

ANNUAL MONITORING REPORT
August 2000 – August 2001
Soil and Groundwater Remediation
Building LCH-4015
Marine Corps Base
Camp Lejeune, North Carolina

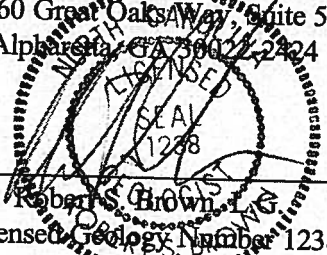
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ACRONYM LIST

AFVR	aggressive fluid/vapor recovery
AST	aboveground storage tank
BQL	below quantitation limits
CAP	corrective action plan
cfh	cubic feet per hour
cfm	cubic feet per minute
ft bls	feet below land surface
GP	geoprobe
J.A. Jones	J.A. Jones Environmental Services Company
Law	Law Engineering and Environmental Services, Inc.
LNAPL	light non-aqueous phase liquid
µg/l	micrograms per liter
MADEP VPH	Massachusetts Department of Environmental Protection, Volatile Petroleum Hydrocarbon
MADEP EPH	Massachusetts Department of Environmental Protection, Extractable Petroleum Hydrocarbon
mg/m ³	milligrams per cubic meter
MTBE	methyl tert-butyl ether
MW	monitoring well
NAVFACENGCOM	Navy Atlantic Division, Naval Facilities Engineering Command
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
PAH	Polynuclear aromatic compounds
Paradigm	Paradigm Analytical Laboratories, Inc.
psi	pounds per square inch
PVC	polyvinyl chloride
RBCA	Risk Based Corrective Action
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	volatile organic compound

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EXECUTIVE SUMMARY

From November 1998 to August 2001, J.A. Jones Environmental Services Company (J.A. Jones) implemented the selected approach as outlined in the August 27, 1996 CAP prepared by Law. The selected remedial approach consisted of installation and operation of a biosparge and soil vapor extraction remediation system and groundwater monitoring to track petroleum-impacted groundwater migration/attenuation.

J.A. Jones prepared a Draft Annual Monitoring Report in October 2002 presenting operation and monitoring results from November 1998 through August 2001. Because J.A. Jones remedial contract expired in early 2003, the Department of the Navy Atlantic Division, NAVFACENGCOM, has retained Shaw Environmental, Inc. to complete this Annual Monitoring Report.

In May 2000, the quarterly groundwater sampling schedule was modified. The number of monitoring wells sampled was decreased every other quarterly sampling event so that six wells were sampled instead of the regular 18. For example, six wells were sampled during the Nov 27 2000 and May 23 2001 events and 18 wells were sampled during the Feb 20 2001 and Aug 14 2001 sampling events.

The interpreted areal extent of dissolved volatile aromatic hydrocarbons and PAHs in the vicinity of monitoring wells MW-1, MW-2, and MW-3 has decreased since the initial groundwater sampling event conducted just prior to treatment system startup.

The interpreted areal extent of dissolved volatile aromatic hydrocarbons and polynuclear aromatic hydrocarbons in the vicinity of monitoring well MW-11 has remained consistent since the initial groundwater sampling event. LNAPL was detected in monitoring well MW-11 during the July, August, October, November 2000 and April, June, July, and August 2001 groundwater elevation surveys. Three AFVR events were conducted at MW-11 on August 30, 2000, November 21, 2000, and April 27, 2001. Due to minimal quantities of petroleum hydrocarbons recovered, further AFVR events were discontinued. After discontinuing AFVR events a passive skimmer was installed in MW-11 to capture and remove free product. If sufficient product is detected in monitoring well MW-11, J.A. Jones recommends collecting a sample for fingerprint analysis.

The decreasing trend of detected contaminant concentrations, with the exception of monitoring well MW-11, indicates that the biosparge/soil vapor extraction treatment system is effective in volatilizing the dissolved petroleum hydrocarbons present in the groundwater at the LCH-4015 site. Shaw recommends evaluating the LCH-4015 site conditions to determine whether the site can be reclassified to an "intermediate" or "low risk" site. A preliminary evaluation completed by J.A. Jones suggested that the site meets all of the criteria to be reclassified as "low risk." J.A. Jones also recommended that samples collected from groundwater monitoring wells should

be analyzed for MADEP VPH and EPH during the semi-annual groundwater monitoring well sampling events in addition to the USEPA Methods 602 and 625.

SECTION 1.0

INTRODUCTION

As part of the installation, operation, and maintenance of the soil and groundwater treatment system at Building LCH-4015 located on Camp Lejeune, North Carolina, the NAVFACENGCOM has retained Shaw Environmental Inc. to complete this Annual Monitoring report. The purpose of this report is to present the findings and recommendations associated with the operation of the soil and groundwater treatment system and groundwater monitoring activities, which took place from August 2000 to August 2001.

This Annual Monitoring Report is organized into four sections of text including tables that present historical analytical data from sampling events and groundwater elevations at the site. Figures provided in this report present groundwater elevation contour maps detailing groundwater flow direction and dissolved contaminant plume isopleth maps, which present the distribution of the volatile aromatic and polynuclear aromatic hydrocarbons detected above NCDENR groundwater quality standards. Also included are four appendices that present monitoring well construction records for monitoring wells MW-21, MW-22, and MW-23, AFVR Results, and laboratory analytical reports from the groundwater monitoring well and soil vapor extraction system sampling events.

Section 1.0 Introduction includes the site history, an operational overview of the soil and groundwater treatment system, operations and maintenance objectives, sampling and analyses requirements, and annual reporting requirements.

Section 2.0 Operations and Maintenance provides a summary of the operation of the soil and groundwater treatment system including any problems encountered and troubleshooting required during system operation.

Section 3.0 Analytical Summary presents a summary of the analytical results from the air effluent samples collected from the soil vapor extraction system and the groundwater samples collected from the on site monitoring wells.

Section 4.0 Conclusions and Recommendations addresses the conclusions and any recommendations from the annual operation of the soil and groundwater treatment system, and quarterly groundwater monitoring well sampling events.

This Annual Monitoring Report documents the operation and performance of the soil and groundwater treatment system throughout its operation from August 2000 to August 2001.

1.1 SITE HISTORY

Building LCH-4015 is part of the Midway Park Community Center for the Marine Corps Base Camp Lejeune. The Midway Park Community Center Complex consists of the Community Center building (LCH-4014), former fueling and maintenance area (LCH-4015), Marine Corps Exchange Convenience Store (LCH-4034), and the former diked fuel tank farm (SLCH-4024).

The Midway Park Community Center Complex is shown on **Figure 1-1**. The figure locates present and former fueling systems, as well as provides a general plan of the Midway Park Community Center and Building LCH-4015 site. The original horizontal ASTs and their associated piping were installed around 1945 and consisted of two 14,000-gallon gasoline tanks that supplied fuel to four gasoline dispensers located on a pump island to the north of the building; one 14,000-gallon diesel tank that supplied fuel to a dispenser located on the north side of Building LCH-4015; one 3,000-gallon No. 2 fuel oil tank that supplied fuel oil to a boiler contained within Building LCH-4014. There were also a number of smaller storage tanks at the site. The gasoline, diesel, and Number 2 fuel oil storage tanks distributed fuel through a number of underground product piping distribution systems of varying pipe sizes: pipes were between 1- to 2- inches in diameter.

There was an offloading facility located south of LCH-4015. This fueling system is not operable and was removed from service and replaced by USTs in 1992. These USTs were removed in spring 2002 and consisted of three fiberglass USTs consisting of two 10,000-gallon gasoline tanks and one 2,500-gallon premium gasoline tank. Presently, ASTs are being used to provide fuel to the new fueling system at the Marine Corps Exchange Convenience Store.

According to information provided in the Comprehensive Site Assessment Report prepared by Law and dated June 7, 1996, petroleum-impacted soil and groundwater present at the site were suspected to be the result of a release of diesel fuel and gasoline from the former pipeline distribution network from the Building LCH-4015 tank farm. The first indication of a suspected release was identified in November 1994, when R.E. Wright Environmental, Inc. identified petroleum-impacted soil and groundwater at the site during their "Five Well Site Check" investigation. In 1990, the tanks at Building LCH-4015 were emptied of product, and the three 14,000-gallon ASTs were removed, relocated, and reinstalled for use at other locations on the base. The horizontal and vertical extent of product and petroleum-impacted soil and groundwater were documented in the CAP, dated August 27, 1996, prepared by Law.

A draft work plan, prepared by J.A. Jones, outlining required construction activities associated with installation of the groundwater treatment system, was submitted to the Navy for approval on July 1, 1997. A draft work plan was approved by the Navy on April 25, 1997 and was finalized and submitted to the state on July 2, 1997.

Construction activities, including installation of the biosparge wells and horizontal soil vapor extraction trenches, installation of the biosparge and soil vapor extraction piping, and

construction of the treatment building foundation were completed between August 10, 1998 and November 25, 1998. The soil and groundwater treatment system was delivered to the site from Fliteway Technologies, Inc. on September 2, 1998. The treatment equipment was tested in the field, and the electrical service connections were completed on November 11, 1998. The soil and groundwater treatment system was started on November 30, 1998 and has operated continuously, except during occasional maintenance repairs, hurricane shutdowns and quarterly groundwater sampling events.

On January 2001, J.A. Jones submitted to the Navy an Annual Monitoring Report documenting the operation and performance of the soil and groundwater treatment system for the period from November 1998 to August 2000. Because J.A. Jones remedial contract expired in early 2003, Shaw Environmental Inc. has been retained by the Department of the Navy Atlantic Division, Naval Facilities Engineering Command, to complete the Annual Monitoring Report.

1.2 SOIL AND GROUNDWATER TREATMENT SYSTEM

The soil and groundwater treatment system was designed to prevent migration of the dissolved groundwater contaminant plume and reduce groundwater contaminant concentrations in the area of Building LCH-4015 to site rehabilitation levels regulated by the NCDENR. These site rehabilitation levels are provided in the NCAC Title 15A Subchapter 2L *Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina*. According to the Corrective Action Plan, dated August 27, 1996, prepared by Law, the primary groundwater contaminants identified at the site are benzene, ethylbenzene, xylenes, MTBE, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and benzo(k)fluoranthene. The maximum detected groundwater concentrations of these contaminants, as presented in the Corrective Action Plan, current maximum detected limits based on the August 2001 analytical results, the percent reduction, and their corresponding site rehabilitation levels, as established in NCAC Title 15A Subchapter 2L, are provided as follows:

<u>Groundwater Constituent</u>	<u>Maximum Detected Concentration</u>	<u>Current Maximum Detected Concentration</u>	<u>% Decrease in Site Contamination</u>	<u>Site Rehabilitation Concentration</u>
Benzene	10,600 µg/l	440 µg/l	-95.85%	1.0 µg/l
Ethylbenzene	2,960 µg/l	870 µg/l	-70.61%	29 µg/l
Total Xylenes	9,960 µg/l	1,360 µg/l	-86.36%	530 µg/l
MTBE	256 µg/l	53 µg/l	-79.30%	200 µg/l
Naphthalene	524 µg/l	320 µg/l	-38.93%	21 µg/l
1-Methylnaphthalene	271 µg/l	430 µg/l	+58.67%	*
2-Methylnaphthalene	345 µg/l	320 µg/l	-7.25%	28 µg/l
Benzo(k)fluor-anthene	9.4 µg/l	BQL	-100%	0.47 µg/l

The asterisk (*) indicates that no numerical standard has been established. As a result, according to NCAC Title 15A Subchapter 2L, the target rehabilitation concentration is the laboratory detection limit. BQL indicates that the detected concentration is below the laboratory quantitation limit.

The soil and groundwater treatment system installed at the site consists of thirty-eight biosparge wells and five soil vapor extraction wells. Compressed air is supplied to the thirty-eight biosparge wells by a rotary vane air compressor located in the treatment building through 1-inch diameter Air-Pro™ high-density polyethylene compressed air pipe. A coalescing filter inline with the compressed air removes trace oils and lubricants that may be present in the compressed air.

Each biosparge well is constructed of 4.5 feet of 2-inch diameter schedule 80 PVC well casing coupled with 2-inch diameter, 0.02-inch slot width Circumslot™ PVC well screen installed to an approximate well completion depth of 6 to 8 feet below land surface (ft bls). A flush-mounted steel well vault protects and provides access to a flowmeter and air regulator with pressure gauge. In addition, the steel well vault maintains a surface seal protecting the integrity of the well at the surface.

Soil vapor is recovered through five 2-inch diameter, 0.02-inch slot width Circumslot™ PVC horizontal well screens using a positive displacement blower. Moisture generated from the soil vapor extraction process is removed using an air/water separator and any particulate is removed through a filter prior to the positive displacement blower. Moisture removed from the air/water separator is conveyed to a vertical polyethylene storage tank using a centrifugal transfer pump. An assembly of intrinsically safe water level switches within the air/water separator controls the centrifugal pump. The level switches cause the following responses based on water level conditions:

- The first (i.e., lowest) high level switch will activate the centrifugal transfer pump, which will operate until the low level switch interrupts power to the pump;

- The second high-level switch will shut down the soil vapor extraction and biosparge systems, causing an alarm condition. Manual restart is required to continue operation after this switch is triggered.

Condensate accumulated in the compressed air receiver is transferred to the vertical storage tank using an electronically timed condensate drain. The polyethylene storage tank has a high level switch that will shut down the soil vapor extraction and biosparge systems, causing an alarm condition. Like the air/water separator, manual restart is required to continue operation after the switch is activated.

1.3 OPERATIONS AND MAINTENANCE REQUIREMENTS

Scheduled operation and maintenance inspections were performed weekly to maintain the performance and operation of the treatment equipment, to inspect moisture accumulation level in the storage tank, and to collect and record instrumentation readings. Instrumentation readings include biosparge and soil vapor extraction pressure, vacuum, and flow rate at the wells and within the treatment building. The frequency of the scheduled operations and maintenance inspections are presented as follows.

<u>Event Description</u>	<u>Frequency</u>
Record Instrumentation Readings	Monthly
Verify Proper Operation of Fail Safe Conditions	Monthly
Service Equipment	As Required by the Manufacturer's Instructions
Measure and Record Groundwater Elevations	Monthly
Collect Groundwater Monitoring Well Samples	Quarterly
Collect Soil Vapor Extraction Effluent Sample	Quarterly

Non-scheduled operations and maintenance events were required to troubleshoot equipment and treatment system malfunctions and to repair and adjust treatment system equipment.

1.4 SAMPLING AND ANALYSES REQUIREMENTS

Groundwater monitoring well and soil vapor extraction effluent samples were collected monthly during the first quarter of operation of the treatment system and quarterly thereafter. Each groundwater sample collected from on site monitoring wells were delivered by overnight carrier to Paradigm, and analyzed for volatile aromatic hydrocarbons using USEPA Method 602 and polynuclear aromatic hydrocarbons by USEPA Method 610. Groundwater samples were collected from the following on site monitoring wells:

- MW-1 through MW-3, MW-5, MW-9, and MW-11 on a quarterly basis;
- MW-4, MW-6 through MW-8, MW-10, MW-12, and MW-14 through MW-19 were sampled on a semi-annual basis; and

- MW-20 was only sampled once during this monitoring period because of recurring measurable free product in this well.

On June 5 to 8, 2001, three intermediate depth monitoring wells (MW-21, MW-22 and MW-23) were installed to 32-ft bls. The wells were installed in response to a request by NCDENR to assess the vertical extent of groundwater contamination at the site. Silty sands and clay were observed during the installation of these monitoring wells. These wells were sampled in June 2001 (following installation) and once again in August 2001. **Appendix A** provides a copy of the well construction records.

Three temporary monitoring wells (GP-01, GP-02 and GP-03) were installed using direct push methods to assess contamination from other sources in the vicinity of MW-11. GP-01 was located in the down gradient direction while GP-02 and GP-03 were located upgradient from MW-11. **Figure 1-1** illustrates the locations of monitoring wells MW-21, MW-22, and MW-23 and geoprobe locations GP-01, GP-02, and GP-03.

Groundwater analytical results from these wells detected VOC contamination in only one well, GP-01 (benzene, 15 µg/l; ethylbenzene, 50 µg/l; and total xylenes, 14 µg/l. PAH contamination was detected in only one well, GP-01 (naphthalene, 190 µg/l; 1-methylnaphthalene, 360 µg/l; 2-methylnaphthalene, 440 µg/l; acenaphthene, 27 µg/l; fluorene, 47 µg/l; and phenanthrene, 80 µg/l).

The air quality effluent samples, collected quarterly from the soil vapor extraction system, were delivered by overnight carrier to Paradigm and analyzed for volatile aromatic hydrocarbons using USEPA Method 18.

In addition, groundwater elevation was measured monthly in 23 groundwater monitoring wells (MW-1 through MW-23).

SECTION 2.0

OPERATIONS AND MAINTENANCE

2.1 OPERATION HISTORY

Operation and maintenance of the soil and groundwater treatment system began on the system start-up date of November 30, 1998. Since November 30, 1998, the soil and groundwater treatment system has been inspected a minimum of once per week. Frequency of the operation and maintenance inspections increased during system repair and troubleshooting activities. In addition, scheduled inspections were conducted during the groundwater monitoring well and soil vapor extraction effluent sampling events. A summary of the operation and maintenance inspections is provided in **Table 2-1**.

Based on the results from the May 23, 1996 biosparge pilot study, Law recommended, in their August 27, 1996 CAP, a total air injection flow rate of 36 cfh at 3.7 psi. At this design injection flow rate, Law estimated an 18-foot radius for each biosparge well.

During treatment system operation by J.A. Jones from August 2000 through August 2001, biosparge well injection flowrates were adjusted during routine site inspections to match the design parameters recommended by Law. J.A. Jones was able to maintain the biosparge well injection at the designed flowrate of 36 cfh without causing excessive mounding, greater than 1.5 feet, of the groundwater table.

Discharge flowrates were measured on a monthly basis using Dwyer Instruments Inc. Capsuhelic differential pressure indicators located in each soil vapor extraction well. The total flow rate per month was calculated by summing the measured flow rates from each soil vapor extraction well. The average total flow rate, based on measurements obtained from August 2000 through August 2001, was determined to be approximately 180 cfm.

Groundwater elevations were measured monthly from each of the monitoring wells in the network from August 29, 2000 to August 14, 2001. During the first six weeks of treatment system operation, the groundwater elevations were measured more frequently to evaluate the groundwater mounding conditions at the Building LCH-4015 site during the adjustment and optimization of the biosparge well injection flow rate. The groundwater elevation data is presented in **Table 2-2**. The groundwater contour maps presenting the groundwater elevations for each quarter is provided on **Figures 2-1 through 2-4**. The figures illustrate groundwater elevations under static groundwater conditions following a one week period of treatment system shut down in preparation for the quarterly groundwater sampling event.

AFVR events were performed on MW-11 on August 30, 2000, November 21, 2000, and April 27, 2001 for LNAPL removal. A total of approximately 1.5 gallons of LNAPL and 0.15 gallons of VOCs were removed from monitoring well MW-11 during the three AFVR events. AFVR events discontinued due to the minimal recovery results. Free product has not been detected in any other wells at this site. **Appendix B** provides a summary of the AFVR events and results.

2.2 SYSTEM REPAIR AND TROUBLESHOOTING

No major repair associated with the operation of the system has been performed since the start-up of the soil and groundwater treatment system on November 30, 1998. **Table 2-1** provides a summary of pertinent information regarding the soil and groundwater treatment system installation and major repairs.

2.3 SYSTEM-DERIVED WASTE

From August 2000 to August 2001 approximately 4,591 gallons of groundwater accumulated during monitoring well development, collected in the condensate tank and during AFVR events were transported to the RR-72 Former Rifle Range groundwater recovery and treatment system and the Shaw North Plant treatment plant for treatment.

The transportation and disposal log, presented as **Table 2-3**, provides the complete history of the waste material accumulated during construction activities and derived during treatment system operation. The table includes the transporter, waste treatment destination, date of shipment, volume and/or weight of the material.

SECTION 3.0

ANALYTICAL SUMMARY

Groundwater samples were collected from on site monitoring wells MW-1 through MW-3, MW-5, MW-9, and MW-11 on a quarterly basis. Monitoring wells MW-4, MW-6 through MW-8, MW-10, MW-12, and MW-14 through MW-19 were sampled on a semi-annual basis. Monitoring well MW-20 was sampled only once during this operating period. Groundwater samples were collected from monitoring wells MW-21 through MW-23 and temporary monitoring wells GP-01 through GP-03 on June 11, 2001. Monitoring wells MW-21 through MW-23 were also sampled during the August 2001 event. Groundwater samples were delivered by overnight carrier to Paradigm and analyzed for volatile aromatic hydrocarbons using USEPA Method 602 and polynuclear aromatic hydrocarbons using USEPA Method 610.

Volatile aromatic hydrocarbons were not detected in any of the groundwater samples collected from monitoring wells MW-06, MW-07, MW-08, MW-10, MW-12, MW-14 through MW-20, MW-22, and MW-23 during any of the sampling events conducted at the site from August 2000 until August 2001.

Polynuclear aromatic hydrocarbons were not detected in any of the groundwater samples collected from monitoring wells MW-06 through MW-10, MW-12, and MW-14 through MW-23 during any of the sampling events conducted at the site from August 2000 until August 2001.

On August 3, 1998, groundwater samples were collected from the twenty on site groundwater monitoring wells to establish the contaminant concentrations prior to the November 30, 1998 treatment system start-up date. The following paragraphs address each well individually with regard to analytical results from the August 1998 sampling event through the August 2001 groundwater sampling event.

MW-1: The volatile aromatic hydrocarbons benzene, ethylbenzene, toluene, and total xylenes were detected in the groundwater sample collected from monitoring well MW-01 during the initial August 3, 1998 sampling event at concentrations of 3,400 µg/l, 2,000 µg/l, 3,800 µg/l, and 6,600 µg/l, respectively. Benzene, ethylbenzene, toluene, and total xylenes concentrations detected in groundwater samples collected from monitoring well MW-01 in August 2001, approximately three years after treatment system startup, have decreased to 440 µg/l, 870 µg/l, 69 µg/l, and 1,360 µg/l, respectively. The established 15A NCAC 2L groundwater quality standards for benzene, ethylbenzene, toluene, and total xylenes are 1 µg/l, 29 µg/l, 1,000 µg/l, and 530 µg/l, respectively.

The PAHs naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene were detected in the groundwater sample collected from monitoring well MW-01 during the August 1998 sampling event at concentrations of 460 µg/l, 60 µg/l, and 64 µg/l, respectively. Detected concentrations of naphthalene and 1-methylnaphthalene have decreased to 320 µg/l and 37 µg/l, respectively, and 2-methylnaphthalene remained nearly unchanged at 71 µg/l, since the initial sampling event in August 1998. The established 15A NCAC 2L groundwater quality standards for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene are 21 µg/l, laboratory quantitation limit, and 28 µg/l, respectively.

MW-2: The volatile aromatic hydrocarbons benzene, ethylbenzene, and total xylenes were detected in the groundwater sample collected from monitoring well MW-02 during the initial August 3, 1998 sampling event at concentrations of 4,500 µg/l, 270 µg/l, and 1,300 µg/l, respectively. Benzene, ethylbenzene, toluene and total xylenes concentrations detected in groundwater samples collected from monitoring well MW-02 on August 14, 2001, have decreased to 110 µg/l, 79 µg/l, below laboratory quantitation limits, and 540 µg/l, respectively. The established 15A NCAC 2L groundwater quality standards for benzene, ethylbenzene, toluene, and total xylenes are 1 µg/l, 29 µg/l, 1,000 µg/l, and 530 µg/l, respectively.

The PAHs naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene were detected in the groundwater sample collected from monitoring well MW-02 during the August 3, 1998 sampling event at concentrations of 260 µg/l, 25 µg/l, and 46 µg/l, respectively. Concentrations of naphthalene were detected at 54 µg/l during the August 2001 sampling event. Concentrations of 1-methylnaphthalene and 2-methylnaphthalene have each decreased to below laboratory quantitation limits since the initial sampling event in August 1998. The established 15A NCAC 2L groundwater quality standards for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene are 21 µg/l, laboratory quantitation limit, and 28 µg/l, respectively.

MW-3: The volatile aromatic hydrocarbons benzene, toluene, and MTBE, were detected in the groundwater sample collected from monitoring well MW-03 during the initial August 3, 1998 sampling event at concentrations of 2,400 µg/l, 3,900 µg/l, and 760 µg/l, respectively. During the August 2001 groundwater monitoring well sampling event, benzene, ethylbenzene, toluene, total xylenes and MTBE concentrations detected in the groundwater sample collected from monitoring well MW-03 decreased to 220 µg/l, 360 µg/l, below laboratory quantitation limits, 130 µg/l, and 49 µg/l, respectively. The detected concentrations of benzene and ethylbenzene in the August 2001 groundwater sampling event are above the established 15A NCAC 2L standards of 1 µg/l and 29 µg/l, respectively.

The polynuclear aromatic hydrocarbon naphthalene was detected in the groundwater sample collected from monitoring well MW-03 during the August 3, 1998 sampling event at a concentration of 31 µg/l. Detected concentrations of naphthalene have remained constant over the last year, including the August 2001 result of 94 µg/l. Concentrations of 1-methylnaphthalene and 2-methylnaphthalene were detected in the groundwater sample collected from monitoring well MW-03 at concentrations of 41 µg/l, and 10 µg/l, respectively, during the

August 2001 sampling event. The established 15A NCAC 2L groundwater quality standard for 1-methylnaphthalene is the laboratory quantitation limit. The established 15A NCAC 2L groundwater quality standard for 2-methylnaphthalene is 28 µg/l.

MW-4: Low concentrations of ethylbenzene (7 µg/l), total xylenes (8 µg/l), and naphthalene (17 µg/l) were detected in groundwater samples collected from monitoring well MW-4. Volatile aromatic hydrocarbons and polynuclear aromatic hydrocarbons were not detected at concentrations above the 15A NCAC 2L groundwater quality standards in groundwater samples collected from monitoring well MW-4 during the sampling events conducted at the site.

MW-5: Benzene was detected in the August 4, 1998 groundwater sample collected from monitoring well MW-5 at a concentration of 130 µg/l, which is above the 15A NCAC 2L groundwater quality standard of 1 µg/l. Concentrations have decreased to below laboratory quantitation limits for benzene and all other volatile aromatic hydrocarbons and polynuclear aromatic hydrocarbons during the August 2001 sampling event.

MW-9: Benzene concentrations detected in groundwater samples collected from monitoring well MW-9 have fluctuated since the initial groundwater sampling event from a concentration of 650 µg/l detected during the January 1999 sampling event to 14 µg/l detected in the August 2001 sampling event. Ethylbenzene, MTBE, and total xylenes are all below established 15A NCAC 2L groundwater quality standards based on the August 2001 results. Polynuclear aromatic hydrocarbons have not been detected in groundwater samples collected from monitoring well MW-09 since groundwater sampling was initiated.

MW-11: Review of the analytical results from groundwater samples collected from monitoring well MW-11 indicate that detected concentrations of benzene and ethylbenzene have fluctuated slightly since the initial groundwater sampling event. Benzene concentrations have ranged from below laboratory quantitation limit to 7 µg/l, which is marginally above the established the 15A NCAC 2L groundwater quality standard of 1 µg/l. Ethylbenzene concentrations have ranged from 48 µg/l to 58 µg/l, which is also marginally above the established 15A NCAC 2L groundwater quality standard of 29 µg/l.

Total PAHs detected in groundwater samples collected from monitoring well MW-11 have increased since the initial groundwater sampling event at the site. Detected concentrations of naphthalene decreased slightly from 240 µg/l during the August 4, 1998 groundwater sampling event to 220 µg/l in the August 2001 groundwater sampling event. Although concentrations of acenaphthene, fluorene, and phenanthrene increased from below quantitation limits during the August 4, 1998 sampling event to 43 µg/l, 50 µg/l, and 110 µg/l, respectively, during the August 2001 groundwater sampling event, the concentrations remained below the established 15A NCAC 2L their respective groundwater quality standard of 80 µg/l, 280 µg/l, and 210 µg/l. Detected concentrations of 1-methylnaphthalene and 2-methylnaphthalene increased from 180 µg/l and 150 µg/l, respectively, during the initial groundwater sampling event to 430 µg/l and 320 µg/l, respectively, during the August 2001 groundwater sampling event. These

concentrations remain above the established 15A NCAC 2L groundwater quality standard of the method quantitation limit and 28 µg/l.

MW-21: Volatile aromatic hydrocarbons were detected above the 15A NCAC 2L groundwater quality standards in groundwater samples collected from monitoring well MW-21 during the August 2001 sampling event. Benzene was detected at 10 µg/l, which is above the established 15A NCAC 2L standard of 1 µg/l.

Additionally three temporary monitoring wells GP-01, GP-02 and GP-03 were installed using a geoprobe in the vicinity of MW-11. They were installed to assess the possibility of contamination from other sources due to the presence of free product in MW-11. GP-01 was located down gradient while GP-02 and GP-03 were located upgradient from MW-11. VOC contamination was detected only in GP-01 with benzene, ethylbenzene and total xylenes at concentrations of 15 µg/l, 50 µg/l, and 14 µg/l, respectively. PAH contamination was detected in the sample collected from GP-01 with naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, fluorene and phenanthrene at concentrations of 190 µg/l, 360 µg/l, 440 µg/l, 27 µg/l, 47 µg/l and 80 µg/l, respectively. Since contamination was not observed upgradient in GP-02 and GP-03, offsite contamination is unlikely.

Table 3-1 presents a summary of detected contaminant concentrations in groundwater samples collected from the on site groundwater monitoring wells during each sampling event. **Appendix C** provides the laboratory analytical reports from the groundwater monitoring well sampling events.

Dissolved contaminant plume isopleth maps, which present the distribution of the volatile aromatic hydrocarbons and the polynuclear aromatic hydrocarbons detected above the 15A NCAC 2L groundwater quality standards, are presented in **Figures 3-1 through 3-8**.

During each groundwater sample collection event, from August 2000 to August 2001, an air quality sample was collected from the soil vapor extraction system effluent. Each air quality sample was delivered by overnight carrier to Paradigm and analyzed for volatile aromatic hydrocarbons using USEPA Method 18. The sample collection events conducted during treatment system operation were completed on August 15, 2000, November 21, 2000, February 13, 2001, May 15, 2001, and August 6, 2001.

Volatile aromatic hydrocarbons were detected above laboratory quantitation limits in one of the five air quality samples collected from the soil vapor extraction effluent during the period of this Annual Report. The initial air quality sample collected on November 30, 1998 had detected concentrations of benzene, ethylbenzene, toluene, and total xylenes of 7.9 mg/m³, 8.0 mg/m³, 28.6 mg/m³, and 24.3 mg/m³, respectively.

During the February 13, 2001 sampling event benzene, ethylbenzene, toluene, and total xylenes were detected at 1.2 mg/m³, 1 mg/m³, 7 mg/m³, and 4.3 mg/m³, respectively. During the last air

sampling event of August 6, 2001, volatile aromatic hydrocarbons were not detected in air quality samples above the laboratory quantitation limits. **Table 3-2** presents a summary of the detected contaminant concentrations in the air quality samples collected from the soil vapor extraction system effluent. **Appendix D** provides the laboratory data from the air quality sampling events.

SECTION 4.0

CONCLUSIONS AND RECOMMENDATIONS

From August 2000 to August 2001, J.A. Jones implemented the selected remedial approach as outlined in the August 27, 1996 CAP prepared by Law. The selected remedial approach consisted of air sparging and soil vapor extraction to volatilize dissolved hydrocarbons present in the groundwater and to collect the vapors generated during air sparging. J.A. Jones installed, operated, and performed groundwater monitoring at this site. The current goal is to maintain optimum treatment system performance and to track petroleum-impacted groundwater migration/attenuation to verify remediation progress.

J.A. Jones completed installation and began operation of the Building LCH-4015 remediation system on November 30, 1998. Groundwater samples were collected from on-site monitoring wells both quarterly and semi-annually. The samples were analyzed for volatile aromatic hydrocarbons, using USEPA Method 602, and polynuclear aromatic hydrocarbons, using USEPA Method 610.

During groundwater elevation surveys completed at the Building LCH-4015 site, LNAPL was detected in monitoring well MW-11 in nine of the past 12 months at apparent thicknesses ranging from 0.01 feet to 1.22 feet, respectively. Three AFVR events at monitoring well MW-11 were completed. During the AFVR events, only minor quantities of LNAPL and VOC's as gasoline and/or diesel fuel were recovered. Monitoring well MW-11 is located in an active parking lot and although the integrity of the monitoring well cap is maintained in good condition, the LNAPL presence may be related to parking lot use. To determine if any potential nearby source of free product exists, three temporary monitoring wells were installed both up- and down gradient from MW-11. The upgradient temporary wells (GP-2 and GP-3) did not detect any contamination, while the downgradient well (GP-1) VOCs and PAHs above groundwater quality standards. A passive skimmer has been installed in MW-11 to recover any free phase product. Additional AFVR events will be conducted on an as-needed basis.

According to the groundwater elevation data collected by J.A. Jones, the direction of groundwater flow is predominantly toward the north, in the direction of monitoring well MW-11, with flow components toward the south and southwest.

The dissolved petroleum hydrocarbon concentrations at the Building LCH-4015 site have decreased in the vicinity of monitoring wells MW-1, MW-2, and MW-3 since the August 1998 sampling event was completed just prior to treatment system start up. Since the August 1998 sampling event, detected concentrations of volatile aromatic hydrocarbons (USEPA Method 602 compounds) have been reduced from 15,800 µg/l to 2,739 µg/l in monitoring well MW-01, 6,070 µg/l to 729 µg/l in monitoring well MW-02, and 7,060 µg/l to 759 µg/l in monitoring

well MW-03. Dissolved concentrations of benzene have been reduced by over 95% since the development of the CAP, based on maximum detected concentrations. During the quarterly monitoring well sampling event completed in August 2001, the interpreted areal extent of the dissolved volatile aromatic hydrocarbon contaminant plume, above the 15A NCAC 2L groundwater quality standards, extended from the former location of Building LCH-4015 to southeast of Building LCH-4034.

Concentrations of PAHs naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have fluctuated at wells MW-1 through MW-3, and MW-11 during previous sampling events. A majority of the other monitoring wells have not detected contaminant concentrations above laboratory quantitation limits dating back to 1998. The interpreted areal extent of the dissolved polynuclear aromatic hydrocarbon contaminants in the vicinity of monitoring wells MW-01 and MW-03 has decreased slightly since the initial groundwater sampling event conducted just prior to start up of the treatment system.

Since operation of the treatment system at LCH-4015 began in November 1998, the soil vapor extraction system has maintained an average flow rate of approximately 36 cfh. Vapor extraction flowrates were measured from each of the four soil vapor extraction wells while the air quality samples were collected from the treatment system effluent (after dilution air was added to the vapor flow). Dilution air is added at the air/water separator tank to reduce total system vacuum to minimize entrainment of groundwater by the SVE system. Due to the addition of dilution air to the SVE system effluent, recovered concentrations of VOC's may not be detected above the laboratory quantitation limits in the samples collected. Therefore, Shaw recommends the collection of air quality samples prior to the air/water separator (i.e., before the dilution air valve) to obtain a more accurate measurement of VOCs recovered by the SVE system.

Although volatile aromatic and polynuclear aromatic hydrocarbons continue to be present above the 15A NCAC 2L groundwater quality standards, review of historical analytical results indicate VOCs concentration continue to demonstrate a decreasing trend while the PAHs concentrations trend appears to be asymptotic. The total mass of VOC's removed by the soil vapor extraction system and the overall reduction in contaminant concentrations within the dissolved petroleum contaminant plume indicates that the biosparge/soil vapor extraction treatment system is effective in volatilizing the petroleum hydrocarbons present in the groundwater at the Building LCH-4015 site.

Shaw recommends the following changes to the groundwater monitoring well sample collection and analysis protocol:

- Discontinue groundwater sample collection from MW-6, MW-7, MW-8, MW-10, MW-12, MW-14, MW-15, MW-16, MW-17, and MW-19. Analytical results

from these wells have not detected contaminants of concern above the laboratory quantitation limit in all sampling events dating back to August 1998.

- Continue sampling MW-1, MW-2, MW-3, MW-9, MW-11, MW-18 and MW-21 on a quarterly schedule. The samples will be analyzed for volatile aromatic hydrocarbons using (Method 602), polynuclear aromatic hydrocarbons using Method 625 (plus 10 largest non-target peaks identified), MADEP EPH and MADEP VPH.
- Continue sampling MW-4 and MW-5. The samples will be analyzed for volatile aromatic hydrocarbons (Method 602) only. PAH compounds have not been detected in these wells above the laboratory quantitation limit dating back to August 1999

In addition, monitoring well MW-11 should continue to be gauged on a monthly basis to evaluate LNAPL occurrence. Additional AFVR events will be performed as needed. If sufficient product is detected in monitoring well MW-11, Shaw recommends collecting a sample for fingerprint analysis.

In a draft annual monitoring report J.A. Jones recommended evaluating the LCH-4015 site conditions to determine whether the site can be reclassified to an "intermediate" or "low risk" site. A preliminary evaluation suggested that the site meets all of the criteria to be reclassified as "low risk".

Catlin has been contracted to complete a remediation system optimization survey at the site in 2004. Until the survey has been completed, Shaw recommends continued treatment system operation and quarterly sampling of the select monitoring wells discussed above until dissolved petroleum related constituent concentrations meet the site rehabilitation concentrations established by the 15A NCAC 2L groundwater quality standards. Conclusions of the optimization survey will include recommendations for additional soil contamination assessment due to an UST release discovered in spring 2002 during UST removal activities. A 24 hour release report was submitted to WiRO/UST on May 2, 2002.

Table 2-1
Historic Summary of Operation and Maintenance Inspections
Building LCH-4015
Camp Lejeune, North Carolina
August 1, 2000 to August 31, 2001

Date	Arrival Status	Departure Status	Inspection Comments
8/1-31/00	Operational	Operational	Performed system operation and maintenance.
8/1/00	Operational	Operational	Performed routine site visit.
8/2/00	Operational	Operational	Emptied condensate storage tanks of approximately 725 gallons of accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment for treatment.
8/3/00	Operational	Operational	Performed routine site visit. Emptied condensate storage tank of approximately 700 gallons of water accumulated during system operation, prepared manifest, and transported water to RR-72 former Rifle Range system for treatment.
8/4/00	Operational	Operational	Performed routine site visit.
8/7/00	Operational	Operational	Emptied condensate storage tanks of approximately 400 gallons of accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment for treatment. Performed system maintenance.
8/9/00	Operational	Operational	Performed routine site visit. Emptied condensate storage tank of approximately 350 gallons of water accumulated during system operation, prepared manifest, and transported water to RR-72 former Rifle Range system for treatment.
8/11/00	Operational	Operational	Performed routine site visit. Adjusted the soil vapor extraction dilution valve to control the amount of groundwater drawn into the system.
8/14/00	Operational	Operational	Performed routine site visit.
8/15/00	Operational	Operational	Conducted SVE system sampling event. Emptied condensate storage tank of approximately 700 gallons of water accumulated during system operation, prepared manifest, and transported water to RR-72 former Rifle Range system for treatment.
8/22 & 23/00	Non-Operational	Operational	Conducted semi-annual groundwater monitoring well sampling event and groundwater elevation survey from each of the monitoring wells in the network. Emptied condensate storage tank of approximately 125 gallons of water accumulated during system operation, prepared manifest, and transported water to RR-72 former Rifle Range system for treatment. Performed troubleshooting to the flowmeter and the capuhelic gauges.
8/24/00	Operational	Operational	Performed routine site visit.
8/25/00	Operational	Operational	Conducted technical review and annual groundwater elevation survey summary.
8/28/00	Operational	Operational	Emptied condensate storage tanks of approximately 400 gallons of accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment for treatment. Performed system maintenance.
8/29/00	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary. Conducted groundwater elevation survey for each of the monitoring wells in the network.
8/30/00	Operational	Operational	Conducted an aggressive fluid vapor recovery (AFVR) event on monitoring well MW-11. During the event, approximately 1.0 gallons of LNAPL and 0.03 gallons of VOC's were removed. Emptied condensate tank of approximately 315 gallons of water accumulated during system operation, prepared manifest, and transported to SHAW North Plant for treatment.
8/31/00	Operational	Operational	Performed routine site visit.
9/1-30/00	Operational	Operational	Performed system operation and maintenance.
9/5/00	Operational	Operational	Performed routine system maintenance.

Table 2-1
 Historic Summary of Operation and Maintenance Inspections
 Building LCH-4015
 Camp Lejeune, North Carolina
 August 1, 2000 to August 31, 2001

Date	Arrival Status	Departure Status	Inspection Comments
9/6/00	Operational	Operational	Emptied condensate storage tanks of approximately 500 gallons of accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment for treatment.
9/7/00	Operational	Operational	Emptied condensate storage tanks of approximately 300 gallons of accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment system for treatment.
9/8/00	Operational	Operational	Performed routine site visit.
9/12/00	Operational	Operational	Performed routine system maintenance.
9/13/00	Operational	Operational	Performed groundwater elevation survey from each of the monitoring wells in the network. Emptied condensate tank of approximately 225 gallons accumulated during system operation, prepared manifest, and transported water to RR-72 former rifle range treatment system for treatment.
9/29/00	Operational	Operational	Performed routine site visit.
10/1-31/00	Operational	Operational	Performed system operation and maintenance.
10/2/00	Operational	Operational	Performed routine system maintenance.
10/5/00	Operational	Operational	Performed maintenance to the soil vapor extraction system.
10/7/00	Operational	Operational	Performed routine system maintenance.
10/12/00	Operational	Operational	Performed groundwater elevation survey from each of the monitoring wells in the network.
10/17/00	Operational	Operational	Begin performing aggressive fluid vapor recovery (AFVR) event on monitoring well MW-11. AFVR event was terminated due to malfunctioning vacuum truck. Performed groundwater elevation survey from each of the monitoring wells in the network.
10/18 & 20/00	Operational	Operational	Performed routine site visit.
10/26 & 31/00	Operational	Operational	Performed routine site visit.
11/1-30/00	Operational	Operational	Performed system operation and maintenance.
11/2 & 3/00	Operational	Operational	Performed routine site visit.
11/10/00	Operational	Operational	Performed routine site visit and gauged monitoring well MW-11 for presence of LNAPL. Installed a passive skimmer in monitoring well MW-11.
11/15/00	Operational	Operational	Performed routine site visit.
11/20/00	Operational	Operational	Performed routine system maintenance.
11/21/00	Operational	Non-Operational	Conducted an aggressive fluid vapor recovery (AFVR) event on monitoring well MW-11. During the event, approximately 0.5 gallons of LNAPL and 0.11 gallons of VOC's were removed. Transported approximately 268 gallons of water accumulated during system operation, prepared manifest, and transported to SHAW North Plant for treatment. Conducted SVE system sampling event and shut down biosparge system in preparation of quarterly groundwater sampling event.
11/27/00	Non-Operational	Operational	Conducted quarterly groundwater monitoring well sampling event and groundwater elevation survey from each of the monitoring wells in the network. Performed routine site visit.
11/29/00	Operational	Operational	Performed routine site visit. Emptied condensate storage tank of approximately 350 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.

Table 2-1
 Historic Summary of Operation and Maintenance Inspections
 Building LCH-4015
 Camp Lejeune, North Carolina
 August 1, 2000 to August 31, 2001

Date	Arrival Status	Departure Status	Inspection Comments
12/1-31/00	Operational	Operational	Performed system operation and maintenance.
12/1 & 4/00	Operational	Operational	Performed routine site visit.
12/5/00	Operational	Operational	Emptied condensate storage tank of approximately 275 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.
12/6/00	Operational	Operational	Emptied condensate storage tank of approximately 700 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.
12/7 & 8/00	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary. Emptied condensate storage tank of approximately 700 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.
12/11/00	Operational	Operational	Performed routine site visit. Conducted groundwater elevation survey from each of the monitoring wells in the network. Emptied condensate storage tank of approximately 175 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.
12/14/00	Operational	Operational	Performed routine site visit. Conducted groundwater elevation survey from each of the monitoring wells in the network. Emptied condensate storage tank of approximately 175 gallons of water accumulated during system operation, prepared manifest, and transported to RR-72 former Rifle Range treatment system for treatment.
12/18/00	Operational	Operational	Performed routine site visit.
12/28/00	Operational	Operational	Performed routine system maintenance.
1/1-31/01	Operational	Operational	Performed system operation and maintenance.
1/2/01	Operational	Operational	Performed routine site visit.
1/8/01	Operational	Operational	Performed routine site visit.
1/18/01	Operational	Operational	Conducted groundwater elevation survey from each of the monitoring wells in the network.
1/19/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
1/22 & 25/01	Operational	Operational	Performed routine site visit.
1/31/01	Operational	Operational	Performed routine site visit.
2/1-28/01	Operational	Operational	Performed system operation and maintenance.
2/1/01	Operational	Operational	Performed routine site visit and installed an air dilution valve on the soil vapor extraction system.
2/5/01	Operational	Operational	Performed routine site visit.
2/6/01	Operational	Operational	Transported approximately 400 gallons of water accumulated during system operation, prepared manifest, and transported to SHAW North Plant for treatment.
2/8/01	Operational	Operational	Performed routine site visit.
2/9/01	Operational	Operational	Performed routine site visit. Emptied approximately 0.03 gallons of product from the passive skimmer in monitoring well MW-11.

Table 2-1
 Historic Summary of Operation and Maintenance Inspections
 Building LCH-4015
 Camp Lejeune, North Carolina
 August 1, 2000 to August 31, 2001

Date	Arrival Status	Departure Status	Inspection Comments
2/12/01	Operational	Operational	Transported approximately 400 gallons of water accumulated during system operation, prepared manifest, and transported to SHAW North Plant for treatment.
2/13/01	Operational	Non-Operational	Conducted SVE system sampling event and shut down biosparge system in preparation of quarterly groundwater sampling event. Transported approximately 300 gallons of water accumulated during system operation, prepared manifest, and transported to SHAW North Plant for treatment.
2/20/01	Non-Operational	Operational	Conducted semi-annual groundwater monitoring well sampling event and groundwater elevation survey from each of the monitoring wells in the network.
2/27/01	Operational	Operational	Performed routine system maintenance.
3/1-31/01	Operational	Operational	Performed system operation and maintenance.
3/1 & 2/01	Operational	Operational	Performed routine system maintenance.
3/5 & 6/01	Operational	Operational	Performed routine site visit.
3/7/01	Operational	Operational	Performed routine site visit and conducted groundwater elevation survey from each of the monitoring wells in the network.
3/9 & 15/01	Operational	Operational	Performed routine site visit.
3/19-20/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
3/27 & 28/01	Operational	Operational	Performed routine site visit.
4/1-30/01	Operational	Operational	Performed system operation and maintenance.
4/2/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
4/5 & 6/01	Operational	Operational	Performed routine site visit.
4/10/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary. Emptied approximately 0.1 gallons of product from the passive skimmer in monitoring well MW-11.
4/11/01	Operational	Operational	Gauged monitoring well MW-11 for LNAPL occurrence.
4/12/01	Operational	Operational	Conducted groundwater elevation summary from each of the monitoring wells in the network.
4/16/01	Operational	Operational	Gauged monitoring well MW-11 for LNAPL occurrence.
4/20/01	Operational	Operational	Performed routine site visit.
4/26/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
4/27/01	Operational	Operational	Conducted AFVR event on monitoring well MW-11. Recovered approximately 0.01 gallons of VOC's as gasoline. Approximately 139 gallons of groundwater accumulated during the AFVR event were transported to the SHAW North Plant groundwater treatment system for treatment.
5/1-31/01	Operational	Operational	Performed system operation and maintenance.
5/1 & 2/01	Operational	Operational	Performed routine site visit.
5/4/01	Operational	Operational	Performed routine site visit.
5/7/01	Operational	Operational	Performed routine site visit. Replaced broken regulator gauges in air sparge wells AS-2, AS-3, and AS-31.
5/8/01	Operational	Operational	Performed routine site visit.
5/10/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.

Table 2-1
 Historic Summary of Operation and Maintenance Inspections
 Building LCH-4015
 Camp Lejeune, North Carolina
 August 1, 2000 to August 31, 2001

Date	Arrival Status	Departure Status	Inspection Comments
5/11 & 14/01	Operational	Operational	Prepared site visit report.
5/15 & 16/01	Operational	Non-Operational	Performed maintenance to the air compressor.
5/17/01	Operational	Non-Operational	Conducted SVE system sampling event and shut down biosparge system in preparation of quarterly groundwater sampling event.
5/23/01	Non-Operational	Operational	Conducted quarterly groundwater monitoring well sampling event and groundwater elevation survey from each of the monitoring wells in the network.
5/31/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
6/1-30/01	Operational	Operational	Performed system operation and maintenance.
6/4/01	Non-Operational	Operational	Performed maintenance to effluent flow meter.
6/5-8/01	Operational	Operational	Subcontractor Mann Drilling on-site to install groundwater monitoring wells MW-21, MW-22, and MW-23, and three geoprobe borings.
6/11/01	Non-Operational	Operational	Conducted groundwater sampling event from monitoring wells MW-21, MW-22, and MW-23, and the three geoprobe borings GP-01, GP-02, and GP-03.
6/15/01	Operational	Operational	Performed routine site visit.
6/20/01	Operational	Operational	Conducted groundwater elevation survey from each of the monitoring wells in the network. Subcontractor John L. Pierce Surveyors on-site to obtain top of casing elevations of the three new monitoring wells MW-21, MW-22, and MW-23.
6/21/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
6/25/01	Operational	Operational	Performed site visit. Approximately 350 gallons of groundwater accumulated during treatment system operation were transported to the SHAW North Plant groundwater treatment system for treatment.
6/28/01	Non-Operational	Operational	Performed maintenance to the air compressor water separator.
7/1-31/01	Operational	Operational	Performed system operation and maintenance.
7/2/01	Non-Operational	Operational	Performed maintenance to the air compressor.
7/5/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
7/9/01	Operational	Operational	Performed routine site visit.
7/10/01	Operational	Operational	Conducted groundwater elevation survey from each of the monitoring wells in the network. Performed maintenance to the flow meters.
7/25/01	Operational	Operational	Performed routine site visit.
7/30/01	Operational	Operational	Performed routine system maintenance.
7/31/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.
8/1-31/01	Operational	Operational	Performed system operation and maintenance.
8/6/01	Operational	Non-Operational	Conducted SVE system sampling event and shut down biosparge system in preparation of semi-annual groundwater sampling event.
8/14 & 15/01	Non-Operational	Operational	Conducted semi-annual groundwater monitoring well sampling event and groundwater elevation survey from each of the monitoring wells in the network.
8/20/01	Operational	Operational	Performed routine site visit.
8/22/01	Operational	Operational	Performed routine system maintenance.
8/28/01	Operational	Operational	Prepared site visit report and preventative maintenance and inspection summary.

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	8/14/2001				7/10/2001				6/20/2001			
	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Groundwater Elevation (ft., msl)
MW1	29.78		4.35	25.43		3.83	25.95		3.50	26.28		26.28
MW2	29.24		2.88	26.36		2.20	27.04		1.77	27.47		27.47
MW3	32.02		6.78	25.24		5.69	26.33		5.25	26.77		26.77
MW4	32.68		7.81	24.87		6.50	26.18		5.50	27.18		27.18
MW5	29.35		3.50	25.85		2.62	26.73		2.25	27.10		27.10
MW6	29.11		3.86	25.25		3.24	25.87		2.64	26.47		26.47
MW7	29.67		3.11	26.56		2.28	27.39		2.40	27.27		27.27
MW8	28.79		4.55	24.24		3.67	25.12		2.50	26.29		26.29
MW9	28.35		3.51	24.84		1.94	26.41		1.74	26.61		26.61
MW10	28.28		2.15	26.13		1.75	26.53		1.61	26.67		26.67
MW11	29.18	6.06	6.17	23.01	5.72	5.75	23.43	5.24	5.25	23.93		23.93
MW12	29.23		4.60	24.63		3.95	25.28		3.44	25.79		25.79
MW14	29.45		4.63	24.82		4.13	25.32		3.71	25.74		25.74
MW15	29.26		4.78	24.48		4.18	25.08		4.00	25.26		25.26
MW16	29.62		2.92	26.70		1.46	28.16		1.85	27.77		27.77
MW17	29.76		3.84	25.92		2.54	27.22		2.00	27.76		27.76
MW18	29.86		1.41	28.45		1.48	28.38		1.95	27.91		27.91
MW19	29.98		25.93	4.05		26.51	3.47		27.25	2.73		2.73
MW20	29.16		25.23	3.93		25.78	3.38		26.52	2.64		2.64
MW21	29.85		25.92	3.93		25.94	3.91		26.60	3.25		3.25
MW22	29.14		25.04	4.10		25.78	3.36		26.48	2.66		2.66
MW23	29.86		25.80	4.06		26.42	3.44		27.21	2.65		2.65

Notes:

ft = feet

toc = top of casing elevation

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR ever

³ Groundwater elevation measurements made same day after AFVR ever

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	5/23/2001				4/27/01 ³				4/27/01 ²	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	4/27/01 ²	Groundwater Elevation (ft., msl)
	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Groundwater Elevation (ft., msl)							
MW1	29.78		25.63		3.92	25.86		25.86	3.90					3.90	25.88
MW2	29.24		27.08		2.11	27.13		27.13	2.12					2.12	27.12
MW3	32.02		26.02		5.42	26.60		26.60	5.39					5.39	26.63
MW4	32.68		27.54		6.13	26.55		26.55	6.15					6.15	26.53
MW5	29.35		26.33		2.51	26.84		26.84	2.50					2.50	26.85
MW6	29.11		25.96		5.95	23.16		23.16	2.93					2.93	26.18
MW7	29.67		27.53		2.85	26.82		26.82	1.68					1.68	27.99
MW8	28.79		25.64		3.72	25.07		25.07	2.69					2.69	26.10
MW9	28.35		27.05		0.00	28.35		28.35	0.00					0.00	28.35
MW10	28.28		27.00		0.00	28.28		28.28	0.00					0.00	28.28
MW11	29.18		23.22		10.55	18.63	4.62	18.63	5.86					5.86	23.32
MW12	29.23		25.13		3.84	25.39		25.39	3.86					3.86	25.37
MW14	29.45		25.21		4.00	25.45		25.45	4.00					4.00	25.45
MW15	29.26		24.80		4.49	24.77		24.77	4.42					4.42	24.84
MW16	29.62		27.28		2.51	27.11		27.11	2.53					2.53	27.09
MW17	29.76		27.60		2.34	27.42		27.42	2.34					2.34	27.42
MW18	29.86		28.70		2.47	27.39		27.39	0.95					0.95	28.91
MW19	29.98		4.96		25.30	4.68		4.68	25.25					25.25	4.73
MW20	29.16		3.92		24.58	4.58		4.58	24.56					24.56	4.60
MW21	29.85			Not Measured	Not Measured										
MW22	29.14			Not Measured	Not Measured										
MW23	29.86			Not Measured	Not Measured										

Notes:

ft = feet

toc = top of casing elevator

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR ever

³ Groundwater elevation measurements made same day after AFVR ever

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	4/12/2001	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	3/7/2001	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	2/20/01 ¹	Groundwater Elevation (ft., msl)
MW1	29.78		3.75	26.03		3.20	26.58		3.25	26.53
MW2	29.24		1.71	27.53		1.60	27.64		2.00	27.24
MW3	32.02		5.07	26.95		4.67	27.35		4.93	27.09
MW4	32.68		5.56	27.12		4.75	27.93		4.92	27.76
MW5	29.35		2.05	27.30		1.91	27.44		2.31	27.04
MW6	29.11		2.60	26.51		2.28	26.83		2.66	26.45
MW7	29.67		2.60	27.07		2.03	27.64		2.30	27.37
MW8	28.79		2.82	25.97		1.34	27.45		1.56	27.23
MW9	28.35		1.93	26.42		1.00	27.35		1.05	27.30
MW10	28.28		1.75	26.53		1.14	27.14		1.25	27.03
MW11	29.18	4.45	4.67	24.51		3.82	25.36		5.06	24.12
MW12	29.23		3.36	25.87		3.10	26.13		3.82	25.41
MW14	29.45		3.57	25.88		3.52	25.93		4.02	25.43
MW15	29.26		4.13	25.13		3.84	25.42		3.98	25.28
MW16	29.62		2.90	26.72		1.08	28.54		1.35	28.27
MW17	29.76		2.12	27.64		1.57	28.19		1.45	28.31
MW18	29.86		1.64	28.22		1.61	28.25		1.94	27.92
MW19	29.98		26.25	3.73		26.30	3.68		26.73	3.25
MW20	29.16		25.52	3.64		25.62	3.54		26.68	2.48
MW21	29.85									
MW22	29.14									
MW23	29.86									

Notes:

ft = feet

toc = top of casing elevator

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR ever

³ Groundwater elevation measurements made same day after AFVR ever

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	1/18/2001	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	12/11/2000	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	11/27/2000	Groundwater Elevation (ft., msl)
MW1	29.78		3.56	26.22		3.12	26.66		3.82	25.96
MW2	29.24		1.63	27.61		0.85	28.39		1.64	27.60
MW3	32.02		4.40	27.62		4.10	27.92		4.16	27.86
MW4	32.68		4.85	27.83		4.38	28.30		6.80	25.88
MW5	29.35		1.65	27.70		1.93	27.42		1.87	27.48
MW6	29.11		2.68	26.43		2.04	27.07		3.72	25.39
MW7	29.67		2.39	27.28		1.58	28.09		3.32	26.35
MW8	28.79		1.52	27.27		1.17	27.62		2.96	25.83
MW9	28.35		1.01	27.34		0.00	28.35		0.00	28.35
MW10	28.28		Not Measured			0.00	28.28		1.36	26.92
MW11	29.18		6.79	22.39		6.16	23.02	6.82	6.85	22.33
MW12	29.23		5.38	23.85		4.72	24.51		5.59	23.64
MW14	29.45		4.57	24.88		3.83	25.62		4.98	24.47
MW15	29.26		4.16	25.10		3.52	25.74		4.96	24.30
MW16	29.62		1.31	28.31		0.45	29.17		2.23	27.39
MW17	29.76		1.50	28.26		0.71	29.05		2.81	26.95
MW18	29.86		2.16	27.70		1.47	28.39		2.90	26.96
MW19	29.98		24.79	5.19		26.21	3.77		24.95	5.03
MW20	29.16		24.10	5.06		25.39	3.77		24.04	5.12
MW21	29.85									
MW22	29.14									
MW23	29.86									

Notes:

ft = feet

toc = top of casing elevator

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR ever

³ Groundwater elevation measurements made same day after AFVR ever

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	11/21/00 ¹	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	11/21/00 ²	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	10/12/2000	Groundwater Elevation (ft., msl)
MW1	29.78		5.22	24.56		4.75	25.03		3.87	25.91
MW2	29.24		2.87	26.37		2.82	26.42		2.19	27.05
MW3	32.02		6.03	25.99		5.94	26.08		5.52	26.50
MW4	32.68		6.80	25.88		6.72	25.96		6.18	26.50
MW5	29.35						29.35		2.51	26.84
MW6	29.11		3.77	25.34		3.72	25.39		3.35	25.76
MW7	29.67		3.32	26.35		3.32	26.35		3.14	26.53
MW8	28.79		2.98	25.81		2.96	25.83		3.42	25.37
MW9	28.35		2.45	25.90		2047	-2018.65		2.47	25.88
MW10	28.28		1.43	26.85		1.36	26.92		0.00	28.28
MW11	29.18		10.11	19.07	5.33	5.35	23.83	6.44	6.48	22.70
MW12	29.23		5.57	23.66		5.59	23.64		4.82	24.41
MW14	29.45		4.94	24.51		4.98	24.47		4.51	24.94
MW15	29.26		4.93	24.33		4.96	24.30		4.60	24.66
MW16	29.62		2.38	27.24		2.23	27.39		2.50	27.12
MW17	29.76		2.87	26.89		2.81	26.95		2.65	27.11
MW18	29.86		3.42	26.44		2.9	26.96		2.85	27.01
MW19	29.98		25.05	4.93		24.95	5.03		25.62	4.36
MW20	29.16		24.18	4.98		24.01	5.15		25.00	4.16
MW21	29.85									
MW22	29.14									
MW23	29.86									

Notes:

ft = feet

toc = top of casing elevation

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR event

³ Groundwater elevation measurements made same day after AFVR event

Table 2-2
Building LCH-4015
Camp Lejeune, North Carolina
Water Level Measurement Summary
August 1, 2000 to August 31, 2001

Sample Point	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	9/13/2000	Groundwater Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	8/29/2000	Groundwater Elevation (ft., msl)
MW1	29.78		3.45	26.33		3.62	26.16
MW2	29.24		1.29	27.95		1.48	27.76
MW3	32.02		4.61	27.41		4.75	27.27
MW4	32.68		5.25	27.43		5.20	27.48
MW5	29.35		1.60	27.75		1.80	27.55
MW6	29.11		2.65	26.46		2.80	26.31
MW7	29.67		2.56	27.11		2.30	27.37
MW8	28.79		2.61	26.18		2.20	26.59
MW9	28.35		1.85	26.50		1.62	26.73
MW10	28.28		1.50	26.78		1.02	27.26
MW11	29.18		5.92	23.26		6.45	22.73
MW12	29.23		4.25	24.98		4.60	24.63
MW14	29.45		3.88	25.57		4.05	25.40
MW15	29.26		3.96	25.30		4.26	25.00
MW16	29.62		1.55	28.07		1.20	28.42
MW17	29.76		1.83	27.93		1.70	28.06
MW18	29.86		1.76	28.10		1.02	28.84
MW19	29.98		26.45	3.53		26.35	3.63
MW20	29.16		25.80	3.36		25.70	3.46
MW21	29.85						
MW22	29.14						
MW23	29.86						

Notes:

ft = feet

toc = top of casing elevation

msl = mean sea level

¹ System not operational during water level survey

² Groundwater elevation measurements made same day prior to AFVR ever

³ Groundwater elevation measurements made same day after AFVR ever

TABLE 2-3
TRANSPORTATION AND DISPOSAL LOG
J.A. JONES ENVIRONMENTAL SERVICES COMPANY
CAMP LEJEUNE, NORTH CAROLINA
PROJECT NUMBER: 005-037A

GALLONS TO DATE 4,591
GALLONS TO RR-72 3,052
GALLONS TO SHAW 1,539
TONS TO DATE 0.00
DRUMS TO DATE 0.00

DATE SHIPPED	DISPOSAL FACILITY	HAULER	TONS	GALLONS	DRUMS	MANIFEST NUMBER	LOAD NUMBER	COMMENTS
11/21/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		277		1273	W-033	Recovered Soil Vapor Water & AFVR event
11/29/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		350		1275	W-034	Recovered Soil Vapor Water
12/5/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		275		1276	W-035	Recovered Soil Vapor Water
12/6/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		700		1277	W-036	Recovered Soil Vapor Water
12/8/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		700		1278	W-037	Recovered Soil Vapor Water
12/11/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		175		1279	W-038	Recovered Soil Vapor Water
12/14/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		175		1282	W-039	Recovered Soil Vapor Water
12/29/2000	Groundwater Treatment System, Former Rifle Range RR-72	J.A. Jones Environmental Services Company		400		1285	W-040	Recovered Soil Vapor Water
2/6/2001	SHAW North Plant, Camp Lejeune, NC 28547	J.A. Jones Environmental Services Company		400		1290	W-041	Recovered Soil Vapor Water
2/12/2001	SHAW North Plant, Camp Lejeune, NC 28547	J.A. Jones Environmental Services Company		400		1292	W-042	Recovered Soil Vapor Water
2/13/2001	SHAW North Plant, Camp Lejeune, NC 28547	J.A. Jones Environmental Services Company		300		1293	W-043	Recovered Soil Vapor Water
4/27/2001	SHAW North Plant, Camp Lejeune, NC 28547	J.A. Jones Environmental Services Company		139		2546	W-044	Groundwater Accumulated During AFVR Event
6/25/2001	SHAW North Plant, Camp Lejeune, NC 28547	J.A. Jones Environmental Services Company		300		2589	W-045	Recovered Soil Vapor Water
			0.00	4591.00	0.00	SOIL:	0	Loads
						WATER:	13	Loads
						DRUMS:	0	Loads

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-01					
			USTLCH4015-MW01-02D 11/14/2002 #	USTLCH4015-MW01-02C 8/13/2002 *#	USTLCH4015-MW01-02B 5/22/2002 *#	USTLCH4015-MW01-02A 2/21/2002 *#	USTLCH4015-MW01-01D 11/19/2001 #	USTLCH4015-MW01-01C 8/14/2001 *#
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		130	230	210	170	360	440
Ethylbenzene	29		330	620	740	480	990	870
Toluene	1000		21	27	41	80	86	69
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		493	590	1,010	1,080	1,570	1,360
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		190	300	280	200	270	320
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		25	31	36	23	29	37
2-Methylnaphthalene	28		45	58	65	41	57	71

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NC DENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-01					
			USTLCH4015-MW01-01B 5/23/2001 *#	USTLCH4015-MW01-01A 2/20/2001 *#	USTLCH4015-MW01-00D 11/27/2000 *#	USTLCH4015-MW01-00C 8/22/2000 *#	USTLCH4015-MW01-00B 5/24/2000 *#	USTLCH4015-MW01-00A 2/22/2000 *#
<i>Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L</i>								
Benzene	1		340	510	590	690	700	410
Ethylbenzene	29		770	920	1,100	1,000	1,100	650
Toluene	1000		190	340	180	140	210	320
Methyl-ter-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		1,700	1,900	2,200	1,730	2,290	1,540
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>								
Naphthalene	21		210	270	250	290	220	160
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		30	37	41	53	48	24
2-Methylnaphthalene	28		54	55	66	77	67	36

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-01					
			USTLCH4015-MW01-99D 11/23/1999	USTLCH4015-MW01-99C 8/19/1999 *#	USTLCH4015-MW01-99B 5/26/1999 *#	USTLCH4015-MW01-99A2 2/23/1999 *	USTLCH4015-MW01-99A 1/26/1999 *	USTLCH4015-MW01-98D3 12/28/1998
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		590	1,400	1,200	1,900	1,600	2,200
Ethylbenzene	29		970	1,600	1,700	2,100	1,700	1,400
Toluene	1000		440	680	1,600	4,500	3,100	3,600
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		2,040	3,500	5,360	8,100	7,000	6,800
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		220	300	350	160	440	450
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		46	57	75	29	50	50
2-Methylnaphthalene	28		68	95	130	52	80	98

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-01 USTLCH4015-MW01-98C2 8/4/1998	MW-02					USTLCH4015-MW02-02A 2/21/2002 *#	USTLCH4015-MW02-01D 11/19/2001 #
Sample ID Sample Date			USTLCH4015-MW02-02D 11/14/2002 #	USTLCH4015-MW02-02C 8/13/2002 *#		USTLCH4015-MW02-02B 5/22/2002 *#						
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L												
Benzene	1				3,400	87	250	400	820	550		
Ethylbenzene	29				2,000	72	110	140	140	150		
Toluene	1000				3,800	11	17	BQL	92	19		
Methyl-tert-butyl ether	200				BQL	BQL	BQL	BQL	BQL	BQL		
Total Xylenes	530				6,600	380	510	440	140	1,100		
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L												
Naphthalene	21				460	160	190	190	95	68		
Acenaphthene	80				BQL	BQL	BQL	BQL	BQL	BQL		
Fluorene	280				BQL	BQL	BQL	BQL	BQL	BQL		
Phenanthrene	210				BQL	BQL	BQL	BQL	BQL	BQL		
1-Methylnaphthalene	Detection Limit				60	13	12	16	BQL	BQL		
2-Methylnaphthalene	28				64	15	13	16	BQL	BQL		

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-02					
			USTLCH4015-MW02-01C	USTLCH4015-MW02-01B	USTLCH4015-MW02-01A	USTLCH4015-MW02-00D	USTLCH4015-MW02-00C	USTLCH4015-MW02-00B
Volatle Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		110	85	26	5	12	36
Ethylbenzene	29		79	7	BQL	2	3	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		540	BQL	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		54	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		Sample Location Sample ID Sample Date	MW-02					
NCDENR Regulatory Limit			USTLCH4015-MW02-00A 2/22/2000 *#	USTLCH4015-MW02-99D 11/23/1999	USTLCH4015-MW02-99C 8/19/1999 *#	USTLCH4015-MW02-99B 5/26/1999 *#	USTLCH4015-MW02-99A2 2/24/1999 *	USTLCH4015-MW02-99A 1/26/1999 *
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		55	130	6,600	7,200	5,400	1,900
Ethylbenzene	29		BQL	14	290	440	360	170
Toluene	1000		BQL	BQL	BQL	BQL	BQL	840
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	330
Total Xylenes	530		BQL	BQL	720	730	580	800
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		BQL	19	190	26	62	110
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	24	BQL	BQL	12
2-Methylnaphthalene	28		BQL	BQL	27	BQL	BQL	14

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-02		MW-03			
			USTLCH4015-MW02-98D3	USTLCH4015-MW02-98C2	USTLCH4015-MW03-02D	USTLCH4015-MW03-02C	USTLCH4015-MW03-02B	USTLCH4015-MW03-02A
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		2,600 BQL	4,500 270	7 7	77 23	160 56	210 84
Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	13	13	BQL	37
Methyl-tert-butyl ether	200		BQL	1,300	BQL	BQL	16	33
Polynuclear Aromatic Hydrocarbons by USEPA method 625/870C, ug/L								
Total Xylenes	530							
Naphthalene	21		69	260	BQL	17	40	57
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	25	17	24	26	27
2-Methylnaphthalene	28		BQL	46	16	22	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDEMR Regulatory Limit	Sample Location Sample ID Sample Date	MW-03					
			USTLCH4015-MW03-01D 11/19/2001 #	USTLCH4015-MW03-01C 8/14/2001 #	USTLCH4015-MW03-01B 5/23/2001 #	USTLCH4015-MW03-01A 2/20/2001 #	USTLCH4015-MW03-00D 11/27/2000 #	USTLCH4015-MW03-00C 8/22/2000 #
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		220	220	230	520	390	460
Ethylbenzene	29		160	360	410	440	620	590
Toluene	1000		8	BQL	BQL	51	57	55
Methyl-tert-butyl ether	200		35	49	190	BQL	BQL	BQL
Total Xylenes	530		53	130	160	230	220	400
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		66	94	69	85	140	88
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		36	41	32	33	59	33
2-Methylnaphthalene	28		BQL	10	14	14	31	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		Sample Location Sample ID Sample Date	MW-03						
			USTLCH4015-MW03-00B 5/24/2000 *#	USTLCH4015-MW03-00A 2/22/2000 *#	USTLCH4015-MW03-99D 11/23/1999	USTLCH4015-MW03-99C 8/19/1999 *#	USTLCH4015-MW03-99B 5/26/1999 *#	USTLCH4015-MW03-99A2 2/24/1999 *	
NCDENR Regulatory Limit									
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L	Benzene	1	570	760	810	1,200	2,400	1,800	
	Ethylbenzene	29	430	290	580	700	530	140	
	Toluene	1000	87	170	100	260	810	570	
	Methyl-tert-butyl ether	200	62	100	BQL	BQL	BQL	320	
	Total Xylenes	530	360	390	720	2,200	1,600	530	
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L									
	Naphthalene	21	BQL	45	54	58	68	19	
	Acenaphthene	80	BQL	BQL	BQL	BQL	BQL	BQL	
	Fluorene	280	BQL	BQL	BQL	BQL	BQL	BQL	
	Phenanthrene	210	BQL	BQL	BQL	BQL	BQL	BQL	
	1-Methylnaphthalene	Detection Limit	BQL	13	19	21	22	BQL	
	2-Methylnaphthalene	28	BQL	BQL	BQL	BQL	BQL	BQL	

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-03			MW-04		
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L			Sample ID	Sample Date	USTLCH4015-MW03-99A 1/26/1999 *	USTLCH4015-MW03-98D3 12/28/1998	USTLCH4015-MW03-98C2 8/4/1998	USTLCH4015-MW04-02C 8/13/2002 *#	USTLCH4015-MW04-02A 2/26/2002 *#	USTLCH4015-MW04-02A 2/21/2002 *#
Benzene		1			1,100	2,200	2,400	BQL	NA	BQL
Ethylbenzene		29			BQL	290	BQL	1	NA	6
Toluene		1000			360	980	3,900	BQL	NA	BQL
Methyl-tert-butyl ether		200			330	BQL	760	BQL	NA	BQL
Total Xylenes		530			200	1,300	BQL	BQL	NA	7
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L										
Naphthalene		21			30	59	31	BQL	BQL	NA
Acenaphthene		80			BQL	BQL	BQL	BQL	BQL	NA
Fluorene		280			BQL	BQL	BQL	BQL	BQL	NA
Phenanthrene		210			BQL	BQL	BQL	BQL	BQL	NA
1-Methylnaphthalene		Detection Limit			BQL	BQL	BQL	BQL	BQL	NA
2-Methylnaphthalene		28			BQL	BQL	BQL	BQL	BQL	NA

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

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verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-04					
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L			Sample ID	Sample Date	USTLCH4015-MW04-01C 8/14/2001 *#	USTLCH4015-MW04-01A 2/20/2001 *#	USTLCH4015-MW04-00C 8/22/2000 *#	USTLCH4015-MW04-00A 2/22/2000 *#	USTLCH4015-MW04-99D 11/23/1999	USTLCH4015-MW04-99C 8/19/1999 *#
Benzene		1		BQL	BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene		29		7	2	5	7	7	14	
Toluene		1000		BQL	BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether		200		BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes		530		8	2	4	6	8	16	
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L										
Naphthalene		21		17	BQL	BQL	BQL	BQL	BQL	20
Acenaphthene		80		BQL	BQL	BQL	BQL	BQL	BQL	BQL
Fluorene		280		BQL	BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene		210		BQL	BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene		Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL	11
2-Methylnaphthalene		28		BQL	BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-04					MW-05
			USTLCH4015-MW04-99B 5/26/1999 *#	USTLCH4015-MW04-99A2 2/23/1999 *	USTLCH4015-MW04-99A 1/26/1999 *	USTLCH4015-MW04-98D3 12/28/1998	USTLCH4015-MW04-98C2 8/4/1998	
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29		12	8	11	11	23	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		15	9	12	11	23	8 BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		13	BQL	BQL	BQL	14	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		Sample Location Sample ID Sample Date	MW-05					
NCDENR Regulatory Limit			USTLCH4015-MW05-02C 8/13/2002 *#	USTLCH4015-MW05-02B 5/22/2002 *#	USTLCH4015-MW05-02A 2/21/2002 *#	USTLCH4015-MW05-01D 11/19/2001 #	USTLCH4015-MW05-01C 8/14/2001 *#	USTLCH4015-MW05-01B 5/23/2001 *#
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		BQL	20	2	BQL	BQL	BQL
Ethylbenzene	29		BQL	4	BQL	BQL	BQL	BQL
Toluene	1000		BQL	66	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		5	94	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	24	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/827/0C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCIDNR Regulatory Limit	Sample Location Sample ID Sample Date	MW-05					
			USTLCH4015-MW05-01A	USTLCH4015-MW05-00D	USTLCH4015-MW05-00C	USTLCH4015-MW05-00B	USTLCH4015-MW05-00A	USTLCH4015-MW05-99D
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		7	18	BQL	BQL	2	16
Ethylbenzene	29		2	25	BQL	BQL	27	140
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		8	220	3	13	34	72
Total Xylenes	530		4	223	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	13
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-05					
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L			Sample ID	Sample Date	USTLCH4015-MW05-99C 8/19/1999 *#	USTLCH4015-MW05-99B 5/26/1999 *#	USTLCH4015-MW05-99A2 2/23/1999 *	USTLCH4015-MW05-99A 1/26/1999 *	USTLCH4015-MW05-98D3 12/28/1998	USTLCH4015-MW05-98C2 8/4/1998
Benzene		1			BQL	BQL	BQL	2	BQL	130
Ethylbenzene		29			BQL	BQL	BQL	BQL	BQL	24
Toluene		1000			BQL	BQL	BQL	BQL	BQL	170
Methyl-tert-butyl ether		200			BQL	7	24	17	7	79
Total Xylenes		530			BQL	BQL	BQL	BQL	BQL	49
Polynuclear Aromatic Hydrocarbons by USEPA method 625.8270C, ug/L										
Naphthalene		21			BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene		80			BQL	BQL	BQL	BQL	BQL	BQL
Fluorene		280			BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene		210			BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene		Detection Limit			BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene		28			BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-06					
			USTLCH4015-MW06-02C	USTLCH4015-MW06-02A	USTLCH4015-MW06-01C	USTLCH4015-MW06-01A	USTLCH4015-MW06-00C	USTLCH4015-MW06-00A
Volatiles Aromatic Hydrocarbons by USEPA method 602, ug/L			8/14/2002 *#	2/21/2002 *#	8/14/2001 *#	2/20/2001 *#	8/23/2000 *#	2/22/2000 *#
Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location		MW-06					
		Sample ID	Sample Date	USTLCH4015-MW06-99D	USTLCH4015-MW06-99C	USTLCH4015-MW06-99B	USTLCH4015-MW06-99A2	USTLCH4015-MW06-99A	USTLCH4015-MW06-98D3
<i>Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L</i>									
Benzene	1			BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29			BQL	BQL	1	BQL	BQL	BQL
Toluene	1000			BQL	BQL	7	BQL	BQL	BQL
Methyl-tert-butyl ether	200			BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530			BQL	BQL	9	BQL	BQL	BQL
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>									
Naphthalene	21			BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80			BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280			BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210			BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit			BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28			BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location		MW-06 USTLCH4015-MW06-98C2	MW-07				
		Sample ID	Sample Date		USTLCH4015-MW07-02C	USTLCH4015-MW07-02A	USTLCH4015-MW07-01C	USTLCH4015-MW07-01A	USTLCH4015-MW07-00C
<i>Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L</i>									
Benzene	1			BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29			BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000			BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200			BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530			BQL	BQL	BQL	BQL	BQL	BQL
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>									
Naphthalene	21			BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80			BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280			BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210			BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit			BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28			BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-07				
			USTLCH4015-MW07-00A 2/22/2000 *#	USTLCH4015-MW07-99D 11/23/1999	USTLCH4015-MW07-99C 8/19/1999 *#	USTLCH4015-MW07-99B 5/26/1999 *#	USTLCH4015-MW07-99A 2/23/1999 * 1/26/1999 *
Volatle Aromatic Hydrocarbons by USEPA method 602, ug/L							
Benzene	1		2	BQL	BQL	BQL	BQL
Ethylbenzene	29		1	BQL	BQL	BQL	BQL
Toluene	1000		1	BQL	BQL	3	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		3	BQL	BQL	3	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L							
Naphthalene	21		BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location		MW-07		MW-08	
		Sample ID	Sample Date	USTLCH4015-MW07-98D3	USTLCH4015-MW07-98C2	USTLCH4015-MW08-02A	USTLCH4015-MW08-02A
<i>Volatiles Aromatic Hydrocarbons by USEPA method 602, ug/L</i>							
Benzene	1			BQL	BQL	NA	BQL
Ethylbenzene	29			BQL	BQL	NA	BQL
Toluene	1000			BQL	BQL	NA	BQL
Methyl-tert-butyl ether	200			BQL	BQL	NA	BQL
Total Xylenes	530			BQL	BQL	NA	BQL
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>							
Naphthalene	21			BQL	BQL	BQL	NA
Acenaphthene	80			BQL	BQL	BQL	NA
Fluorene	280			BQL	BQL	BQL	NA
Phenanthrene	210			BQL	BQL	BQL	NA
1-Methylnaphthalene	Detection Limit			BQL	BQL	BQL	NA
2-Methylnaphthalene	28			BQL	BQL	BQL	NA

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-08					
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L				USTLCH4015-MW08-01A 2/20/2001 *#	USTLCH4015-MW08-00C 8/22/2000 *#	USTLCH4015-MW08-00A 2/22/2000 *#	USTLCH4015-MW08-99D 11/23/1999	USTLCH4015-MW08-99C 8/19/1999 *#	USTLCH4015-MW08-99B 5/26/1999 *#
	Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
	Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
	Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
	Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
	Total Xylenes	530		BQL	BQL	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L									
	Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
	Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
	Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
	Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
	1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
	2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDEMR Regulatory Limit	Sample Location Sample ID Sample Date	MW-08				MW-09	
			USTLCH4015-MW08-99A2	USTLCH4015-MW08-99A	USTLCH4015-MW08-98D3	USTLCH4015-MW08-98C2	USTLCH4015-MW09-02D	USTLCH4015-MW09-02C
<i>Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L</i>			2/24/1999 *	1/26/1999 *	12/28/1998	8/4/1998	11/14/2002 #	8/13/2002 *#
Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	BQL	BQL	16	29
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>							BQL	BQL
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-09					
			USTLCH4015-MW09-02B 5/22/2002 *#	USTLCH4015-MW09-02A 2/21/2002 *#	USTLCH4015-MW09-01D 11/19/2001 #	USTLCH4015-MW09-01C 8/14/2001 *#	USTLCH4015-MW09-01B 5/23/2001 *#	USTLCH4015-MW09-01A 2/20/2001 *#
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		1	3	16	14	73	18
Ethylbenzene	29		BQL	4	25	14	38	33
Toluene	1000		BQL	BQL	1	BQL	BQL	BQL
Methyl-tert-butyl ether	200		44	24	36	53	37	30
Total Xylenes	530		BQL	BQL	11	3	12	19
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		BQL	BQL	11	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-09					
			USTLCH4015-MW09-00D 11/27/2000 *#	USTLCH4015-MW09-00C 8/22/2000 *#	USTLCH4015-MW09-00B 5/24/2000 *#	USTLCH4015-MW09-00A 2/22/2000 *#	USTLCH4015-MW09-99D 11/23/1999	USTLCH4015-MW09-99C 8/19/1999 *#
Volatiles Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		18	71	110	98	210	510
Ethylbenzene	29		44	33	14	19	25	43
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		49	62	82	95	120	150
Total Xylenes	530		28	44	BQL	BQL	36	100
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-09					MW-10
			USTLCH4015-MW09-99B 5/26/1999 *#	USTLCH4015-MW09-99A2 2/24/1999 *	USTLCH4015-MW09-99A 1/26/1999 *	USTLCH4015-MW09-98D3 12/28/1998	USTLCH4015-MW09-98C2 8/4/1998	
Volatiles Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		270	540	500	650	230	BQL
Ethylbenzene	29		BQL	BQL	30	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL	85	BQL
Methyl-tert-butyl ether	200		150	220	250	200	200	BQL
Total Xylenes	530		BQL	BQL	46	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625.6270C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-10					
			USTLCH4015-MW10-02A	USTLCH4015-MW10-01C	USTLCH4015-MW10-01A	USTLCH4015-MW10-00C	USTLCH4015-MW10-00A	USTLCH4015-MW10-99D
<i>Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L</i>								
Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	BQL	BQL	BQL	BQL
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L</i>								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-10					
			USTLCH4015-MW10-99C 8/19/1999 *#	USTLCH4015-MW10-99B 5/26/1999 *#	USTLCH4015-MW10-99A2 2/24/1999 *	USTLCH4015-MW10-99A 1/26/1999 *	USTLCH4015-MW10-98D3 12/28/1998	USTLCH4015-MW10-98C2 8/4/1998
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		BQL	BQL	BQL	BQL	BQL	BQL
Ethylbenzene	29		BQL	BQL	BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 615/8270C, ug/L								
Naphthalene	21		BQL	BQL	BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-11					
			USTLCH4015-MW11-02D 11/14/2002 #	USTLCH4015-MW11-02C 8/14/2002 *#	USTLCH4015-MW11-02B 5/22/2002 *#	USTLCH4015-MW11-02A 2/21/2002 *#	USTLCH4015-MW11-01D 11/19/2001 #	USTLCH4015-MW11-01C 8/14/2001 *#
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		BQL	BQL	BQL	3	5	7
Ethylbenzene	29		25	44	37	28	51	58
Toluene	1000		BQL	BQL	BQL	1	BQL	3
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	4	BQL	5	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		20	21	95	130	200	220
Acenaphthene	80		11	BQL	41	49	48	43
Fluorene	280		11	BQL	62	65	78	50
Phenanthrene	210		13	11	110	180	120	110
1-Methylnaphthalene	Detection Limit		150	150	390	410	630	430
2-Methylnaphthalene	28		BQL	BQL	130	360	270	320

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-11					
			USTLCH4015-MW11-01B 5/23/2001 *#	USTLCH4015-MW11-01A 2/20/2001 *#	USTLCH4015-MW11-00D 11/27/2000 *#	USTLCH4015-MW11-00C 8/23/2000 *#	USTLCH4015-MW11-00B 5/24/2000 *#	USTLCH4015-MW11-00A 2/22/2000 *#
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L								
Benzene	1		5	5	5	BQL	2	11
Ethylbenzene	29		51	50	48	68	49	62
Toluene	1000		2	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		10	BQL	BQL	15	5	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L								
Naphthalene	21		71	180	120	4,400	350	230
Acenaphthene	80		37	26	24	510	47	BQL
Fluorene	280		76	47	47	1,500	84	12
Phenanthrene	210		180	92	96	2,900	190	15
1-Methylnaphthalene	Detection Limit		400	480	430	13,000	900	220
2-Methylnaphthalene	28		310	170	100	11,000	720	20

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-11					
			USTLCH4015-MW11-99D 11/23/1999	USTLCH4015-MW11-99C 8/19/1999 *#	USTLCH4015-MW11-99B 5/26/1999 *#	USTLCH4015-MW11-99A2 2/23/1999 *	USTLCH4015-MW11-99A 1/26/1999 *	USTLCH4015-MW11-98D3 12/28/1998
<i>Volatle Aromatic Hydrocarbons by USEPA method 602, ug/L</i>								
Benzene	1		BQL	3	7	8	11	8
Ethylbenzene	29		63	55	53	42	65	68
Toluene	1000		BQL	BQL	BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	9	13	21	16
<i>Polynuclear Aromatic Hydrocarbons by USEPA method 625.8270C, ug/L</i>								
Naphthalene	21		230	190	190	80	100	240
Acenaphthene	80		14	BQL	BQL	BQL	BQL	BQL
Fluorene	280		26	BQL	BQL	BQL	BQL	BQL
Phenanthrene	210		40	10	BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		320	180	180	92	82	180
2-Methylnaphthalene	28		140	BQL	30	62	91	220

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-11		MW-12				
Volatile Aromatic Hydrocarbons by USEPA method 602, ug/L			Sample ID	Sample Date	USTLCH4015-MW11-98C2	USTLCH4015-MW12-02C	USTLCH4015-MW12-02A	USTLCH4015-MW12-01C	USTLCH4015-MW12-01A	USTLCH4015-MW12-00C	
Benzene		1			8/3/1998						
Ethylbenzene		29			8	BQL	BQL	BQL	BQL	BQL	
Toluene		1000			77	BQL	BQL	BQL	BQL	BQL	
Methyl-tert-butyl ether		200			BQL	BQL	BQL	BQL	BQL	BQL	
Total Xylenes		530			BQL	BQL	BQL	BQL	BQL	BQL	
Polynuclear Aromatic Hydrocarbons by USEPA method 625/8270C, ug/L					12	BQL	BQL	BQL	BQL	BQL	
Naphthalene		21									
Acenaphthene		80			240	BQL	BQL	BQL	BQL	BQL	
Fluorene		280			BQL	BQL	BQL	BQL	BQL	BQL	
Phenanthrene		210			BQL	BQL	BQL	BQL	BQL	BQL	
1-Methylnaphthalene		Detection Limit			180	BQL	BQL	BQL	BQL	BQL	
2-Methylnaphthalene		28			150	BQL	BQL	BQL	BQL	BQL	

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter		NCDENR Regulatory Limit	Sample Location		MW-12					
Volatle Aromatic Hydrocarbons by USEPA method 602, ug/L	Sample ID		Sample Date	USTLCH4015-MW12-00A 2/22/2000 *#	USTLCH4015-MW12-99D 11/23/1999	USTLCH4015-MW12-99C 8/19/1999 *#	USTLCH4015-MW12-99B 5/26/1999 *#	USTLCH4015-MW12-99A2 2/23/1999 *	USTLCH4015-MW12-99A 1/26/1999 *	
	Benzene	1								
	Ethylbenzene	29								
	Toluene	1000								
	Methyl-tert-butyl ether	200								
	Total Xylenes	530								
Polynuclear Aromatic Hydrocarbons by USEPA method 625/870C, ug/L										
	Naphthalene	21								
	Acenaphthene	80								
	Fluorene	280								
	Phenanthrene	210								
	1-Methylnaphthalene	Detection Limit								
	2-Methylnaphthalene	28								

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-1 (continued)
Summary of Detected Concentrations
Groundwater Monitoring Well Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	NCDENR Regulatory Limit	Sample Location Sample ID Sample Date	MW-12		MW-13	
			USTLCH4015-MW12-98D3	USTLCH4015-MW12-98C2	USTLCH4015-MW13-98C2	USTLCH4015-MW13-98C2
Volatle Aromatic Hydrocarbons by USEPA method 602, ug/L			12/28/1998	8/3/1998	8/3/1998	
Benzene	1		BQL	BQL	BQL	BQL
Ethylbenzene	29		BQL	BQL	BQL	BQL
Toluene	1000		BQL	BQL	BQL	BQL
Methyl-tert-butyl ether	200		BQL	BQL	BQL	BQL
Total Xylenes	530		BQL	BQL	BQL	BQL
Polynuclear Aromatic Hydrocarbons by USEPA method 625/627/6C, ug/L						
Naphthalene	21		BQL	BQL	BQL	BQL
Acenaphthene	80		BQL	BQL	BQL	BQL
Fluorene	280		BQL	BQL	BQL	BQL
Phenanthrene	210		BQL	BQL	BQL	BQL
1-Methylnaphthalene	Detection Limit		BQL	BQL	BQL	BQL
2-Methylnaphthalene	28		BQL	BQL	BQL	BQL

Notes:

NA indicates the sample was not analyzed for this constituent.

Bold type indicates detected concentrations above laboratory quantitation limits.

Detected concentrations above the regulatory limits are indicated by shading.

BQL = Below Laboratory Quantitation Limit

* verified with laboratory data package

verified with electronic data deliverables

Table 3-2
Summary of Detected Concentrations
Treatment System Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	Sample Location		SVE-E						
	Sample ID	Sample Date	USTLCH4015-SVE-I-02D	USTLCH4015-SVE-I-02C	USTLCH4015-SVE-I-02B	USTLCH4015-SVE-I-02A	USTLCH4015-SVE-I-01D	USTLCH4015-SVE-E-01C	USTLCH4015-SVE-E-01B
<i>Volatiles Aromatic Hydrocarbons by USEPA Method 18, mg/m³</i>									
Benzene			11/6/2002 *	8/6/2002 *	5/15/2002 *	2/13/2002 *	11/13/2001 *	8/6/2001 *	5/17/2001 *
Ethylbenzene			BQL	BQL	BQL	BQL	BQL	BQL	BQL
Toluene			BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes			0.098	BQL	BQL	0.26	BQL	BQL	BQL

NOTES:
 NA indicates the sample was not analyzed for this constituent.
 Bold type indicates detected concentrations above laboratory quantitation limits.
 BQL = Below Laboratory Quantitation Limit
 SVE-E = Soil Vapor Extraction System Effluent
 ^ Detected concentrations were present below laboratory quantitation limits.
 * verified with laboratory data package

Table 3-2
Summary of Detected Concentrations
Treatment System Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	Sample Location		SVE-E					
	Sample ID	Sample Date	USTLCH4015-SVE-E-01A	USTLCH4015-SVE-E-00D	USTLCH4015-SVE-E-00C	USTLCH4015-SVE-E-00B	USTLCH4015-SVE-E-00A	USTLCH4015-SVE-E-99D
Volatile Aromatic Hydrocarbons by USEPA Method 18, $\mu\text{g}/\text{m}^3$			2/13/2001 *	11/21/2000 *	8/15/2000 *	5/15/2000 *	2/22/2000	11/19/1999
	Benzene		1.2	BQL	BQL	BQL	BQL	BQL
	Ethylbenzene		1	BQL	BQL	BQL	BQL	BQL
	Toluene		7	BQL	BQL	BQL	BQL	BQL
	Total Xylenes		4.3	BQL	BQL	BQL	BQL	BQL

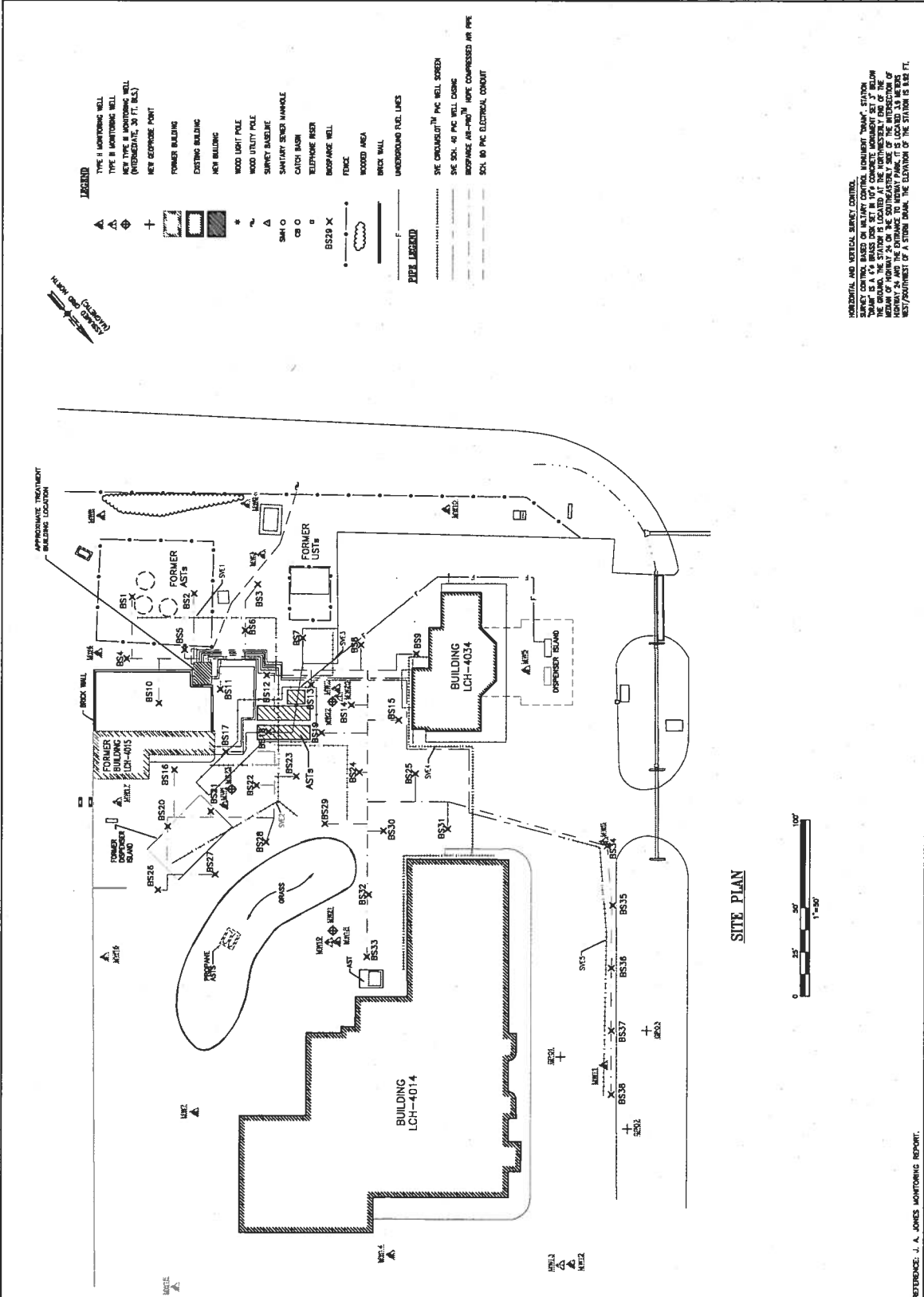
NOTES:
 NA indicates the sample was not analyzed for this constituent.
 Bold type indicates detected concentrations above laboratory quantitation limit
 BQL = Below Laboratory Quantitation Limit
 SVE-E = Soil Vapor Extraction System Effluent
 * Detected concentrations were present below laboratory quantitation limit
 * verified with laboratory data package

Table 3-2
Summary of Detected Concentrations
Treatment System Samples
Building LCH-4015
Camp Lejeune, North Carolina

Parameter	Sample Location Sample ID	SVE-E					
		USTLCH4015-SVE-E-99C	USTLCH4015-SVE-E-99B	USTLCH4015-SVE-E-99A2	USTLCH4015-SVE-E-99A	USTLCH4015-SVE-E-98D3	USTLCH4015-SVE-E-98D2
<i>Volatile Aromatic Hydrocarbons by USEPA Method 18, mg/m³</i>	Sample Date	8/10/1999 *	5/19/1999 *	2/15/1999 *	1/20/1999 *	12/22/1998	11/30/1998
Benzene		0.36	BQL	7	0.7	1.2	7.9
Ethylbenzene		0.12 [^]	BQL	2.8	0.2	BQL	8
Toluene		0.79	BQL	28.0	1.8	1.2	28.6
Total Xylenes		0.3 [^]	BQL	9.3	0.6	0.4	24.3

NOTES:
 NA indicates the sample was not analyzed for this constituent
 Bold type indicates detected concentrations above laboratory quantitation limit
 BQL = Below Laboratory Quantitation Limit
 SVE-E = Soil Vapor Extraction System Effluent
[^] Detected concentrations were present below laboratory quantitation limit
 * verified with laboratory data package

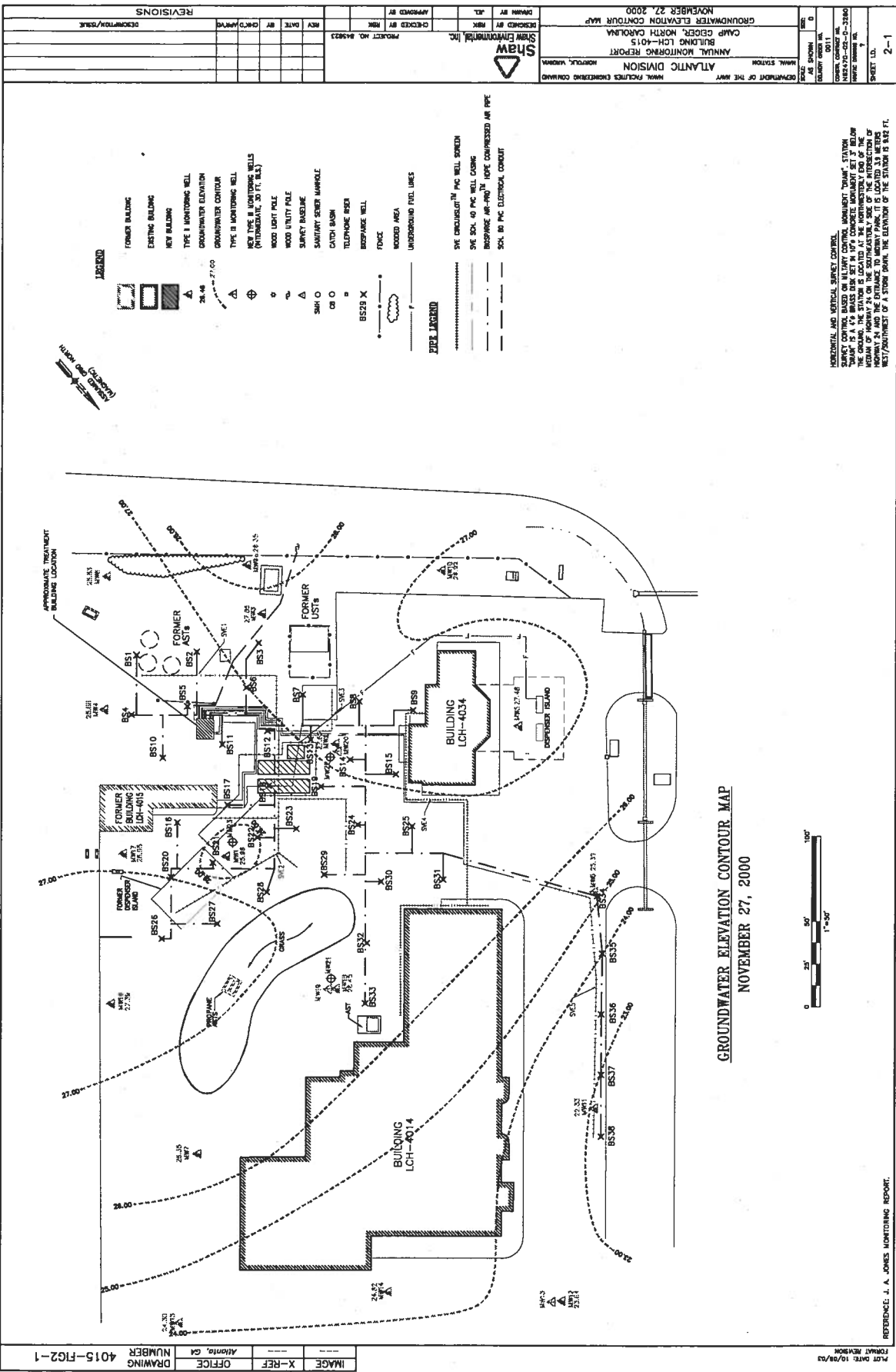
ATLANTIC DIVISION ANNUAL MONITORING REPORT CAMP GEORGE, NORTH CAROLINA BUILDING LCH-4015		PROJECT NO. 4015-1 DRAWN BY: JAL CHECKED BY: NIK APPROVED BY: NIK	
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTOLAK, VIRGINIA		SHEET NO. 1-1 SHEET TOTAL 1-1	



HORIZONTAL AND VERTICAL SURVEY CONTROL
SURVEY CONTROL BASED ON MILITARY CONTROL MONUMENT "TJANK" STATION "TJANK" IS A 9" DIAMETER BRASS DISK SET IN 10" CONCRETE MONUMENT SET 3" BELOW THE GROUND. THE STATION IS LOCATED AT THE NORTHWEST END OF THE MIDDLE OF HIGHWAY 24 ON THE SOUTHEASTLY SIDE OF THE INTERSECTION OF HIGHWAY 24 AND THE ENTRANCE TO MOUNTAIN PARK. IT IS LOCATED 3.9 METERS WEST/SOUTHWEST OF A STORM DRAIN. THE ELEVATION OF THE STATION IS 942 FT.

PLOT DATE: 10/08/11
 FORMAT: MEMPHIS

GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 27, 2000



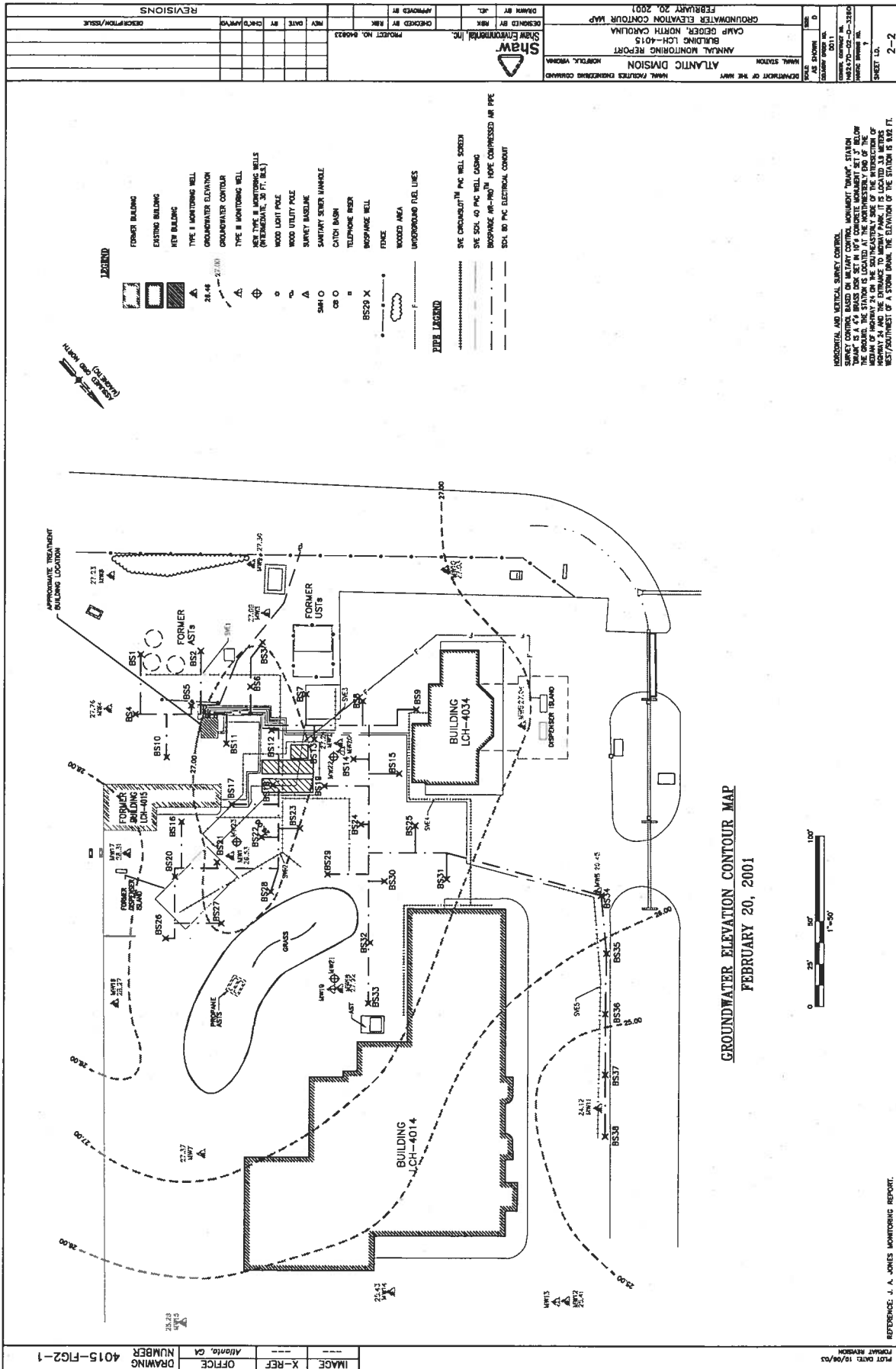
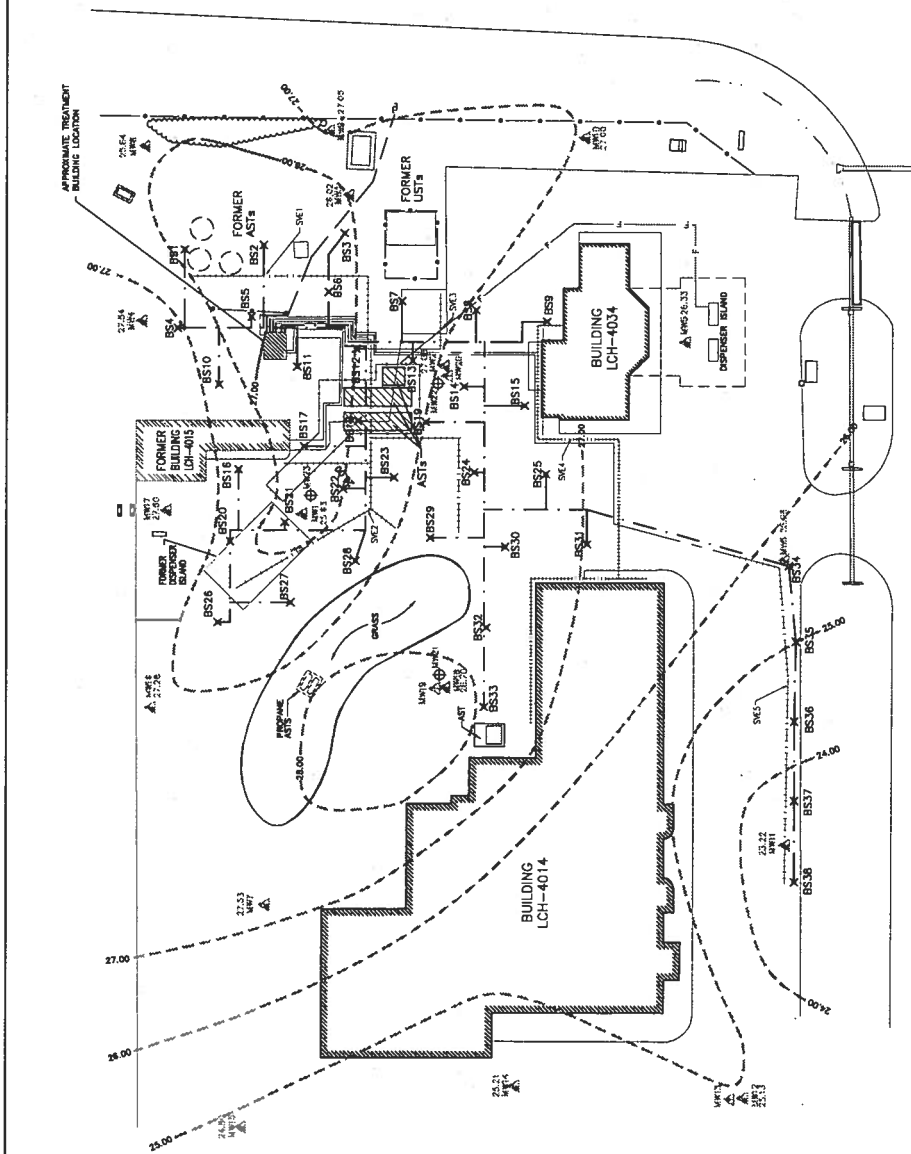


IMAGE	X-REF	OFFICE	DRAWING NUMBER
---	---	Atlanta, GA	4015-F1G2-3



GROUNDWATER ELEVATION CONTOUR MAP
MAY 23, 2001

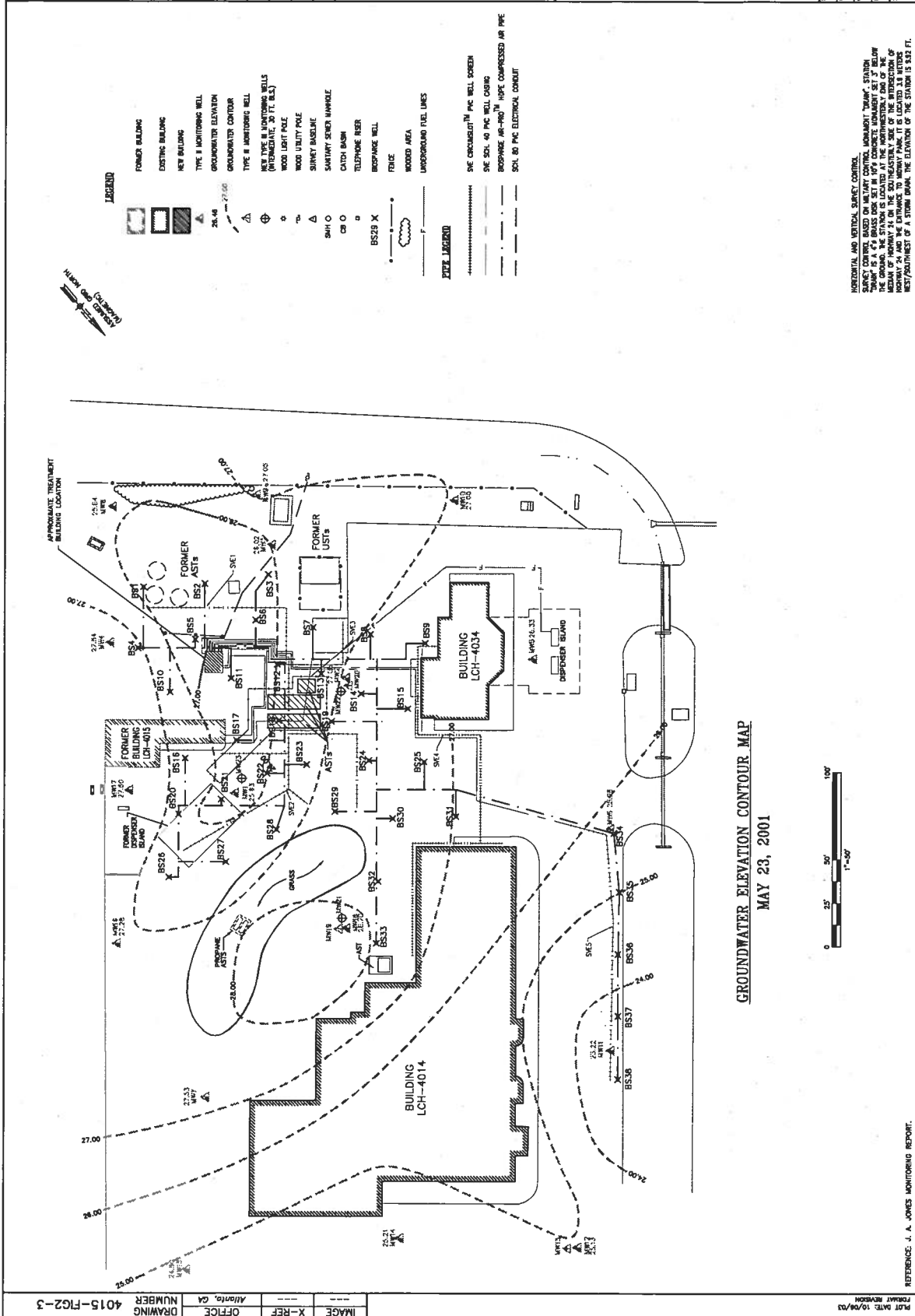


REFERENCE: J. A. JONES MONITORING REPORT.

HORIZONTAL AND VERTICAL SURVEY CONTROL

SHEET 6		DATE		MAY 23, 2001	
PROJECT NO. 843823		CHECKED BY		APPROVED BY	
REV		DATE		BY	
CHG		DATE		BY	
DESCRIPTION/REVISIONS		DATE		BY	
ATLANTIC DIVISION		ATLANTIC DIVISION		ATLANTIC DIVISION	
HARBOR FACILITIES ENGINEERING COMMAND		HARBOR FACILITIES ENGINEERING COMMAND		HARBOR FACILITIES ENGINEERING COMMAND	
ANNUAL MONITORING REPORT		ANNUAL MONITORING REPORT		ANNUAL MONITORING REPORT	
BUILDING 104-1015		BUILDING 104-1015		BUILDING 104-1015	
CAMP GEORGE, NORTH CAROLINA		CAMP GEORGE, NORTH CAROLINA		CAMP GEORGE, NORTH CAROLINA	
GROUNDWATER ELEVATION CONTOUR MAP		GROUNDWATER ELEVATION CONTOUR MAP		GROUNDWATER ELEVATION CONTOUR MAP	
DRAWN BY		JCL		APPROVED BY	
CHECKED BY		BY		APPROVED BY	
PROJECT NO. 843823		PROJECT NO. 843823		PROJECT NO. 843823	
REVISIONS		REVISIONS		REVISIONS	

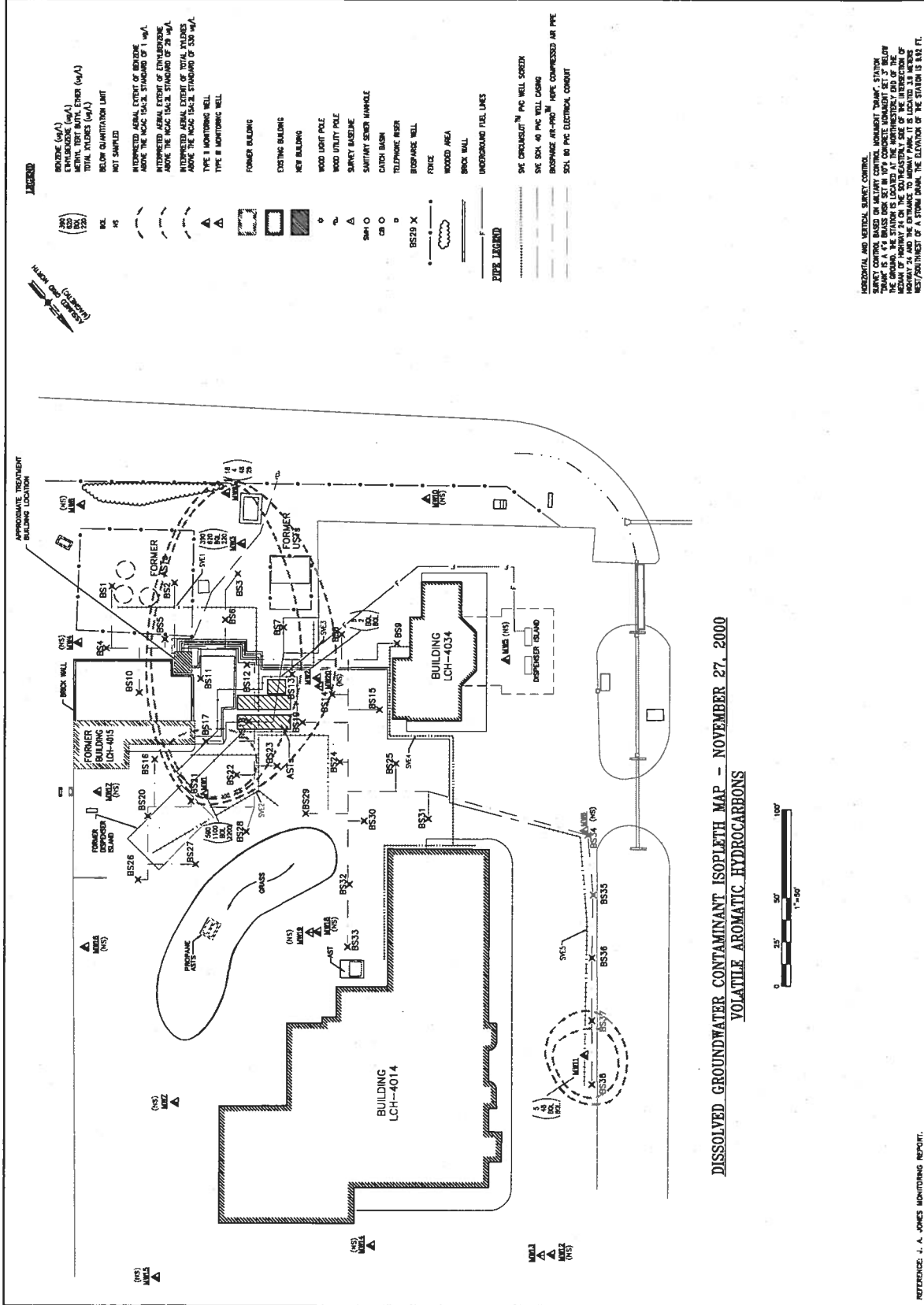
ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND MONROVIA, VIRGINIA		PROJECT NO. 4015-FIG2-3	
BUILDING LCH-4015 CAMP GEIGER, NORTH CAROLINA GROUNDWATER ELEVATION CONTOUR MAP MAY 23, 2001		DESIGNED BY JEL CHECKED BY JEL APPROVED BY JEL	
REVISIONS DESCRIPTION/DATE		REV. DATE BY CHK'D BY DATE 1 11/10/00 JEL JEL 11/10/00 2 05/23/01 JEL JEL 05/23/01	



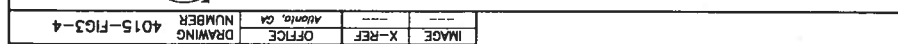
DRAWING NUMBER 4015-FIG2-3	OFFICE Atlanta, GA	IMAGE X-REF	PLOT DATE: 10/04/03 PLOTTER: J. A. JONES
-------------------------------	-----------------------	----------------	---

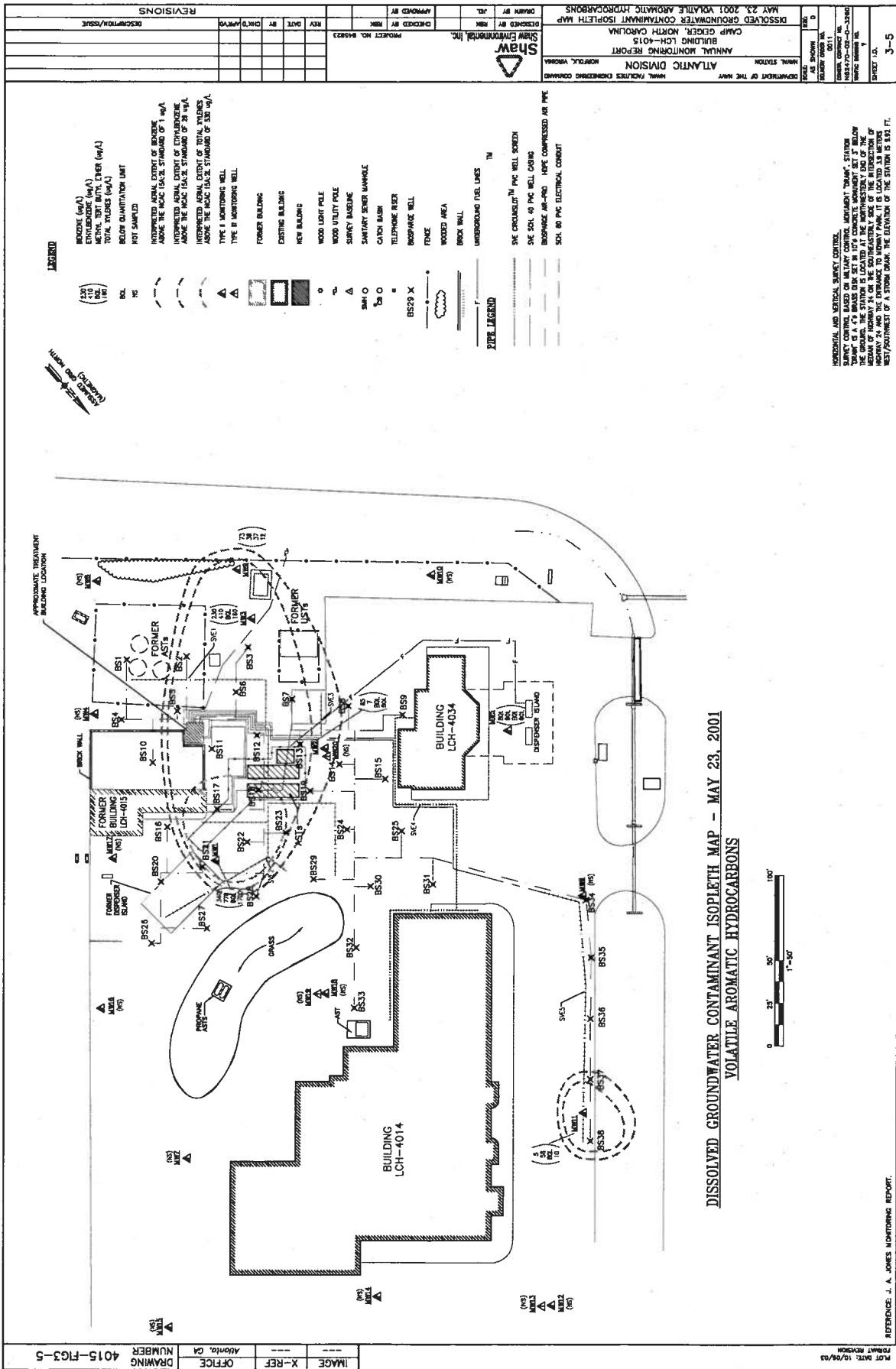


ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NAUTICAL VESSEL		SHAW SHAW STEERING EQUIPMENT, INC. PROJECT NO. 845823		DESIGNED BY: RNR CHECKED BY: RNR DRAWING BY: JLT		DISSESSED GROUNDWATER CONTAMINANT ISOPETH MAP NOVEMBER 27, 2000 VOLATILE AROMATIC HYDROCARBONS	
ANALYTICAL MONITORING REPORT BUILDING ICH-4015 CAMP GREEN, NORTH CAROLINA		ANALYST: [] DATE: []		TITLE: [] SCALE: []		SHEET: [] OF: []	
REVISIONS DESCRIPTION/REVISION		RNY DATE BY CDR'S NAME		PROJECT NO. 845823		DISSESSED GROUNDWATER CONTAMINANT ISOPETH MAP NOVEMBER 27, 2000 VOLATILE AROMATIC HYDROCARBONS	







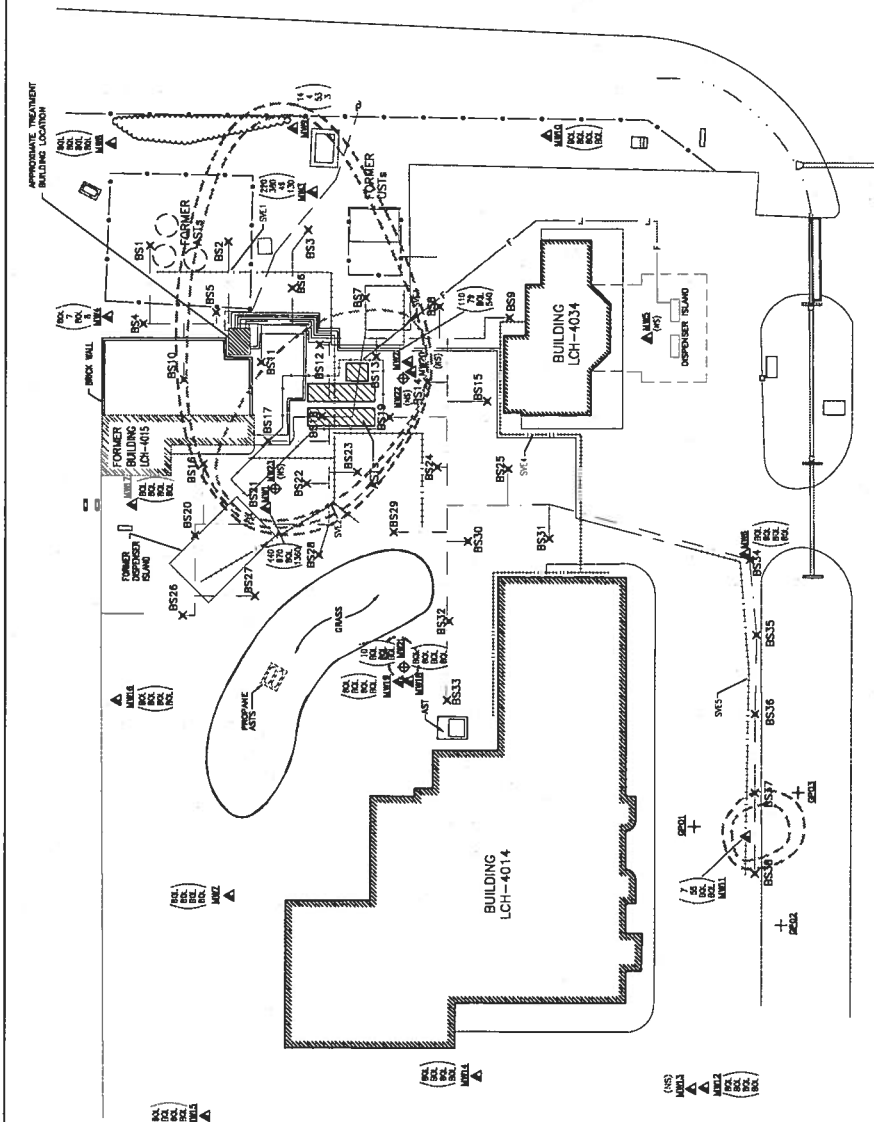


DISSOLVED GROUNDWATER CONTAMINANT ISOPLETH MAP - MAY 23, 2001
VOLATILE AROMATIC HYDROCARBONS



REFERENCE: J. A. JONES MONITORING REPORT.

IMAGE	X-REF	OFFICE	DRAWING NUMBER
---	---	Atlanta, GA	4015-FG3-7



DISSOLVED GROUNDWATER CONTAMINANT ISOPLETH MAP - AUGUST 14, 2001
VOLATILE AROMATIC HYDROCARBONS



HORIZONTAL AND VERTICAL SURVEY CONTROL. SURVEY CONTROL, BASED ON MILITARY CONTROL MONUMENT "DRAIN", STATION "DRAIN" IS A 4" BRASS DISK SET IN 10" CONCRETE MONUMENT SET 3" BELOW THE GROUND. THE STATION IS LOCATED AT THE NORTHWESTLY END OF THE MEDIAN OF HIGHWAY 24 ON THE SOUTHEASTLY SIDE OF THE INTERSECTION OF HIGHWAY 24 AND THE ENTRANCE TO MINNY PARK. IT IS LOCATED 3.0 METERS WEST-SOUTHWEST OF A STORM DRAIN. THE ELEVATION OF THE STATION IS 9.52 FT.

[illegible]

APPENDIX A

WELL CONSTRUCTION RECORDS

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone(919)733-3221

WELL CONSTRUCTION RECORD

MW-21

DRILLING CONTRACTOR: MANN DRILLING CO.DRILLER REGISTRATION NUMBER: 2156STATE WELL CONSTRUCTION
PERMIT NUMBER: _____

FOR OFFICE USE ONLY

QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent _____ GW-1 Ent. _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: CAMP LEJEUNE County: ONSLOW

BLDG 4015 MIDWAY PARK

(Road Community, or Subdivision and Lot No.)

2. OWNER COMMANDING GENERALADDRESS AC'S,EMD,MCB PSC BOX 20004

(Street or Route No.)

CAMP LEJEUNE NC 28542-0004

City or Town State Zip Code

3. DATE DRILLED 6/6/01 USE OF WELL: MONITOR4. TOTAL DEPTH 31.5'5. CUTTINGS COLLECTED YES ☒ NO ☐6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS -5 FT. Above Land Surface**Casing terminated at or below land surface is illegal unless a variance is issued
in accordance with 15A NCAC 2C.01

9. YIELD (gpm) _____ METHOD OF TEST _____

10. WATER ZONES (depth): _____

11. CHLORINATION: Type _____ Amount _____

12. CASING:

Depth		Diameter		Wall Thickness	Material
From	To	Ft	In.	or Weight/Ft.	
From <u>-5</u>	To <u>24</u>	Ft <u>4</u>		<u>SCD 40'</u>	<u>PVC</u>
From <u>-5</u>	To <u>31.5</u>	Ft <u>2</u>		<u>SCD 40'</u>	<u>PVC</u>
From _____	To _____	Ft _____		_____	_____

13. GROUT:

Depth		Material	Method
From	To	Ft.	
From <u>5</u>	To <u>23</u>	Ft. <u>CEMENT</u>	<u>TREMIE</u>
From <u>23</u>	To <u>25</u>	Ft. <u>BENTONITE</u>	<u>HAND</u>

14. SCREEN:

Depth		Diameter	Slot Size	Material
From	To	Ft	in.	
From <u>26.5</u>	To <u>31.5</u>	Ft <u>2</u>	in. <u>.01</u>	<u>C-SLOT PVC</u>
From _____	To _____	Ft _____	in. _____	_____
From _____	To _____	Ft _____	in. _____	_____

15. SAND/GRAVEL PACK:

Depth		Size	Material
From	To	Ft.	
From <u>25</u>	To <u>31.5</u>	Ft. <u>#2</u>	<u>SAND</u>
From _____	To _____	Ft _____	_____

16. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL
CONSTRUCTION STANDARDS. AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT

Submit original to Division of Environmental Management and copy to well owner.

DATE

6-12-01

North Carolina - Department of Environment, Health, and Natural Resources
 Division of Environmental Management - Groundwater Section
 P.O. Box 29535 - Raleigh, N.C. 27626-0535
 Phone(919)733-3221

WELL CONSTRUCTION RECORD

MW-22

DRILLING CONTRACTOR: MANN DRILLING CO.

STATE WELL CONSTRUCTION

DRILLER REGISTRATION NUMBER: 2156

PERMIT NUMBER: _____

FOR OFFICE USE ONLY

QUAD. NO. _____ SERIAL NO. _____
 Lat. _____ Long. _____ RO _____
 Minor Basin _____
 Basin Code _____
 Header Ent _____ GW-1 Ent. _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: CAMP LEJEUNE County: ONSLOWBLDG 4015 MIDWAY PARK

(Road Community, or Subdivision and Lot No.)

2. OWNER

COMMANDING GENERAL

ADDRESS

AC/S,EMD,MCB PSC BOX 20004

(Street or Route No.)

CAMP LEJEUNENC28542-0004

City or Town

State

Zip Code

3. DATE DRILLED 6/7/01USE OF WELL: MONITOR

4. TOTAL DEPTH

32'5. CUTTINGS COLLECTED YES ☒ NO ☐6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS -5 FT. Above Land Surface*

*Casing Terminated at or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C.01s

9. YIELD (gpm) _____ METHOD OF TEST _____

10. WATER ZONES (depth): _____

11. CHLORINATION: Type _____ Amount _____

12. CASING:

		Depth		Diameter		Wall Thickness	Material
From	To	Ft	Ft			or Weight/Ft.	
From <u>-5</u>	To <u>24</u>	Ft	<u>4</u>			<u>SCD 40</u>	<u>PVC</u>
From <u>-5</u>	To <u>27</u>	Ft	<u>2</u>			<u>SCD 40</u>	<u>PVC</u>
From _____	To _____	Ft					

13. GROUT:

		Depth	Material	Method
From	To	Ft.		
From <u>5</u>	To <u>23</u>	Ft.	<u>CEMENT</u>	<u>TREMIE</u>
From <u>23</u>	To <u>25</u>	Ft.	<u>BENTONITE</u>	<u>HAND</u>

14. SCREEN:

		Depth	Diameter	Slot Size	Material
From	To	Ft	in.	in.	
From <u>27</u>	To <u>32</u>	Ft	<u>2</u>	<u>.01</u>	<u>C-SLOT PVC</u>
From _____	To _____	Ft.	in.	in.	
From _____	To _____	Ft.	in.	in.	

15. SAND/GRAVEL PACK:

		Depth	Size	Material
From	To	Ft.		
From <u>25</u>	To <u>32</u>	Ft.	<u>#2</u>	<u>SAND</u>
From _____	To _____	Ft.		

16. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL CONSTRUCTION STANDARDS. AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT

Submit original to Division of Environmental Management and copy to well owner.

DATE

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

WELL CONSTRUCTION RECORD

MW-23

DRILLING CONTRACTOR: **MANN DRILLING CO.**

FOR OFFICE USE ONLY			
QUAD. NO.	SERIAL NO.		
Lat.	Long.	RO	
Minor Basin			
Basin Code			
Header Ent		GW-1 Ent.	

DRILLER REGISTRATION NUMBER: 2156 STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)Nearest Town: CAMP LEJEUNE County: ONSLOW

BLDG 4015 MIDWAY PARK

(Road Community, or Subdivision and Lot No.)

2. OWNER COMMANDING GENERALADDRESS AC/S,EMD,MCB PSC BOX 20004

(Street or Route No.)

CAMP LEJEUNE NC 28542-0004

City or Town

State

Zip Code

3. DATE DRILLED 6/6/01 USE OF WELL: MONITOR4. TOTAL DEPTH 32'5. CUTTINGS COLLECTED YES ☒ NO ☐6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS -.5 FT. Above Land Surface*

*Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .015

9. YIELD (gpm) _____ METHOD OF TEST _____

10. WATER ZONES (depth): _____

11. CHLORINATION: Type _____ Amount _____

12. CASING:

From	Depth	To	Diameter	Wall Thickness or Weight/Ft.	Material
<u>-.5</u>	<u>24</u>	<u>4</u>	<u>4</u>	<u>SCD 40</u>	<u>PVC</u>
<u>-.5</u>	<u>27</u>	<u>2</u>	<u>2</u>	<u>SCD 40</u>	<u>PVC</u>
_____	_____	_____	_____	_____	_____

13. GROUT:

From	Depth	To	Ft.	Material	Method
<u>5</u>	<u>23</u>	<u>23</u>	<u>23</u>	<u>CEMENT</u>	<u>TREMIE</u>
<u>23</u>	<u>25</u>	<u>25</u>	<u>25</u>	<u>BENTONITE</u>	<u>HAND</u>

14. SCREEN:

From	Depth	To	Diameter	Slot Size	Material
<u>27</u>	<u>32</u>	<u>2</u>	<u>2</u>	<u>.01</u>	<u>C-SLOT PVC</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

15. SAND/GRAVEL PACK:

From	Depth	To	Ft.	Size	Material
<u>25</u>	<u>32</u>	<u>2</u>	<u>2</u>	<u>#2</u>	<u>SAND</u>
_____	_____	_____	_____	_____	_____

16. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT

Submit original to Division of Environmental Management and copy to well owner.

DATE

6-12-01

APPENDIX B

AFVR RESULTS

AFVR
Building LCH-4015
AFVR Event - August 30, 2000

Date: August 30, 2000
Diameter of Exhaust Pipe: 4 inches
Vacuum at the Blower (in. of Hg): 26

Vacuum Applied to Recovery/Monitoring Well(s)	Well Vacuum (in. of Hg)	Start Time	Stop Time	Duration (hours)
MW-11		7:30	14:30	7.00

Time Duration And Actual Time Since Start of Vacuum Applied to Recovery/Monitoring Well(s):	Temperature (°F)	Relative Humidity (%)	Velocity (ft/min)	FID Reading (ppm)
Initial - 7:30	142.7	33.9	2576	58.53
15 minutes - 7:45	141.6	41.3	4438	52.08
30 minutes - 8:00	136.9	33.4	6208	21.12
45 minutes - 8:15	131.0	38.2	4626	48.21
1 hour - 8:30	139.4	32.9	4208	42.51
1 hour 15 minutes - 8:45	128.2	38.2	3821	44.96
1 hour 30 minutes - 9:00	160.7	8.9	4446	41.65
1 hour 45 minutes - 9:15	144.3	18.6	4828	46.25
2 hours - 9:30	142.1	17.8	4723	45.21
2 hour 30 minutes - 10:00	149.8	18.9	4483	58.35
3 hours - 10:30	147.7	16.7	3874	57.82
3 hours 30 minutes - 11:00	141.2	18.6	4124	58.61
4 hours - 11:30	138.7	13.9	3850	38.20
4 hours 30 minutes - 12:00	169.0	0.0	4581	40.46
5 hours - 12:30	170.8	22.1	4878	45.95
5 hours 30 minutes - 13:00	180.5	0.0	4849	45.46
6 hours - 13:30	190.4	0.0	3415	51.09
6 hours 30 minutes - 14:00	197.3	0.0	3615	68.41
7 hours - 14:30	191.0	0.0	3248	51.95
Average	154.9	18.6	4252.2	48.3

Recovery Well	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)
MW1	29.78		3.62	26.16
MW2	29.24		1.48	27.76
MW3	32.02		4.75	27.27
MW4	32.68		5.20	27.48
MW5	29.35		1.80	27.55
MW6	29.11		2.80	26.31
MW7	29.67		2.30	27.37
MW8	28.79		2.20	26.59
MW9	28.35		1.62	26.73
MW10	28.28		1.02	27.26
MW11	29.18		6.45	22.73
MW12	29.23		4.6	24.63
MW14	29.45		4.05	25.4
MW15	29.26		4.26	25
MW16	29.62		1.2	28.42
MW17	29.76		1.7	28.06
MW18	29.86		1.02	28.84
MW19	29.98		26.35	3.63
MW20	29.16		25.7	3.46

Notes:
ft = feet
toc = top of casing elevation
msl = mean sea level

**AFVR
LCH-4015
AFVR Event - August 30, 2000**

AFVR Event - Vacuum Applied to Recovery and Monitoring Wells/Calculated Parameters	MW-11
Time Duration (hours)	7.00
Average Temperature ($^{\circ}\text{F}$)	154.9
Average Relative Humidity (%)	18.6
Average Velocity (ft/min)	4252
Average FID Reading (ppm)	48
B_{WSW} (lb. water/lb. dry air)	0.0359
B_{WS} (water vapor % by volume)	0.0544
Stack Pipe Cross Sectional Area (ft^2)	0.087
T_{S} Stack Temperature ($^{\circ}\text{R}$)	614.9
Q_{std} (flow at DSCRM)	301.4
PPM_{W} (wet concentration=measured concentration)	48
PPM_{d} (dry concentration)	51
PPM_{c} (PPM_{v} , volumetric concentration of VOC emissions as carbon, dry basis at STP)	51
C_{cm} (mg/dsm^3 , mass concentration of VOC emissions as carbon)	25
C_{c} (lb/dscf , mass concentration of VOC emissions as carbon, dry basis, at STP)	0.000002
PMR_{c} (lb/hr , pollutant mass removal rate of VOCs as carbon)	0.03
$\text{PMR}_{\text{gas/diesel}}$ (lb/hr , pollutant mass removal rate of VOCs as Gasoline and Diesel Fuel)	0.03
$\text{PMR}_{\text{gas/diesel}}$ (lbs, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.22
$\text{PMR}_{\text{gas/diesel}}$ (gals, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.03
Total Gallons of Pollutant Volume Removal of VOCs as Gasoline and Diesel Fuel	0.03
Gallons of LNAPL Removed as Gasoline and Diesel Fuel from August 30, 2000 AFVR Event	1.00
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel from August 30, 2000 AFVR Event	1.03
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel Since Initiation of AFVR Activites August 30, 2000	1.03

AFVR
Building LCH-4015
AFVR Event - November 21, 2000

Date: November 21, 2000
Diameter of Exhaust Pipe: 4 inches
Vacuum at the Blower (in. of Hg): 26.5

Vacuum Applied to Recovery/Monitoring Well(s)	Well Vacuum (in. of Hg)	Start Time	Stop Time	Duration (hours)
MW-11	27	8:00	15:00	7.00

Time Duration And Actual Time Since Start of Vacuum Applied to Recovery/Monitoring Well(s):	Temperature (^o F)	Relative Humidity (%)	Velocity (ft/min)	FID Reading (ppm)
Initial - 8:00	123.5	14.7	4146	125
15 minutes - 8:15	117.4	14.6	3755	98.85
30 minutes - 8:30	138.7	18.6	4818	136
45 minutes - 8:45	148.6	9.2	4216	166
1 hour - 9:00	137.2	12.4	3958	296
1 hour 15 minutes - 9:15	156.2	15.1	4451	210
1 hour 30 minutes - 9:30	166.1	4.4	2371	216
1 hour 45 minutes - 9:45	178.2	3.2	3759	208
2 hours - 10:00	154.4	12.1	4163	198
2 hour 30 minutes - 10:30	162.1	10.8	3806	175
3 hours - 11:00	160.8	2.6	4744	158
3 hours 30 minutes - 11:30	161.8	5.8	4919	156
4 hours - 12:00	150.3	6.8	5489	147
4 hours 30 minutes - 12:30	152.3	6.9	5300	147
5 hours - 13:00	160.4	5.4	5540	136
5 hours 30 minutes - 13:30	155.7	0.0	3010	131
6 hours - 14:00	146.9	0.0	4864	112
6 hours 30 minutes - 14:30	154.5	4.6	3989	123
7 hours - 15:00	159.7	1.5	4291	119
Average	151.8	7.8	4294.2	160.94

Recovery Well	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)
MW1	29.78		4.75	25.03
MW2	29.24		2.82	26.42
MW3	32.02		5.94	26.08
MW4	32.68		6.72	25.96
MW5	29.35			
MW6	29.11		3.72	25.39
MW7	29.67		3.32	26.35
MW8	28.79		2.96	25.83
MW9	28.35		2047	-2018.65
MW10	28.28		1.36	26.92
MW11	29.18	5.33	5.35	23.83
MW12	29.23		5.59	23.64
MW14	29.45		4.98	24.47
MW15	29.26		4.96	24.3
MW16	29.62		2.23	27.39
MW17	29.76		2.81	26.95
MW18	29.86		2.9	26.96
MW19	29.98		24.95	5.03
MW20	29.16		24.01	5.15

Notes:
ft = feet
toc = top of casing elevation
msl = mean sea level

**AFVR
LCH-4015
AFVR Event - November 21, 2000**

AFVR Event - Vacuum Applied to Recovery and Monitoring Wells/Calculated Parameters	MW-11
Time Duration (hours)	7.00
Average Temperature (°F)	151.9
Average Relative Humidity (%)	7.8
Average Velocity (ft/min)	4294
Average FID Reading (ppm)	161
B _{WSW} (lb. water/lb. dry air)	0.0128
B _{WS} (water vapor % by volume)	0.0201
Stack Pipe Cross Sectional Area (ft ²)	0.087
T _S Stack Temperature (°R)	611.9
Q _{std} (flow at DSCRM)	317.0
PPM _w (wet concentration=measured concentration)	161
PPM _d (dry concentration)	164
PPM _c (PPM _v , volumetric concentration of VOC emissions as carbon, dry basis at STP)	164
C _{cm} (mg/dsm ³ , mass concentration of VOC emissions as carbon)	82
C _c (lb/dscf, mass concentration of VOC emissions as carbon, dry basis, at STP)	0.000005
PMR _c (lb/hr, pollutant mass removal rate of VOCs as carbon)	0.10
PMR _{gas/diesel} (lb/hr, pollutant mass removal rate of VOCs as Gasoline and Diesel Fuel)	0.11
PMR _{gas/diesel} (lbs, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.74
PMR _{gas/diesel} (gals, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.11
Total Gallons of Pollutant Volume Removal of VOCs as Gasoline and Diesel Fuel	0.11
Gallons of LNAPL Removed as Gasoline and Diesel Fuel from November 21, 2000 AFVR Event	0.50
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel from November 21, 2000 AFVR Event	0.61
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel Since Initiation of AFVR Activites August 30, 2000	1.64

AFVR
Building LCH-4015
AFVR Event - April 27, 2001

Date: April 27, 2001

Diameter of Exhaust Pipe: 6 inches

Vacuum at the Blower (in. of Hg): 27

Vacuum Applied to Recovery/Monitoring Well(s)	Well Vacuum (in. of Hg)	Start Time	Stop Time	Duration (hours)
MW-11	27	8:00	12:30	4.50

Time Duration And Actual Time Since Start of Vacuum Applied to Recovery/Monitoring Well(s):	Temperature (°F)	Relative Humidity (%)	Velocity (ft/min)	FID Reading (ppm)
Initial - 8:00	165.4	2.7	8604	18.68
15 minutes - 8:15	168.2	1.8	9602	7.28
30 minutes - 8:30	165.8	3.2	8201	5.21
45 minutes - 8:45	165.4	2.7	7604	5.59
1 hour - 9:00	164.4	3.6	8624	3.24
1 hour 15 minutes - 9:15	178.2	2.4	9834	2.61
1 hour 30 minutes - 9:30	172.8	1.8	9732	2.48
1 hour 45 minutes - 9:45	175.7	1.7	10694	2.41
2 hours - 10:00	168.7	3.2	13367	1.34
2 hour 30 minutes - 10:30	187.3	1.7	11395	1.16
3 hours - 11:00	186.4	1.9	12862	1.01
3 hours 30 minutes - 11:30	174.6	1.8	13418	1.21
4 hours - 12:00	179.1	1.4	9605	1.21
4 hours 30 minutes - 12:30	184.3	1.4	8519	1.21
Average	174.0	2.2	10147.2	3.9

Recovery Well	Top of Casing Elevation (ft., msl)	Depth to Hydrocarbon Product (ft. below toc)	Depth to Groundwater (ft. below toc)	Groundwater Elevation (ft., msl)
MW1	29.78		3.90	25.88
MW2	29.24		2.12	27.12
MW3	32.02		5.39	26.63
MW4	32.68		6.15	26.53
MW5	29.35		2.50	26.85
MW6	29.11		2.93	26.18
MW7	29.67		1.68	27.99
MW8	28.79		2.69	26.10
MW9	28.35		0.00	28.35
MW10	28.28		0.00	28.28
MW11	29.18	4.62	5.86	23.32
MW12	29.23		3.86	25.37
MW14	29.45		4.00	25.45
MW15	29.26		4.42	24.84
MW16	29.62		2.53	27.09
MW17	29.76		2.34	27.42
MW18	29.86		0.95	28.91
MW19	29.98		25.25	4.73
MW20	29.16		24.56	4.60

Notes:

ft = feet

toc = top of casing elevation

msl = mean sea level

**AFVR
LCH-4015
AFVR Event - April 27, 2001**

AFVR Event - Vacuum Applied to Recovery and Monitoring Wells/Calculated Parameters	MW-11
Time Duration (hours)	4.50
Average Temperature ($^{\circ}$ F)	174.0
Average Relative Humidity (%)	2.2
Average Velocity (ft/min)	10147
Average FID Reading (ppm)	4
B _{WSW} (lb. water/lb. dry air)	0.0062
B _{WS} (water vapor % by volume)	0.0098
Stack Pipe Cross Sectional Area (ft ²)	0.196
T _S Stack Temperature ($^{\circ}$ R)	634.0
Q _{std} (flow at DSCRM)	1640.0
PPM _w (wet concentration=measured concentration)	4
PPM _d (dry concentration)	4
PPM _c (PPM _v , volumetric concentration of VOC emissions as carbon, dry basis at STP)	4
C _{cm} (mg/dsm ³ , mass concentration of VOC emissions as carbon)	2
C _c (lb/dscf, mass concentration of VOC emissions as carbon, dry basis, at STP)	0.000000
PMR _c (lb/hr, pollutant mass removal rate of VOCs as carbon)	0.01
PMR _{gas/diesel} (lb/hr, pollutant mass removal rate of VOCs as Gasoline and Diesel Fuel)	0.01
PMR _{gas/diesel} (lbs, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.06
PMR _{gas/diesel} (gals, total pollutant mass removal of VOCs as Gasoline and Diesel Fuel)	0.01
Total Gallons of Pollutant Volume Removal of VOCs as Gasoline and Diesel Fuel	0.01
Gallons of LNAPL Removed as Gasoline and Diesel Fuel from April 27, 2001 AFVR Event	0.00
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel from April 27, 2001 AFVR Event	0.01
Total Gallons of Pollutant Removed as Gasoline and Diesel Fuel Since Initiation of AFVR Activites August 30, 2000	1.65

APPENDIX C

GROUNDWATER MONITORING WELLS – LABORATORY REPORTS