been detected if the SWMU really failed or caused a release |
| SWMU 316 - TC773 O/W | SVOCs<br>Metals | Benzo(a)pyrene<br>Arsenic | No Further Action | • COPCs detected in surface soils below asphalt; may be attributable to asphalt and/or tack oil<br>• Arsenic is essentially background<br>• COPCs not detected in groundwater<br>• COPCs not indicative of SWMU failure or release<br>• More compounds likely would have been detected if the SWMU really failed or caused a release |
| SWMU 317 - TT2453 Release | Metals | Lead | No Further Action | • Isolated, anomalous detect in surface soil sample collected during Phase I CSI in 1997<br>• Concentrations detected in groundwater below screening criteria<br>• Area disturbed during demolition/remediation activities |

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|---|---|---|---|---|
| SWMU 318 - AS515 O/W | VOCs | Benzene<br>Bromoform<br>1,2-Dichlorobenzene<br>1,4-Dichlorobenzene<br>Methylene Chloride<br>1,1,2-Trichloroethane<br>Trichloroethene<br>Vinyl Chloride | RCRA Facility Investigation | • Investigation to be extended into helicopter wash pad area<br>• Being combined with SWMU 303 |
| | SVOCs | Benzo(a)anthracene<br>Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Bis(2-ethylhexyl)phthalate<br>Dibenz(a,h)anthracene<br>Indeno(1,2,3-cd)pyrene<br>4-Methylphenol<br>Naphthalene | | |
| | Metals | Arsenic<br>Cadmium<br>Chromium<br>Mercury<br>Silver | | |
| SWMU 319 - Camp Geiger Wastewater Treatment Plant | SVOCs<br>Metals | Benzo(a)pyrene<br>Mercury<br>Silver | No Further Action | • COPCs slightly above screening criteria<br>• Area disturbed during demolition/highway construction activities<br>• Sample distribution throughout the footprint of former wastewater treatment plant does not indicate evidence of gross contamination |
| SWMU 336 - AS4106 Paint Stripper | VOCs | Methylene Chloride<br>Tetrachloroethene | RCRA Facility Investigation | • RFI to delineate soil and groundwater contamination |
| | Metals | Cadmium | | |

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|---|---|---|---|---|
| SWMU 339 - AS146 Sandblasting Area | VOCs | Bromoform<br>Chloroform<br>Methylene Chloride | No Further Action | • SWMU located in industrial setting<br>• COPCs detected in soil below USEPA Region IX PRGs<br>• COPCs not detected in groundwater<br>• Most of COPCs detected in subsurface soil<br>• Low levels of COPCs appear to be ubiquitous across soils; may be attributable to lab-type preparation/cleaning; not likely attributable to SWMU<br>• COPCs not persistent in the environment at these concentrations |
| SWMU 358 - Sneads Ferry Road Battery Dump | Not Applicable | Not Applicable | No Further Action | • Interim Measures conducted in July 2001<br>• Confirmatory samples collected; no constituents detected above screening criteria |
| SWMU 359 - Lot 201 Battery Dump | VOCs<br>Metals | Methylene Chloride<br>Cadmium<br>Lead<br>Silver | No Further Action | • Interim measures conducted in July/August 2001; source removed<br>• Low level of methylene chloride in subsurface soil; may be attributable to lab-type preparation/cleaning; not likely attributable to SWMU<br>• Metals detected in subsurface soil and groundwater slightly above screening criteria<br>• Additional investigations at Site IR 6 will include the area around SWMU 359 and will evaluate pesticides, cadmium and lead according to state recommendations. |

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| SWMU Designation | Compounds Exceeding Screening Criteria | | Recommendation | Additional Notes/ Comments |
|---|---|---|---|---|
| SWMU 360 - Building 1817 UST | VOCs | Bromoform<br>cis-1,2-dichloroethene<br>Methylene Chloride<br>Tetrachloroethene<br>Trichloroethene | RCRA Facility Investigation | |
| | SVOCs | Acetophenone<br>4-Methylphenol | | |
| | Pesticides | Aldrin<br>alph-/beta-BHC<br>alpha-/gamma-Chlordane<br>4,4'-DDE<br>4,4'-DDT<br>Dieldrin<br>Heptachlor/Heptachlor Epoxide | | |
| | Metals | Arsenic | | |
| SWMU 361 - UST Site 333-C | Pesticides | alpha-/gamma Chlordane<br>4,4'-DDE<br>Heptachlor Epoxide | RCRA Facility Investigation | • Pesticides and arsenic detected in soils at concentrations exceeding screening criteria.<br>• SVOCs and pesticides in groundwater at levels exceeding screening criteria.<br>• VOCs historically detected in groundwater. |
| | SVOCs | 2-Methylnaphthalene<br>Naphthalene | | |
| | Metals | Arsenic | | |
| SWMU 362 - Dog 11 Area | VOCs<br>Pesticides | Methylene Chloride (surface soil)<br>4,4'-DDD (sediment) | No Further Action | • Low level of methylene chloride in surface soil; may be attributable to lab-type preparation/cleaning; not likely attributable to SWMU<br>• The presence of 4,4'-DDD at relatively low levels is indicative of routine, base-wide pesticide application |
| SWMU 363 - M-21 Arresting Gear | VOCs | Bromoform<br>Methylene Chloride | No Further Action | • Low level of VOCs ubiquitous across soils; may be attributable to lab-type preparation/cleaning; not likely attributable to SWMU<br>• Pesticides in groundwater may be attributable to Base operations, but not SWMU |
| | Pesticides | Heptachlor/Heptachlor Epoxide (groundwater only) | | |

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