

**SOIL AND GROUNDWATER SAMPLING
REPORT OF FINDINGS**

FOR

PP-3354

**MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

**NCDENR UST INCIDENT NO. 24015
LAND USE CLASSIFICATION: RESIDENTIAL
RISK CLASSIFICATION: LOW**

MAY 10, 2005

**CONTRACT NO. N62470-01-D-3009
DELIVERY ORDER NO. 0127
CATLIN PROJECT NO. 204-079**



PREPARED BY:

**CATLIN ENGINEERS AND SCIENTISTS
P. O. BOX 10279
WILMINGTON, NORTH CAROLINA 28404-0279
(910) 452-5861**

TABLE OF CONTENTS

	<u>PAGE</u>
LIST OF ACRONYMS	i
A. SITE IDENTIFICATION	1
B. BACKGROUND AND PURPOSE	2
C. METHODS	2
D. RESULTS	3
E. CONCLUSIONS AND RECOMMENDATIONS	4
F. REFERENCES	4

TABLES

TABLE 1A	SUMMARY OF SOIL LABORATORY RESULTS – MADEP EPH/VPH
TABLE 1B	SUMMARY OF SOIL LABORATORY RESULTS – MADEP EPH/VPH AS COMPARED TO THE MSCCS
TABLE 2	SUMMARY OF GROUNDWATER LABORATORY RESULTS – EPA METHOD 602
TABLE 3A	SUMMARY OF GROUNDWATER LABORATORY RESULTS – MADEP EPH/VPH
TABLE 3B	SUMMARY OF GROUNDWATER LABORATORY RESULTS – MADEP EPH/VPH AS COMPARED TO THE 2L GWQS

FIGURES

FIGURE 1	SITE VICINITY MAP
FIGURE 2	PP-3354 SITE PLAN

APPENDICES

APPENDIX A	STANDARD PROCEDURES
APPENDIX B	BORING LOGS
APPENDIX C	LABORATORY ANALYTICAL REPORT AND CHAIN OF CUSTODY DOCUMENTATION

LIST OF ACRONYMS

2001 Guidelines	Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section (Effective July 1, 2001)
2L GWQS	NCAC T15A:02L Groundwater Quality Standards
AMS	Art's Manufacturing and Supply
AST	Aboveground Storage Tank
BQL	Below Quantitation Limit
BLS	Below Land Surface
CATLIN	CATLIN Engineers and Scientists (Formerly RC&A)
CFR	Code of Federal Regulations
CSA	Comprehensive Site Assessment
DEM	Division of Environmental Management
DIPE	Diisopropyl Ether
DOD	Department of Defense
DPT	Direct Push Technology
DWQ	Division of Water Quality
DWM	Division of Waste Management
DTW	Depth to Water
EAD	Environmental Affairs Department
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
EQB	Environmental Quality Branch
FID	Flame Ionization Detector
FOD	Foreign Object Debris
FT	Feet
GCL	Gross Contaminant Level
GIS	Geographic Information System
GPS	Global Positioning System
I/C	Industrial/Commercial
ID	Identification
I&E	Installations and Environment Department
IGWQS	Interim Groundwater Quality Standards
IPE	Isopropyl Ether
LSA	Limited Site Assessment
LUST	Leaking Underground Storage Tank
MADEP	Massachusetts Department of Environmental Protection
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps Outlying Landing Field
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Litre

MSCC	Maximum Soil Contaminant Concentration
MTBE	Methyl tertiary butyl ether
ug/Kg	Micrograms per Kilogram
ug/L	Micrograms per Litre
NA	Not Analyzed
N/A	Not Applicable
NAVFAC Atlantic	Naval Facilities Atlantic Division
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NE	None Established
NM	Not Measured
NMT	No Measurable Thickness
NS	Not Sampled
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbons
PPB	Parts Per Billion
PPM	Parts Per Million
PID	Photo Ionization Detector
PQL	Practical Quantitation Limits
PVC	Polyvinyl chloride
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
Res	Residential
SOW	Scope of Work
STGW	Soil-to-Groundwater
SVOC	Semi Volatile Organic Compound
TDHF	Toxicologically Defined Hydrocarbons Fractions
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
US	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WiRO	Wilmington Regional Office

A. SITE IDENTIFICATION

DATE OF REPORT: January 25, 2005
Facility ID: N/A UST Incident Number (if known): 24015
Land Use Classification: Residential Risk Classification: Low
Site Name: PP-3354
Site Location: 3354 Jones Street, MCB, Camp Lejeune (See Figure 1)
Nearest City/Town: Jacksonville County: Onslow

UST Owner: Commanding General – MCB Camp Lejeune
I&E/EMD/EQB
Address: PSC 20004
MCB Camp Lejeune, NC 28542 Phone: (910) 451-5068

UST Operator: Same as above
Address: Same as above Phone: Same as above

Property Owner: Same as above
Address: Same as above Phone: Same as above

Property Occupant: Military personnel and family
Address: 3354 Jones St., MCB, Camp Lejeune, Jacksonville, NC Phone: Unknown

Consultant/Contractor: CATLIN Engineers and Scientists
Address: 220 Old Dairy Road, Wilmington, North Carolina 28405 Phone: (910) 452-5861

Release Information

Date Discovered: September 6, 2001

Longitude: 77.3676 W Latitude: 34.6851 N

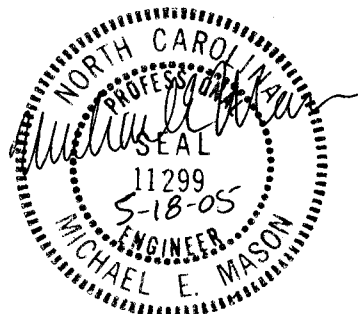
Estimated Quantity of Release: Unknown

Cause of Release: Unknown

Source of Release (e.g. Piping/UST):
Possible leaking UST and/or associated piping

Sizes and contents of UST system(s) from which the release occurred:
Non-regulated, non-commercial, 285-gallon fuel oil UST used for heating a single-family residence

I, Michael E. Mason a Professional Engineer Licensed Geologist (circle one) for
CATLIN Engineers and Scientists, do certify that the information contained in this report is correct and
accurate to the best of my knowledge.



(Please Affix Seal and Signature)

B. BACKGROUND AND PURPOSE

(Refer to Figure 2)

On September 6, 2001, J.A. Jones Environmental Services Company (J.A. Jones) of Charlotte, North Carolina performed UST excavation operations and removed one 285-gallon, non-regulated, non-commercial fuel oil UST from the site (see Figure 2). The fuel oil tank was utilized strictly for heating purposes of a single-family residence. Soil samples obtained from the UST basin during tank removal revealed several target compounds and petroleum hydrocarbon fractions at concentrations above the Soil-to-Groundwater MSCCs, with one petroleum hydrocarbon fraction (C₉-C₂₂ Aromatics) at concentrations above the Residential MSCCs in two excavation sidewall samples.

In July 2002, CATLIN conducted field work and sampling required by NCDENR for a Phase I LSA. One soil sample and one groundwater sample were collected for laboratory analysis from a temporary boring/well. The soil sample was collected from beneath the former product line location. The soil sample results did not reveal any concentrations above the laboratory PQLs. A groundwater sample collected from the temporary monitoring well USTPP3354-TW01 installed in the former UST basin area revealed naphthalene and C₉-C₁₈ aliphatics above the 2L GWQSs. The Phase I LSA Report dated November 29, 2002 concluded the site may be considered for No Further Action.

The site meets the criteria for Low Risk and Residential Land Use. Based on historical soil and groundwater sample results, the site is eligible for “No Further Action” status with issuance of a Notice of Residual Petroleum or Land Use Restriction for soil and groundwater.

The purpose of this investigation was to resample the soil identified in excess of the Residential MSCC and groundwater in excess of the 2L GWQS in order to determine if soil and groundwater contaminant concentrations had naturally attenuated below the applicable MSCCs and 2L GWQSs. If so, the site would be eligible for No Further Action Status without Land Use Restrictions.

C. METHODS

1. Field Methods

(Refer to Figure 2 and Appendices A, B, and C)

All field work was conducted in general accordance with CATLIN’s Standard Procedures provided in Appendix A. CATLIN personnel gathered subsurface soil data by Direct Push Technology boring advancement using an AMS PowerProbe™ 9600D (PowerProbe) on November 3, 2004. When using the PowerProbe, the borings are advanced to depth by static force and a 90-pound hydraulic percussion hammer. Two and one-quarter inch diameter by four-foot length steel is used as casing. Soil samples are continuously collected in one and one-half inch clear liners. Liners are removed from the casing and then cut in half longitudinally to allow for visual/manual classification by the USCS and organic vapor analysis utilizing a FID. A boring log for the USTPP3354-DPT01, USTPP3354-SB02, and USTPP3354-SB03 borings are provided in Appendix B. The boring locations are illustrated on Figure 2

Well materials were installed at the USTPP3354-DPT01 boring in an attempt to determine accurate water table measurements and facilitate groundwater sampling. The well was constructed with 1.25-inch slotted PVC well screen.

The depth to water was measured and a grab groundwater sample was collected. The sample was collected on November 3, 2004 utilizing a peristaltic pump and new polyethylene tubing. The groundwater sample was labeled USTPP3354-DPT01 and the sample location is illustrated on Figure 2.

Soil samples were collected on November 3, 2004 from borings USTPP3354-SB02 and USTPP3354-SB03 at three to four feet BLS, which is at the locations of previously revealed C₉-C₂₂ aromatics concentrations above the Residential MSCCs. The samples were labeled USTPP3354-SB02(3-4') and USTPP3354-SB03(3-4') and the sample locations are illustrated on Figure 2.

New disposable nitrile gloves were worn during sampling activities. All samples were placed into the appropriately labeled glassware and packed on ice in an insulated cooler for transportation to the laboratory. Sample integrity was maintained by following proper chain of custody procedures. A copy of the Chain of Custody is provided following the complete laboratory report in Appendix C.

Boreholes were abandoned to the surface using three-eighth inch bentonite chips. Bentonite and water were poured into the borehole simultaneously to facilitate hydration.

2. Analytical Methods

Samples were transported to Paradigm Analytical Laboratories, Inc. (NC Certification #481) in Wilmington, North Carolina. At the laboratory, the groundwater sample was analyzed for the presence of naphthalene per EPA Method 602 and per MADEP EPH and VPH. The soil sample was analyzed per MADEP EPH and VPH.

D. RESULTS

(Refer to Tables 1A, 1B, 2, 3A, and 3B, and Appendices B and C)

Field observations noted during soil boring advancement indicate site geology comprised of very fine to fine sands with some silts and clays to 12 feet. Damp soils were encountered during boring USTPP3354-DPT01 advancement at approximately 5.5 feet BLS. Saturated soils were noted at eight feet BLS. Boring logs for the soil borings including organic vapor screening results are included in Appendix B. The depth to groundwater as measured on November 3, 2004 in the temporary well USTPP3354-DPT01 was approximately 4.9 feet BLS.

The complete laboratory analytical report is included in Appendix C. The soil sample USTPP3354-SB03(3-4') collected in the area of historical C₉-C₂₂ aromatics contamination revealed the C₉-C₂₂ aromatics hydrocarbon chain concentration above the Residential MSCCs. The soil sample USTPP3354-SB02(3-4'), also collected in an area of historical C₉-C₂₂ aromatics contamination, did not reveal any contaminant concentrations above the Residential MSCCs. Summarized laboratory results are on Tables 1A and 1B.

The naphthalene concentration in the USTPP3354-DPT01 groundwater sample (70.7 ug/L) collected on November 3, 2004 was revealed in excess of the 21 ug/L 2L GWQS. Groundwater sample analysis per MADEP EPH and VPH revealed multiple aromatic and aliphatic hydrocarbon fraction concentrations; however, only the USTPP3354-DPT01 groundwater sample results for the combined hydrocarbon chain C₉-C₂₂ Aromatics (720 ug/L) exceed the 210 ug/L 2L GWQS. Summarized groundwater sample analytical results are on Tables 2, 3A, and 3B.

E. CONCLUSIONS AND RECOMMENDATIONS

The C₉-C₂₂ aromatic concentrations previously detected in the soils around the former UST at PP-3354 have not completely naturally attenuated to below the lowest or Residential MSCC. The naphthalene concentration previously detected in the groundwater around the former UST was detected above the 2L GWQS. The C₉-C₂₂ Aromatics groundwater concentrations historically revealed at PP-3354 have not attenuated below the corresponding 2L GWQS. The current aliphatic and/or aromatic soil and groundwater concentrations and naphthalene groundwater concentrations will prevent the site being granted "No Further Action" status without a Land Use Restriction for soil and groundwater. CATLIN recommends re-sampling soil and groundwater in two years.

F. REFERENCES

CATLIN Engineers and Scientists. *LUST Phase I Limited Site Assessment Report UST PP-3354, MCB Camp Lejeune, NC*, November 29, 2002.

J.A. Jones Environmental Services Company. *Underground Storage Tank Closure Report Marine Corps Base Building CC-3354, MCB Camp Lejeune, NC*, January 24, 2002.

North Carolina Department of Environment and Natural Resources, *Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section* (Effective July 1, 2001).

TABLES

TABLE 1A SUMMARY OF SOIL LABORATORY RESULTS

Date: November 2004

Incident Number and Name:
24015 - PP-3354

Facility ID#: N/A

Analytical Method: MADEP EPH/VPH

Sample ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Date Collected	Sample Depth (ft. BGS)						
USTPP3354-SB02(3-4')	11/3/2004	(3-4')	640	120	54	<10	<10	<10
USTPP3354-SB03(3-4')	11/3/2004	(3-4')	5200	580	1300	<10	19	26

All results are in mg/Kg

TABLE 1B SUMMARY OF SOIL LABORATORY RESULTS

Date: November 2004

Incident Number and Name:
24015 - PP-3354

Facility ID#: N/A

Analytical Method: MADEP EPH/VPH AS COMPARED TO THE MSCCS

Sample ID	Contaminant of Concern →		C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics
	Date Collected	Sample Depth (ft. BGS)				
USTPP3354-SB02(3-4')	11/3/2004	(3-4')	<10	<650	120	<64
USTPP3354-SB03(3-4')	11/3/2004	(3-4')	<10	5,219	580	1,326
Res. MSCC			939	9,386	93,860	469
I/C MSCC			24,528	245,280	Health Based (>100%)	12,264
STGW MSCC			72	3,255	Considered Immobile	34

All results are in mg/Kg

Shaded concentrations exceed the Residential MSCC

TABLE 2 SUMMARY OF GROUNDWATER LABORATORY RESULTS

Date: November 2004

Incident Number and Name:

24015 - PP-3354

Facility ID#: N/A

Analytical Method: EPA METHOD 602

Well ID	Contaminant of Concern →		Naphthalene
	Sample ID	Date Collected	
USTPP3354-DPT01	USTPP3354-DPT01	11/3/2004	70.7
2L GWQS GCL			21 15,500

All results in ug/L

Shaded concentration exceeds the 2L GWQS

TABLE 3A SUMMARY OF GROUNDWATER LABORATORY RESULTS

Date: November 2004

Incident Number and Name:
24015 - PP-3354

Facility ID#: N/A

Analytical Method: MADEP EPH/VPH

Well ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Sample ID	Date Collected						
USTPP3354-DPT01	USTPP3354-DPT01	11/3/2004	1900	340	390	<100	340	330

All results are in ug/L

TABLE 3B SUMMARY OF GROUNDWATER LABORATORY RESULTS

Date: November 2004

Incident Number and Name:
24015 - PP-3354

Facility ID#: N/A

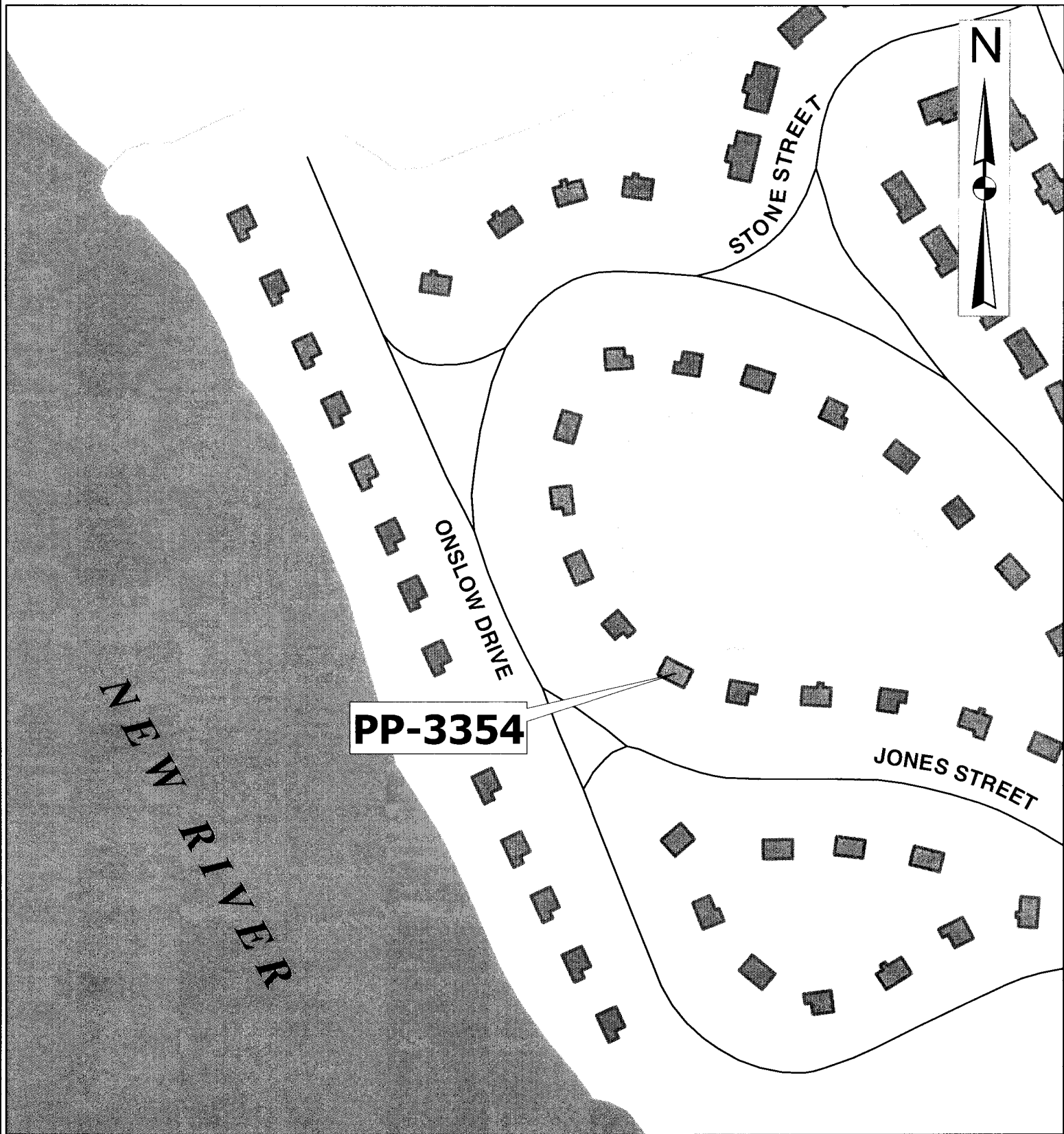
Analytical Method: MADEP EPH/VPH AS COMPARED TO THE 2L GWQS

Well ID	Contaminant of Concern →		C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics
	Sample ID	Date Collected				
USTPP3354-DPT01	USTPP3354-DPT01	11/3/2004	<100	2240	340	720
2L GWQS			420	4200	42,000	210

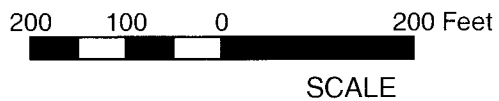
All results in ug/L

Shaded concentration exceeds the 2L GWQS

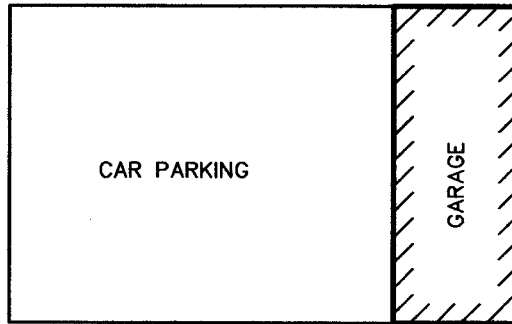
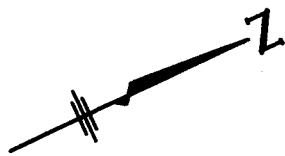
FIGURES



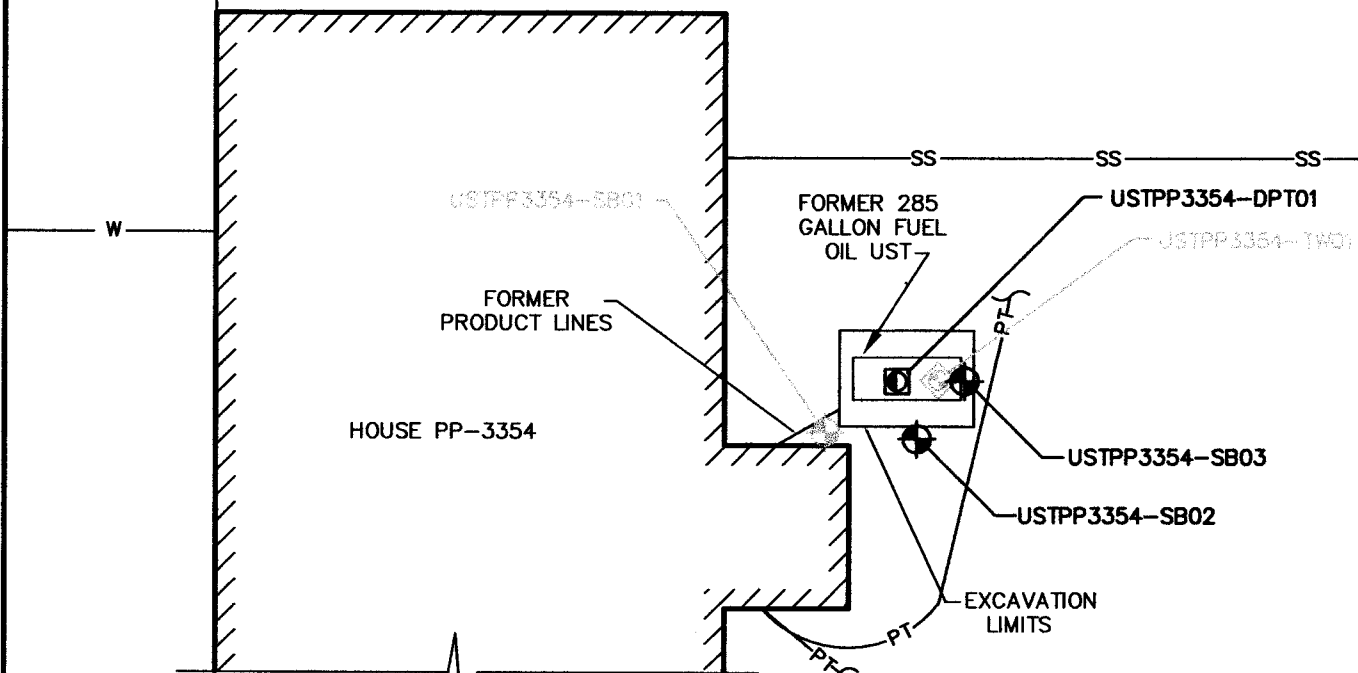
NOTE: All GIS supplied by MCB Camp Lejeune Business and Logistics Support Department



	PROJECT PP-3354 MARINE CORPS BASE CAMP LEJEUNE, NC		TITLE SITE VICINITY MAP		FIGURE 1
	JOB NO. 204-079	DATE JAN 2005	SCALE AS SHOWN	DRAWN BY THW	CHECKED BY BA

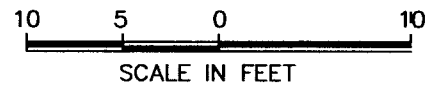


APPROX. 100 FEET TO JONES STREET



LEGEND

PREVIOUS	EXISTING	NEW	DESCRIPTION
			BUILDING
			TEMPORARY WELL
			SOIL BORING AND SOIL SAMPLE
			DPT PROBE AND GROUNDWATER SAMPLE
— SS —			SANITARY SEWER
— W —			WATER LINE
— PT —			UNDERGROUND POWER AND TELEPHONE



NOTE:
1. MAP ADAPTED FROM J.A. JONES

 WILMINGTON, NORTH CAROLINA	PROJECT PP-3354 MARINE CORPS BASE CAMP LEJEUNE, N.C.	TITLE PP-3354 SITE PLAN	FIGURE 2
	JOB NO: 204-079 DATE: DEC 2004	SCALE: 1"=10'	DRAWN BY: WHW CHECKED BY: MEM

APPENDIX A
STANDARD PROCEDURES

CATLIN STANDARD METHODS OF INVESTIGATION

(REVISED APRIL 2002)

1.0 DATA COLLECTION

1.1 BACKGROUND DATA

Background data and history information relevant to the site investigation is generated through numerous sources. These sources may include, but are not limited to, the following:

- Conversations with the client and regulatory officials involved with the incident.
- Review of pertinent regulatory correspondence.
- Review of previous and existing reports and other technical data.
- Review of available historical records.

1.2 SURVEYS AND POTENTIAL RECEPTOR DATA

Physical survey and potential receptor data are collected in accordance with the intended level of investigation. In general, the purpose is to collect sufficient information for site assessment and corrective action planning.

Individual receptors are identified and evaluated in the context of their potential for contaminant impact. Potential receptors of contamination can include surface water bodies, groundwater supply wells, wellhead protection areas, and subsurface building structures.

1.2.1 Horizontal Survey

Horizontal survey data are generated using either accepted general field surveying techniques, or existing survey maps; or by using a combination of existing data and field generated information. The survey area generally extends to a point at least 50 feet beyond suspected plume boundaries. A receptor scale survey of a larger area surrounding a site will be made if appropriate and necessary.

1.2.2 Vertical Survey

A vertical survey is conducted at the site typically within an accuracy of 0.01 foot. The datum plane is generally assumed unless otherwise noted. Assumed temporary benchmarks (TBM) are selected near ground level. The vertical survey includes such points as top of all well casings, selected ground shots, important utility inverts, utility fluid levels, important surface water levels, and other items determined to be significant.

1.3 DRILLING AND MONITORING WELL/PIEZOMETER INSTALLATION

Necessary permits are applied for and obtained in accordance with federal, state, and local requirements prior to drilling or well construction activities. Additionally, the well locations are scanned for underground utilities prior to conducting intrusive subsurface activities. Wells are installed under applicable licensing requirements, and are designed and constructed in accordance with accepted standards and practices. Any wells purposely installed at off-site locations are permitted through appropriate right-of-entry agreements with all necessary property owners and/or their agents.

1.3.1 Drilling Methods and Subsurface Data Collection

Drilling is accomplished utilizing one or more of the following methods:

Auger Drilling

Auger drilling is the preferred, most often used method of subsurface investigation and is accomplished using a vehicle or trailer mounted drill rig. Continuous flight auger types used vary upon the site and situation; ranging from the 4-inch outside diameter solid stem to the 12-inch outside diameter hollow stem. Auger type is selected based upon appropriateness and/or site-specific requirements.

Hand Augering

Hand augering is utilized when economically and scientifically feasible, or when no other method is suitable. Hand augers typically produce three-inch diameter holes and are generally limited to depths of less than 15 feet.

Direct Push

Direct push methods of subsurface investigation are used generally for soil screening purposes or collection of groundwater samples where permanent wells are not viable.

Other Methods

Other drilling methods, such as mud and air rotary, rock coring, cable tool, and large bucket augering are used when site conditions or project requirements dictate.

Regardless of the drilling method used, the drill rig(s) and all drilling tools are thoroughly cleaned between boreholes to prevent cross introduction of contaminants. Split spoon samples are collected and field-described at intervals of five feet or less, and cuttings are continuously monitored for organic vapors. Drill cuttings are containerized for off-site disposal or are spread on the ground surface in proximity to the well or boring in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) requirements. A geologist or engineer, trained in using visual/manual techniques, is always present during drilling and is responsible for subsurface contaminant and geologic data collection. Soils are classified in general agreement with the Unified Soils Classification System (USCS).

1.3.2 Hydropunch Installation

Hydropunch penetrometers (Hydropunches) are used to delineate the spatial extent of dissolved and free phase plumes. Soil borings are advanced to the appropriate depth and then the Hydropunch is advanced through the soil boring into undisturbed material. Groundwater samples are collected by pulling back on the body of the Hydropunch and allowing the groundwater to enter the screened portion of the sample chamber. Samples are retrieved using a decontaminated Teflon bailer or peristaltic pump.

1.3.3 Well Installation

Wells are typically constructed of threaded PVC casing and screen. No glues or cements are used in joining PVC components. Well diameter, slot sizes, and protective covers vary depending upon site-specific conditions or situation-specific requirements.

1.3.4 Well Development

Wells are developed by over-pumping or surging using appropriate pumps, blocks, or bailers. Through development, unwanted fine materials are removed from the natural formation surrounding the well. Well development will be performed no sooner than 24-hours after grouting is completed for the Type III wells. Water generated during development is containerized and properly disposed or is discharged onto the ground in proximity of the well in accordance with NCDENR requirements.

1.4 HYDROGEOLOGIC DATA COLLECTION

Data used to help characterize hydrogeologic conditions at a site are obtained through various procedures including, but not necessarily limited to, those described below:

1.4.1 Regional Geology

Information pertaining to the regional geologic framework is compiled from existing publications, maps, and scientific papers.

1.4.2 Site Geology

Shallow site geology is generally determined from field descriptions and borehole samples. Interpretations with regard to hydrogeologically important contacts, zones, fractures, faults, cleavage, and facies changes are made when possible.

1.4.3 Groundwater Occurrence and Characteristics

Groundwater data is obtained utilizing a number of methods and procedures, not limited to the general list below:

Well Water Levels

After well development, wells are allowed to stabilize for a minimum of 24 hours prior to measuring. Water level and free product thickness (where applicable) measurements are performed using an electronic interface probe or steel tape with water/product finding pastes.

The specific gravity of any accumulated product is determined and used to calculate true hydraulic grade from measured water levels. This information is combined with vertical survey data to determine relative potentiometric surface elevations for all wells.

Aquifer Testing

Various aquifer tests may be used to make determinations of hydraulic conductivity. Slug or pumping tests are often used to characterize site hydrogeologic conditions and to develop remedial action alternatives utilizing appropriate pumping technologies.

Other Methods

Other methods may be deemed appropriate for determining various groundwater characteristics. These other methods may include nested well configurations and/or clustered piezometer installations; sieve or pipette analysis; fracture trace analysis; computer modeling; and geophysical logging.

1.5 PETROLEUM HYDROCARBON DATA COLLECTION

1.5.1 Collection Methods

Petroleum hydrocarbon data is obtained through various methods including, but not limited to, the following:

Field Analysis

- Direct thickness measurement of phase separated components using tapes and/or probes.
- Manual vapor analysis using a photoionization detector (PID) or flame ionization detector (FIS).
- Detectable odor and visual observation.

Laboratory Analysis

- Laboratory analysis of phase-separated products.
- Laboratory vapor, soil, and groundwater analysis using appropriate EPA Methods.

1.5.2 Field Sampling

Field sampling procedures are performed in accordance with recommended protocol, accepted industry standards, and under appropriate chain-of-custody procedures. Generally, sampling procedures are as follows:

Product Samples

Product samples are obtained using clean equipment and containers. Each is shipped to the analytical laboratory in protective containers.

Vapor Samples

PID/FID readings are measured from soil sample headspace using containerized samples that have been brought to ambient temperature.

Carbon tubes are utilized in conjunction with a laboratory-calibrated vacuum pump to obtain vapor samples. The carbon tubes are sealed and refrigerated for shipment to the analytical laboratory (This method is known as the Carbon Adsorption Method).

Soil Samples

Soil samples are immediately packed into clean containers, and refrigerated for shipment to the analytical laboratory.

Groundwater Samples

Groundwater samples are collected in accordance with the following procedures:

- Creeks/Lakes/Etc.

Grab samples are obtained.

- Domestic Wells

Wells are pumped for a time sufficient to completely purge the well and any pressure or holding tanks prior to sampling.

- Monitoring Wells

Water level measurements are made and well volumes calculated for each well.

Three well volumes are removed from each well using a thoroughly cleaned Teflon bailer or appropriate purging pump. If it is not possible to remove three volumes, due to very low yields, a minimum of one volume is removed prior to obtaining a sample.

Where analysis for metals is required, wells are typically sampled utilizing low flow techniques, which reduce turbidity and the potential for matrix interference.

Samples are collected and containerized in a manner that minimizes agitation and contact with the air.

Sampling records are field prepared.

Samples are labeled and proper chain of custody documents are maintained.

Samples are promptly protectively packed, refrigerated, and shipped to the analytical laboratory for analysis.

2.0 DATA EVALUATION

Data obtained as a result of the site investigation is compiled and evaluated and a report is prepared for client review and distribution to the appropriate agencies. Generally, specific data are evaluated as follows:

- Background data are evaluated in context with the suspected or confirmed problem.
- Survey data are utilized to develop site maps and to evaluate contaminant receptors.
- Well construction records are compiled and presented as part of the report. As-built information is used in combination with other data to evaluate subsurface conditions and monitoring well screen settings as they relate to the investigation.
- Subsurface drilling logs are used to develop geologic cross-sections, fence diagrams, isopachs, structure contours, or other constructions. Regional geologic data are used to obtain an overall framework.
- Hydrogeologic data are used to develop contour maps, flow nets and other constructions. The data is also used to calculate various hydrogeologic parameters that describe aquifer characteristics.
- Hydrocarbon data are utilized to develop various plume geometry and isoconcentration maps.
- All data are compiled and utilized for making specific recommendations with regard to remedial action alternatives.

APPENDIX B
BORING LOG

BORING LOG

CATLIN

ENGINEERS and SCIENTISTS
ENGLISH
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 204-079	STATE: NC	COUNTY: Onslow	LOCATION: Havelock
PROJECT NAME: Eight Site Closures		LOGGED BY: Tom Stetler	BORING ID: USTPP3354 -DPT01
		DRILLER: Bobbie Fowler	
LATITUDE:	LONGITUDE:	CREW:	
SYSTEM:	BORING LOCATION: PP-3354		LAND ELEV.: NM
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: 4.9	BORING DEPTH: 12.0
START DATE: 11/03/04	FINISH DATE: 11/03/04	24 HOUR DTW: NM	ROCK DEPTH: --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	SAMP. TYPE	OVA RESULTS (ppm)				LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	
			0	1000	2000	3000				4000	DEPTH
0.0									0.0	LAND SURFACE	
									0.0	TOPSOIL	
	DP DP DP DP		▲10.3				SM		0.3	Very dark brown to black, silty, f. to vf. SAND. Moist. Strong hydrocarbon odor.	
2.0									2.0		
	DP DP DP DP		▲29.7				SC/SM			Dark gray, silty to clayey, f. to vf. SAND. Moist. Strong hydrocarbon odor. 2.4' return on 0-4' tube.	
4.0									4.0		
	DP DP DP DP		▲1640				SC/SM			Same as above.	
									5.3		
							SM		5.5	Unusual. Dark brown to black, silty, f. to vf. SAND layer containing spherical pellets the size of cse. grained sand (similar to bird-shot). May be "bead-blasting" material.	
6.0											
	DP DP DP DP						SP			Light brownish-gray, f. to vf. SAND. Minor dark-brown banding up to 2" in thickness. Moist to wet. Strong hydrocarbon odor. 2.1' return on 4-8' tube.	
	DP DP DP DP		▲19.6						8.0		
10.0											
	DP DP DP DP		▲7.1				SP			Light tan, f. to vf. SAND. Well sorted. Saturated. Slight hydrocarbon odor. Sample is saturated to the point that it will not stay in the tube. .4' return on 4' tube.	
12.0									12.0	Boring Terminated at Depth 12.0 ft Assumes uniform compaction. Set temporary 1" well and abandoned with bentonite following water sample collection.	

CATLIN ENVIRO. LOG 204-079 & SITES.CAMP.LEJUNE.GPJ.CATLIN.GDT.01/05/05

BORING LOG

CATLIN
ENGINEERS and SCIENTISTS
ENGLISH
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 204-079	STATE: NC	COUNTY: Onslow	LOCATION: Havelock
PROJECT NAME: Eight Site Closures		LOGGED BY: Tom Stetler	BORING ID: USTPP3354
		DRILLER: Bobbie Fowler	-SB02
LATITUDE:	LONGITUDE:	CREW:	
SYSTEM:	BORING LOCATION: PP-3354		LAND ELEV.: NM
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: NE	BORING DEPTH: 4.0
START DATE: 11/03/04	FINISH DATE: 11/03/04	24 HOUR DTW: NM	ROCK DEPTH: --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	SAMP. TYPE	OVA RESULTS (ppm)				LAB.	U S C S	L O G	SOIL AND ROCK	
			0	1000	2000	3000				4000	DEPTH
0.0									0.0	LAND SURFACE	
									0.0	TOPSOIL	
	DP DP DP DP		▲0				SM		0.3	Very dark brown to black, silty, f. to vf. SAND. Moist. No hydrocarbon odor.	
1.0									0.8		
	DP DP DP DP		▲0				SM			Dark gray, silty, f. to vf. SAND. Moist. No hydrocarbon odor.	
2.0									2.3		
	DP DP DP DP		▲18								
3.0							SC/ SM			Dark gray, silty to clayey, vf. SAND. Interlayered gray clayey sands up to 1" in thickness. Moist to wet. Strong hydrocarbon odor. 3.6' return on 0-4' tube.	
	DP DP DP DP	DP	▲163.1			USTPP 3354 -SB02 (3-4')					
4.0									4.0	Boring Terminated at Depth 4.0 ft Assumes uniform compaction.	

CATLIN ENVIRO. LOG - 204-079.B.SITES.CAMP.LEJEUNE.GP1.CATLIN.GDT_01/05/05

BORING LOG

CATLIN

ENGINEERS and SCIENTISTS

Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 204-079	STATE: NC	COUNTY: Onslow	LOCATION: Havelock
PROJECT NAME: Eight Site Closures		LOGGED BY: Tom Stetler	BORING ID: USTPP3354-SB03
		DRILLER: Bobbie Fowler	
LATITUDE:	LONGITUDE:	CREW:	
SYSTEM:	BORING LOCATION: PP-3354		LAND ELEV.: NM
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: NE	BORING DEPTH: 4.0
START DATE: 11/03/04	FINISH DATE: 11/03/04	24 HOUR DTW: NM	ROCK DEPTH: --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	SAMP. TYPE	OVA RESULTS (ppm) 0 1000 2000 3000 4000	LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	
							DEPTH	ELEVATION
0.0							0.0	LAND SURFACE
							0.0	TOPSOIL
	DIRECT PUSH	▲0			SM		0.1	Dark brown to black, SILTY, v.f. SAND. Moist. Strong hydrocarbon odor.
							0.4	
1.0	DIRECT PUSH	▲0						
2.0	DIRECT PUSH	▲4.8			SC/SM			Light to dark gray, SILTY to CLAYEY, v.f. SAND. Moist. Strong hydrocarbon odor. 3.2' return on 0-4' tube.
3.0	DIRECT PUSH	▲130.5		USTPP 3354-SB03 (3-4')				
4.0							4.0	Boring Terminated at Depth 4.0 ft Assumes uniform compaction.

CATLIN ENVIRO. LOG 204-079 & SITES.CAMP.LEJUNE.GE.L.CATLIN.GDT 01/24/05

APPENDIX C

**LABORATORY ANALYTICAL REPORT AND
CHAIN OF CUSTODY DOCUMENTATION**

Mr. Ben Ashba
Richard Catlin & Associates
P.O. Box 10279
Wilmington NC 28404-0279

Report Number: G128-1404

Client Project: PP-3354

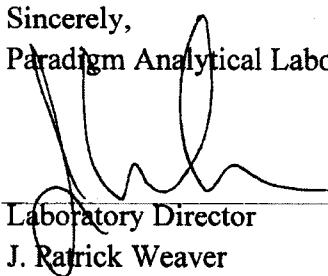
Dear Mr. Ashba:

Enclosed are the results of the analytical services performed under the referenced project. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or the services performed during this project, please call Paradigm at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using Paradigm Analytical Labs for your analytical services. We look forward to working with you again on any additional analytical needs which you may have.

Sincerely,
Paradigm Analytical Laboratories, Inc.



Laboratory Director
J. Patrick Weaver

11/29/04

Date

EPH (Aliphatics/Aromatics) Results

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-SB02(3-4')
Sample Matrix	Soil
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/09/04
Date Analyzed	11/19/04
Dry Weight	83
Dilution Factor	1:1
C ₉ -C ₁₈ Aliphatics*	640 (mg/Kg)
C ₁₉ -C ₃₆ Aliphatics*	120 (mg/Kg)
C ₁₁ -C ₂₂ Aromatics*	54 (mg/Kg)
Aliphatic Surrogate % Recovery	91
Aromatic Surrogate % Recovery	91
Fractionation Surrogate 1 % Recovery	85

Comments:

* = Excludes any surrogates or internal standards.

Lab info: G128-1404-1D

Reviewed By: 

EPH (Aliphatics/Aromatics) Results

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-SB03(3-4')
Sample Matrix	Soil
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/09/04
Date Analyzed	11/18/04
Dry Weight	86.3
Dilution Factor	50:10
C ₉ -C ₁₈ Aliphatics*	5200 (mg/Kg)
C ₁₉ -C ₃₈ Aliphatics*	580 (mg/Kg)
C ₁₁ -C ₂₂ Aromatics*	1300 (mg/Kg)
Aliphatic Surrogate % Recovery	120
Aromatic Surrogate % Recovery	120
Fractionation Surrogate 1 % Recovery	110

Comments:

* = Excludes any surrogates or internal standards.

Lab info: G128-1404-2D

Reviewed By: hw

EPH (Aliphatics/Aromatics) Results

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-DPT01
Sample Matrix	Water
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/16/04
Date Analyzed	11/19/04
Dry Weight	
Dilution Factor	1:1
C ₉ -C ₁₈ Aliphatics*	1900 (µg/L)
C ₁₉ -C ₃₆ Aliphatics*	340 (µg/L)
C ₁₁ -C ₂₂ Aromatics*	390 (µg/L)
Aliphatic Surrogate % Recovery	44
Aromatic Surrogate % Recovery	78
Fractionation Surrogate 1 % Recovery	110

Comments:

* = Excludes any surrogates or internal standards.

Lab info: G128-1404-3G

Reviewed By: 

Attachment 3

EPH Laboratory Reporting Form

Calibration and QA/QC Information

Initial Calibration Date: 11/18/04

Calibration Ranges and Limits

Range	MDL (2/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C ₉ -C ₁₈ Aliphatics	3.84	12.2	100	10
C ₁₉ -C ₃₆ Aliphatics	0.57	1.8	100	10
C ₁₁ -C ₂₂ Aromatics	4.54	14.4	100	10

Calibration Concentration Levels

Range	Levels (µg/mL)	%RSD or CCC	Method of Quantitation
C ₉ -C ₁₈ Aliphatics	6	2.40	Calibration Factor
	30		
	60		
	120		
	240		
C ₁₉ -C ₃₆ Aliphatics	8	1.6	Calibration Factor
	40		
	80		
	160		
	320		
C ₁₁ -C ₂₂ Aromatics	17	2	Calibration Factor
	85		
	170		
	340		
	680		

Calibration Check Date: 11/18/04

Calibration Check

Range	Levels (µg/mL)	RPD
C ₉ -C ₁₈ Aliphatics	60	-0.2
C ₁₉ -C ₃₆ Aliphatics	80	-0.3
C ₁₁ -C ₂₂ Aromatics	340	2.2

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit

RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Attachment 3

EPH Laboratory Reporting Form

Calibration and QA/QC Information

Initial Calibration Date: 11/18/04

Calibration Ranges and Limits

Range	MDL (2/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C ₉ -C ₁₈ Aliphatics	3.84	12.2	100	10
C ₁₉ -C ₃₆ Aliphatics	0.57	1.8	100	10
C ₁₁ -C ₂₂ Aromatics	4.54	14.4	100	10

Calibration Concentration Levels

Range	Levels (µg/mL)	%RSD or CCC	Method of Quantitation
C ₉ -C ₁₈ Aliphatics	6	2.40	Calibration Factor
	30		
	60		
	120		
	240		
C ₁₉ -C ₃₆ Aliphatics	8	1.6	Calibration Factor
	40		
	80		
	160		
	320		
C ₁₁ -C ₂₂ Aromatics	17	2	Calibration Factor
	85		
	170		
	340		
	680		

Calibration Check Date: 11/19/04

Calibration Check

Range	Levels (µg/mL)	RPD
C ₉ -C ₁₈ Aliphatics	120	-1.2
C ₁₉ -C ₃₆ Aliphatics	160	-1.6
C ₁₁ -C ₂₂ Aromatics	340	-4.7

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit

RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-SB02(3-4')
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/03/04
Date Analyzed	11/24/04
Dry Weight	83
Dilution Factor	1
C ₅ -C ₈ Aliphatics**	< 10 (mg/Kg)
C ₉ -C ₁₂ Aliphatics**	< 10 (mg/Kg)
C ₉ -C ₁₀ Aromatics**	< 10 (mg/Kg)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	120

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: g128-1404-1a

Reviewed By: 

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-SB03(3-4')
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/03/04
Date Analyzed	11/24/04
Dry Weight	86
Dilution Factor	1
C ₅ -C ₈ Aliphatics**	< 10 (mg/Kg)
C ₉ -C ₁₂ Aliphatics**	19 (mg/Kg)
C ₉ -C ₁₀ Aromatics**	26 (mg/Kg)
Surrogate % Recovery - PID	120
Surrogate % Recovery - FID	150***

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

***= High surrogate recovery due to matrix interference

Lab Info: g128-1404-2a

Reviewed By: 

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: Richard Catlin & Associates

Project Name: PP-3354

Sample Information and Analytical Results	
Sample Identification	USTPP3354-DPT01
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/10/04
Date Analyzed	11/10/04
Dry Weight	
Dilution Factor	1
C ₅ -C ₈ Aliphatics**	< 100 (µg/L)
C ₉ -C ₁₂ Aliphatics**	340 (µg/L)
C ₉ -C ₁₀ Aromatics**	330 (µg/L)
Surrogate % Recovery - PID	96
Surrogate % Recovery - FID	110

* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

** = Excludes any surrogates or internal standards.

Lab Info: g128-1404-3e

Reviewed By: 

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 10/18/04 PID Initial Calibration Date: 10/18/04

Calibration Ranges and Limits

Range	MDL (07/15/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C ₅ -C ₈ Aliphatics	4.4	14	100	10
C ₉ -C ₁₂ Aliphatics	3.4	11	100	10
C ₉ -C ₁₀ Aromatics	0.13	0.41	100	10

Calibration Concentration Levels

Range	Levels (µg/L)	%RSD or CCC	Method of Quantitation
C ₅ -C ₈ Aliphatics	40	13.5	Calibration Factor
	1000		
	2000		
	3000		
	4000		
C ₉ -C ₁₂ Aliphatics	10	14.5	Calibration Factor
	250		
	500		
	750		
	1000		
C ₉ -C ₁₀ Aromatics	10	3.7	Calibration Factor
	250		
	500		
	750		
	1000		

Calibration Check Date: 11/10/04

Calibration Check

Range	Levels		RPD
	(µg/L)	(mg/Kg)	
C ₅ -C ₈ Aliphatics	2000	200	23.8
C ₉ -C ₁₂ Aliphatics	500	50	10.8
C ₉ -C ₁₀ Aromatics	500	50	4.2

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit

RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 11/16/04 PID Initial Calibration Date: 11/16/04

Calibration Ranges and Limits

Range	MDL (07/15/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C ₅ -C ₈ Aliphatics	4.4	14	100	10
C ₉ -C ₁₂ Aliphatics	3.4	11	100	10
C ₉ -C ₁₀ Aromatics	0.13	0.41	100	10

Calibration Concentration Levels

Range	Levels (µg/L)	%RSD or CCC	Method of Quantitation
C ₅ -C ₈ Aliphatics	40	3.3	Calibration Factor
	1000		
	2000		
	3000		
	4000		
C ₉ -C ₁₂ Aliphatics	10	21.7	Calibration Factor
	250		
	500		
	750		
	1000		
C ₉ -C ₁₀ Aromatics	10	10.6	Calibration Factor
	250		
	500		
	750		
	1000		

Calibration Check Date: 11/24/04

Calibration Check

Range	Levels		RPD
	(µg/L)	(mg/Kg)	
C ₅ -C ₈ Aliphatics	2000	200	-9.6
C ₉ -C ₁₂ Aliphatics	500	50	-5.9
C ₉ -C ₁₀ Aromatics	500	50	-21.9

MDL = Method Detection Limit
ML = Minimum Limit
RL = Reportable Limit

RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
CCC = Correlation Coefficient of Curve

Results for Volatiles
by GC 602

Client Sample ID: USTPP3354-DPT01
 Client Project ID: PP-3354
 Lab Sample ID: G128-1404-3A
 Lab Project ID: G128-1404

Analyzed By: DCS
 Date Collected: 11/03/2004 14:30
 Date Received: 11/4/2004
 Matrix: Water

Analyte	Result ug/L	RL ug/L	Dilution Factor	Date Analyzed
Naphthalene	70.7	4.00	4	11/17/2004
Surrogate Spike Recoveries		Spike Added	Spike Result	Percent Recovery
Trifluorotoluene		40	39.4	98.4

Comments:

All values corrected for dilution.
 BQL = Below quantitation limit.

Reviewed By: 

**List of Reporting Abbreviations
and Data Qualifiers**

B = Compound also detected in batch blank

BQL = Below Quantitation Limit

DF = Dilution Factor

Dup = Duplicate

E = Estimated concentration, exceeds calibration range.

J = Estimated concentration, below calibration range and above MDL

LCS(D) = Laboratory Control Spike (Duplicate)

MDL = Method Detection Limit

MS(D) = Matrix Spike (Duplicate)

PQL = Practical Quantitation Limit

RL = Reporting Limit

RPD = Relative Percent Difference

mg/kg = milligram per kilogram, ppm, parts per million

ug/kg = micrograms per kilogram, ppb, parts per billion

mg/L = milligram per liter, ppm, parts per million

ug/L = micrograms per liter, ppb, parts per billion

% Rec = Percent Recovery

% solids = Percent Solids

Special Notes:

- 1) Metals and mercury samples are digested with a hot block, see the standard operating procedure document for details.
- 2) Uncertainty for all reported data is less than or equal to 30 percent.

