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

OCTOBER 31, 2007

CONTRACT NO. N62470-05-D-6200
DELIVERY ORDER NO. 0016
CATLIN PROJECT NO. 205-077

PREPARED BY:

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

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A. SITE IDENTIFICATION

DATE OF REPORT: October 31, 2007
Facility ID: E-002740 UST Incident Number (if known): 24015
Land Use Classification: Residential Risk Classification: Low
Site Name: PP-3354
Site Location: 3354 Jones Street, Marine Corps Base (MCB), Camp Lejeune (See Figure 1)
Nearest City/Town: Jacksonville County: Onslow

UST Owner: Commanding Officer – 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

The site, shown on Figure 1, is located at Building PP-3354 aboard Marine Corps Base (MCB) Camp Lejeune, North Carolina. Building PP-3354 is located in the Paradise Point Housing Area and was heated using heating oil from a 285-gallon underground storage tank (UST). The former tank was located adjacent to the single family residence and was within several feet of the foundation.

The UST was removed in September 2001 by J.A. Jones Environmental Services Company (J.A. Jones). 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 (STGW) Maximum Soil Contaminant Concentrations (MSCCs), with one petroleum hydrocarbon fraction (C_9-C_{22} Aromatics) at concentrations above the Residential MSCC in two excavation sidewall samples (north wall and east wall).

In July 2002, CATLIN Engineers and Scientists (CATLIN) conducted field work and sampling required by the North Carolina Department of Environment and Natural Resources (NCDENR) for a Phase I Limited Site Assessment (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. Soil sample results did not reveal any concentrations above the laboratory Method Detection Limits (MDLs). A groundwater sample collected from the temporary monitoring well USTPP3354-TW01, installed in the former UST basin area, revealed Naphthalene and C_9-C_{18} Aliphatics above the 2L Groundwater Quality Standards (GWQSs). The Phase I LSA Report, dated November 29, 2002, concluded the site met criteria to be ranked as Low Risk with Residential Land Use and could be considered for No Further Action (NFA) with a Land Use Restriction (LUR).

A Notice of Regulatory Requirements, dated January 10, 2003 was subsequently issued by NCDENR requesting a Soil Assessment Report (SAR). Due to the limited magnitude of the impact identified during the UST removal activities, NCDENR and MCB Camp Lejeune personnel agreed to a limited scope of work consisting of the collection of two soil samples at the former noncompliant sample locations, CC3354-1 and CC3354-2. CATLIN personnel advanced two soil borings, USTPP3354-SB02 and USTPP3354-SB03, in the vicinity of the previous samples CC3354-1 and CC3354-2 in order to establish compliance with current Residential MSCCs. The soil samples were submitted for laboratory analysis per MADEP VPH/EPH, and review of the laboratory analytical results revealed no compounds above current Residential MSCCs. Email correspondence from NCDENR to the MCB Environmental Management Division, dated June 3, 2003, indicated the site was eligible for NFA with a groundwater LUR based upon review of the soil sampling report.

MCB Camp Lejeune periodically monitors soil and groundwater at the site to assess attenuation of contaminant concentrations. CATLIN personnel conducted soil and groundwater sampling at the site in November 2004. Results of the investigation

were submitted in the *Soil and Groundwater Sampling Report of Findings for PP-3354, Marine Corps Base, Camp Lejeune, North Carolina, May 10, 2005.* Soil and groundwater contaminants at the site were detected above the Residential MSCCs and 2L GWQSs, so NFA without a LUR was not achievable at the time.

The purpose of the current investigation was to resample the soil and groundwater in order to assess current site conditions.

C. METHODS

1. Field Methods

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 (DPT) boring advancement using an AMS PowerProbe™ 9600D (PowerProbe) on July 24 and 26, 2007. 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 Unified Soil Classification System (USCS) and organic vapor analysis utilizing a Photo Ionization Detector (PID). A boring log for the USTPP3354-DPT01 and USTPP3354-DPT02 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 one inch slotted PVC well screen.

The depth to water (DTW) measurement was recorded and a grab groundwater sample was collected. The sample was collected on July 26, 2007 utilizing a peristaltic pump and new polyethylene tubing. The groundwater sample was labeled USTPP3354-DPT01 and the sample location is illustrated on Figure 2.

A soil sample was collected on July 24, 2007 from boring USTPP3354-DPT02 at three to four feet BLS, which is at the location of previously revealed C_9-C_{22} Aromatics concentrations above the Residential MSCCs. The sample was labeled USTPP3354-DPT02 and is shown 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 (COC) procedures. A copy of the COC is provided following the 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 SGS Environmental Services, Inc. (NC Certification #481) in Wilmington, North Carolina. At the laboratory, the groundwater sample was analyzed per EPA Method 602 and MADEP VPH and EPH. The soil sample was also analyzed using MADEP VPH and EPH.

D. RESULTS

Field observations noted during soil boring advancement indicate site geology comprised of fine to medium sands with some silts and clays to 12 feet. Moist soils were encountered during boring advancement as shallow as two feet BLS. Saturated soils were noted at 6.5 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 July 26, 2007 in the temporary well USTPP3354-DPT01 was approximately 6.4 feet BLS.

Analytical results for the soil and groundwater samples are included in Appendix C (Please note the samples from this site were included on the COC with additional sites. As a result, only the applicable pages from the lab report are included. Page numbers are not consecutive, as multiple sites were sampled during the same event.). The analytical results are summarized as follows.

Soil – MADEP VPH/EPH

Laboratory analysis of soil sample USTPP3354-DPT02, (3-4') collected in the area of historical C_9-C_{22} aromatics contamination, revealed the C_9-C_{22} Aromatics hydrocarbon chain concentration of 1,013 mg/Kg, which is above the Residential MSCC of 469 mg/Kg. All other MADEP concentrations were detected at concentrations less than the STGW MSCCs. Soil laboratory results are summarized in Table 1 and illustrated on Figure 2.

Groundwater – EPA Method 602 and MADEP VPH/EPH

The Naphthalene concentration in the USTPP3354-DPT01 groundwater sample (93.3 µg/L) collected on July 26, 2007 was in excess of the 2L GWQS of 21 µg/L. Groundwater sample analysis per MADEP VPH/EPH revealed multiple Aromatic and Aliphatic hydrocarbon fraction concentrations; however, only the C_9-C_{22} Aromatics concentration (1,572 µg/L) exceeds the 2L GWQS of 210 µg/L. Groundwater sample analytical results are summarized in Tables 2 and 3 and illustrated on Figure 3.

E. CONCLUSIONS AND RECOMMENDATIONS

The C_9-C_{22} Aromatic concentrations previously detected in the soils around the former UST at PP-3354 have not naturally attenuated to below the Residential MSCCs. Current soil sample results have only slightly decreased as compared to the last sampling event in November 2004 (1,013 mg/Kg C_9-C_{22} Aromatics in 2007 versus 1,326 mg/Kg C_9-C_{22} Aromatics in 2004).

A noncompliant Naphthalene concentration persists in the groundwater at the site. Naphthalene was detected at 93.3 µg/L during this investigation as compared to 70.7 µg/L in the 2004 investigation. Both concentrations are above the 2L GWQS, but below the Gross Contaminant Level (GCL) of 15,500 µg/L. The C_9-C_{22} Aromatics groundwater concentrations historically revealed at PP-3354 have not attenuated below the corresponding 2L GWQS. The current C_9-C_{22} Aromatics concentration of 1,572 µg/L is greater than the 2004 detected concentration of 720 µg/L. All other MADEP fraction concentrations, however, have stabilized or decreased in concentration as compared to the last sampling event in 2004.

Current soil (C_9-C_{22} Aromatics) and groundwater (Naphthalene and C_9-C_{22} Aromatics) contaminants continue to persist at noncompliant concentrations. As a result, the LUR can not be removed from this site. CATLIN recommends re-sampling soil and groundwater in two years.

F. REFERENCES

CATLIN Engineers and Scientists. *Soil and Groundwater Sampling Report of Findings for PP-3354, MCB Camp Lejeune, NC,* May 10, 2005.

CATLIN Engineers and Scientists. *Additional Soil Sampling Letter, Building PP-3354, MCB Camp Lejeune, NC,* May 28, 2003.

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 1
SUMMARY OF SOIL LABORATORY RESULTS
MADEP VPH/EPH

PP-3354, MCB Camp Lejeune

Well ID	Contaminant of Concern →		C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
	Sample ID	Date Collected				
Residential MSCC (mg/kg)			939	9,386	93,860	469
Industrial/Commercial MSCC (mg/kg)			24,528	245,280	#	12,264
Soil to Groundwater MSCC (mg/kg)			72	3300	##	34
USTPP3354-DPT02	USTPP3354-DPT02	7/24/2007	17.6	1,982	310	**1,013**

All results in milligram per Kilogram - mg/kg

Health based level > 100%

Considered immobile

MSCC = Maximum Soil Contaminant Concentrations

Bold concentrations exceed the Residential MSCCs

TABLE 2
SUMMARY OF GROUNDWATER LABORATORY RESULTS
EPA METHOD 602

PP-3354, MCB Camp Lejuene

Well ID	Contaminant of Concern →		Ethylbenzene	Naphthalene	Total Xylenes	All Other EPA Method 602 Compounds
	Sample ID	Date Collected				
GCL (µg/L)			84,500	15,500	87,500	Varies
2L GWQS (µg/L)			550	21	530	Varies
USTPP3354-DPT01	USTPP3354-DPT01	7/26/2007	17	**93.3**	18.8	BMDL

All results in micrograms per liter (µg/L).

BMDL = Below Method Detection Limit

Bold results indicate concentrations above 2L GWQS or GCL

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

TABLE 3
SUMMARY OF GROUNDWATER LABORATORY RESULTS
MADEP VPH/EPH

PP-3354, MCB Camp Lejeune

Well ID	Contaminant of Concern →		C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
	Sample ID	Date Collected				
GCL (µg/L)			NE	NE	NE	NE
2L GWQS (µg/L)			420	4,200	42,000	210
USTPP3354-DPT01	USTPP3354-DPT01	7/26/2007	<100	1,696	<100	**1,572**

All results in micrograms per liter (µg/L).

NE = None Established

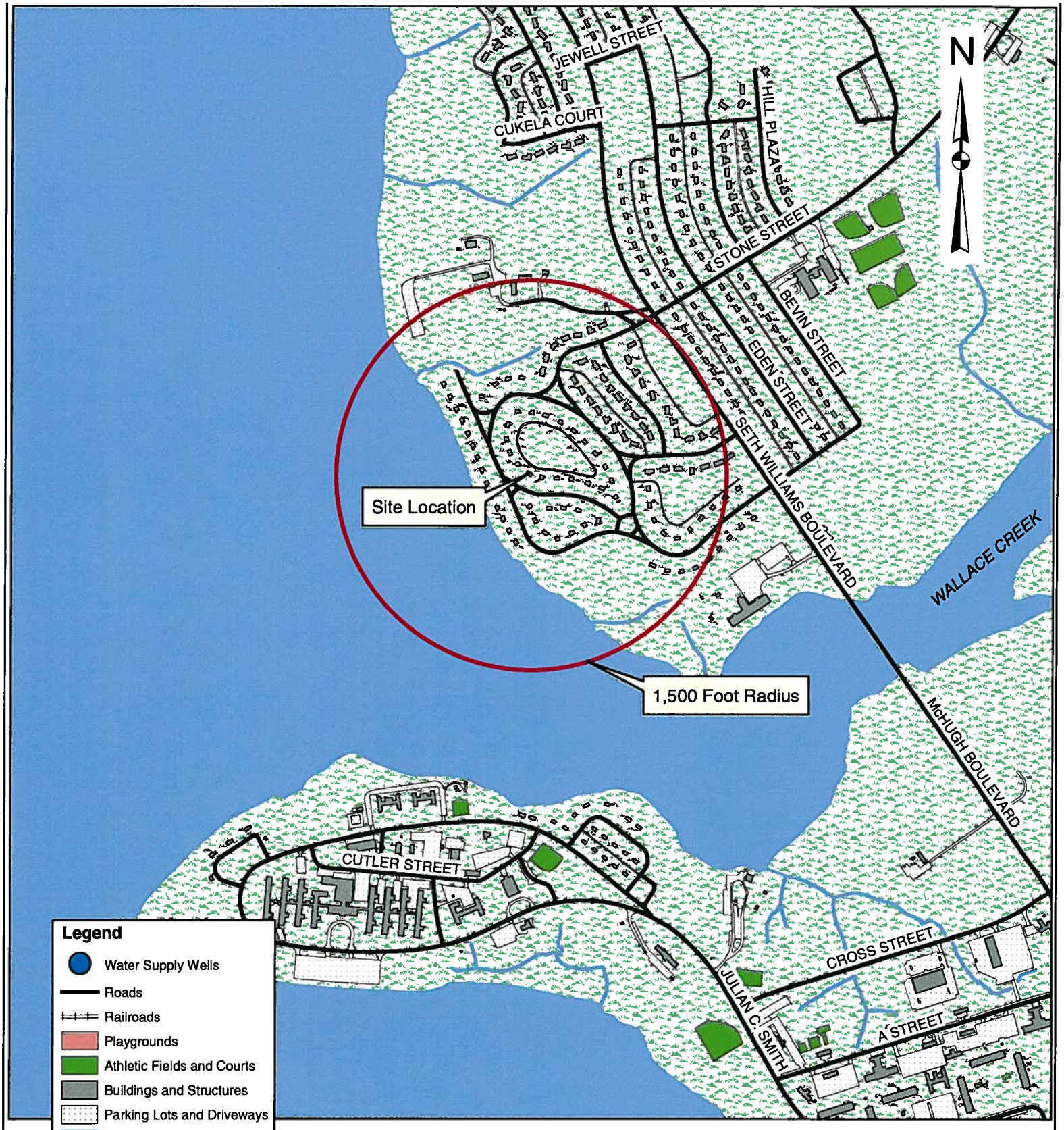
< = Less than Method Detection Limit

Bold results indicate concentrations above 2L GWQS or GCL

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

FIGURES



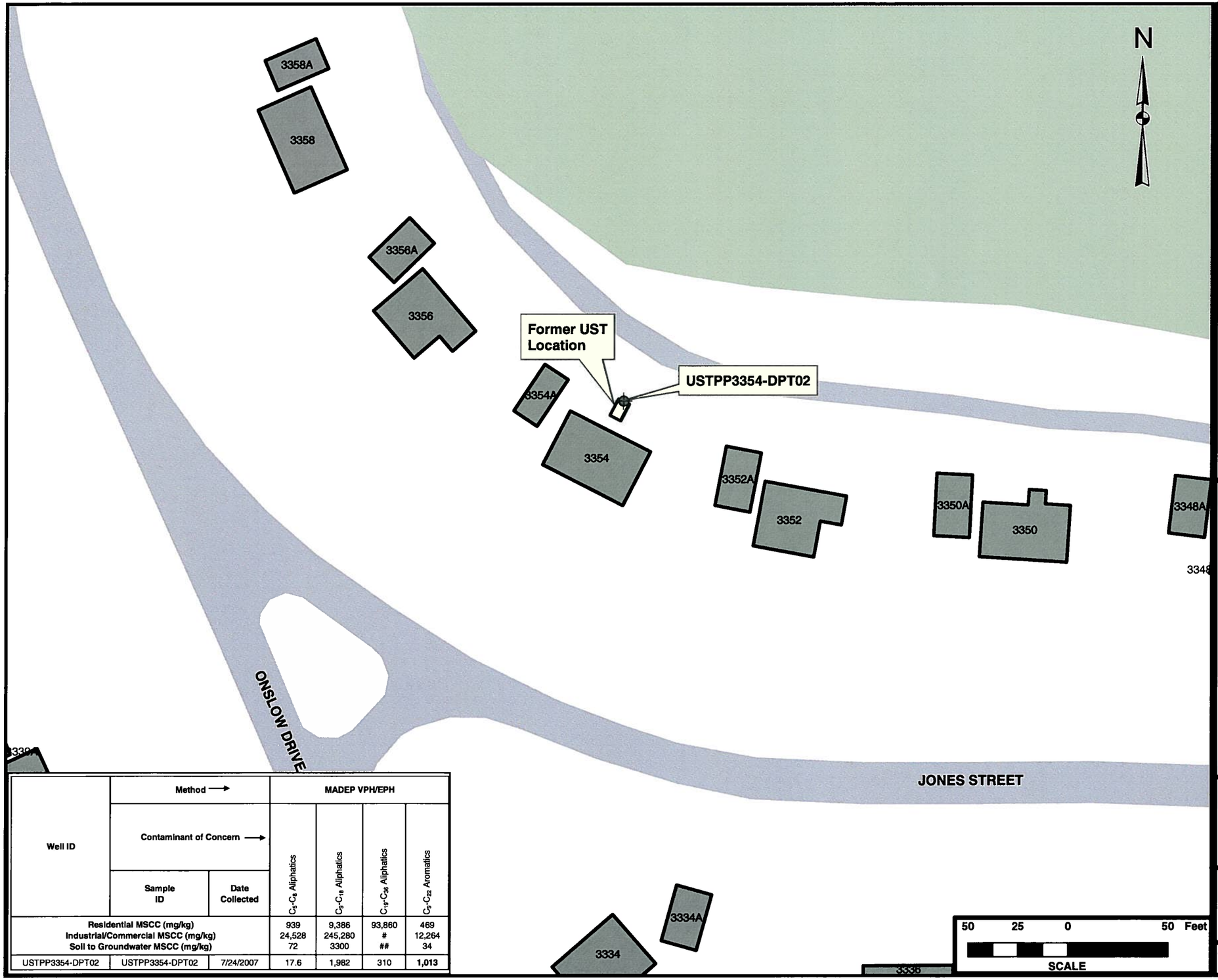
Data Sources: Data Layers provided by MCB Camp Lejeune GIS Office.

CATLIN ENGINEERS and SCIENTISTS

PROJECT: SOIL AND GROUNDWATER SAMPLING REPORT OF FINDINGS SITE PP-3354 MARINE CORPS BASE CAMP LEJEUNE, NC	TITLE: SITE LOCATION MAP				FIGURE 1
JOB NO. 205-077	DATE OCT 2007	SCALE AS SHOWN	DRAWN BY SAC	CHECKED BY MEM	

SOIL AND GROUNDWATER SAMPLING REPORT OF FINDINGS SITE PP-3354 MCB CAMP LEJEUNE, NC

NAVFAC Naval Facilities Engineering Command



LEGEND

- Soil Boring
- Water Supply Wells
- Above Ground Storage Tank
- Underground Storage Tank
- Railroad Tracks

Walls and Fences

- FENCE
- GATE
- WALL

- Buildings and Structures
- Demolished Structures
- Oil/Water Separators
- Slabs
- Roads
- Driveways
- Parking Lots
- Surface Water Bodies
- Creeks and Streams

Vegetation Cover

- Forestland
- Scrubland
- Wetland

Airfield Pavement

- HELIPAD
- RAMP
- RUNWAY
- SHLDR_OVERRUN
- TAXIWAY

NOTES

GIS data layers provided by the MCB Camp Lejeune GIS Department.

All results in milligrams per Kilogram - mg/kg

= Health based level > 100%

= Considered immobile

MSCC = Maximum Soil Contaminant Concentrations

Bold concentrations exceed the Residential MSCCs

Well ID	Method →		MADEP VPH/EPH			
	Contaminant of Concern →		C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
	Sample ID	Date Collected				
Residential MSCC (mg/kg)			939	9,386	93,860	469
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Soil to Groundwater MSCC (mg/kg)			72	3300	##	34
USTPP3354-DPT02	USTPP3354-DPT02	7/24/2007	17.6	1,982	310	**1,013**

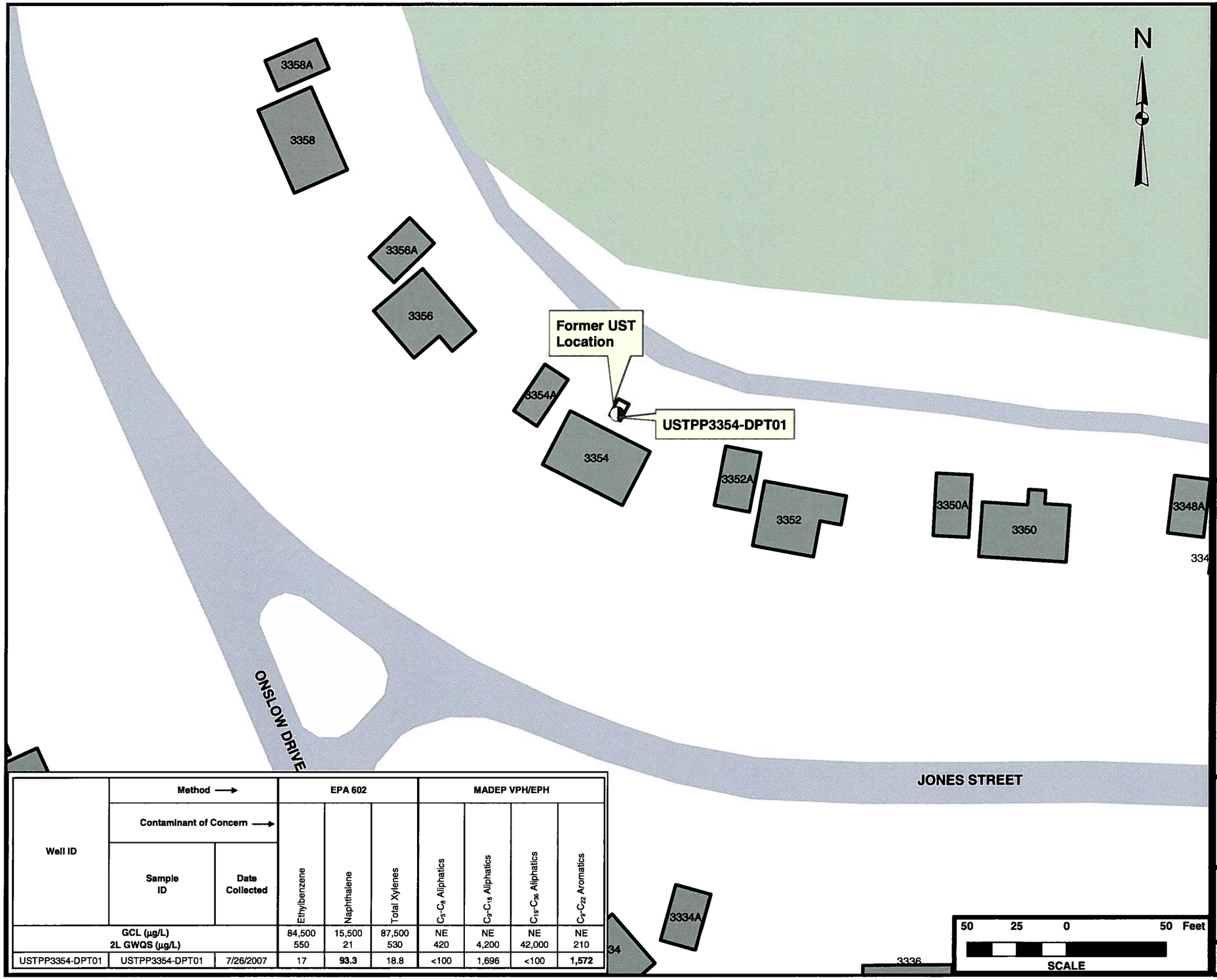
CATLIN ENGINEERS and SCIENTISTS

SITE MAP WITH SUMMARY OF SOIL LABORATORY RESULTS

FIGURE 2

Job No.:	Date:	Scale:	Drawn By:	Checked By:
205-077	OCT 2007	AS SHOWN	SAC	MEM

SOIL AND GROUNDWATER SAMPLING
REPORT OF FINDINGS
SITE PP-3354
MCB CAMP LEJEUNE, NC



LEGEND

- DPT Well
- Water Supply Wells
- Above Ground Storage Tank
- Underground Storage Tank
- Railroad Tracks

Walls and Fences
- FENCE
- GATE
- WALL

- Buildings and Structures
- Demolished Structures
- Oil/Water Separators
- Slabs
- Roads
- Driveways
- Parking Lots
- Surface Water Bodies
- Creeks and Streams

Vegetation Cover
- Forestland
- Scrubland
- Wetland

Airfield Pavement
- HELIPAD
- RAMP
- RUNWAY
- SHLDR_OVERRUN
- TAXIWAY

Well ID	Sample ID	Date Collected	Method → / Contaminant of Concern →	Ethylbenzene	Naphthalene	Total Xylenes	C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
				EPA 602			MADEP VPH/EPH			
GCL (µg/L)				84,500	15,500	87,500	NE	NE	NE	NE
2L GWQS (µg/L)				550	21	530	420	4,200	42,000	210
USTPP3354-DPT01	USTPP3354-DPT01	7/26/2007		17	**93.3**	18.8	<100	1,696	<100	**1,572**

50 25 0 50 Feet
SCALE

NOTES

GIS data layers provided by the MCB Camp Lejeune GIS Department.

All results in micrograms per liter (ug/L)

NE = None Established

< = less than method detection limit

Bold concentrations exceed the 2L GWQS or GCL

GCL = Gross Contaminant Level

2L GWQS = NCAC T15A:02L Groundwater Quality Standards

CATLIN ENGINEERS and SCIENTISTS

SITE MAP WITH SUMMARY OF GROUNDWATER LABORATORY RESULTS

FIGURE 3

Job No.:	Date:	Scale:	Drawn By:	Checked By:
205-077	OCT 2007	AS SHOWN	SAC	MEM

APPENDICES

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 (FID).
- 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, isopaths, 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

WELL LOG

CATLIN ENGINEERS and SCIENTISTS
205-077
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 205-077	STATE: NC	COUNTY: Onslow	LOCATION: Jacksonville
PROJECT NAME: Lejuene LUR Sites		LOGGED BY: J Heter	WELL ID: USTPP3354-DPT01
		DRILLER: Bobbie D. Fowler	
NORTHING: 3840681.2	EASTING: 283103.9	CREW: T Stetler	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: House #3354 backyard		T.O.C. ELEV.:
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: 6.4	TOTAL DEPTH: 12.0
START DATE: 7/26/07	FINISH DATE: 7/26/07	24 HOUR DTW: NM	WELL DEPTH: 11.0

DEPTH	BLOW COUNT 6in	6in	6in	6in	OVA (ppm)	LAB.	USCS	LOG	SOIL AND ROCK DESCRIPTION	WELL DETAIL
									0.0 LAND SURFACE	0.0
0.0					2.8		SP		Grass/organics. Light brown fine SAND. Uniform. Loose. Moist. 2.0	0.0
2.0					NM				No return on sample 4.0	1" Sch. 40 PVC
4.0					78.8		SM		Brown SILTY SAND w/ trace CLAY and black bb's (uniform spherical pellets, possibly bird-blasting pellets). Wet. 6.0	6.0
6.0					608.7		SM/ CL		Dark brown medium SAND w/ SILTY SAND and SANDY CLAY. Saturated @ 6.5' 8.0	
8.0					269.0		SP		Brown fine SAND w/ trace CLAY. Saturated. 10.0	1" Slot .010 Sch. 40 PVC
10.0					177.6		SP		Brown medium SAND. Uniform. Saturated. 12.0	11.0 11.0
									Boring Terminated at Depth 12.0 ft Medium SAND.	

Bentonite Pellets

CATLIN BORING LOG 205-077 LEJUENE LUR SITES.GPJ TEST.GDT 8/20/07

BORING LOG

CATLIN ENGINEERS and SCIENTISTS
205-077
Wilmington, NC

SHEET 1 OF 1

PROJECT NO.: 205-077	STATE: NC	COUNTY: Onslow	LOCATION: Jacksonville
PROJECT NAME: Lejuene LUR Sites	LOGGED BY: J Heter		BORING ID: USTPP3354-DPT02
	DRILLER: Bobbie D. Fowler		
NORTHING: 3,840,683.1	EASTING: 283,104.9	CREW: T Stetler	
SYSTEM: UTM NAD83 (m)	BORING LOCATION: House #3354		LAND ELEV.: NM
DRILL MACHINE: Hand Auger	METHOD: Hand Auger	0 HOUR DTW: NM	BORING DEPTH: 4.0
START DATE: 7/24/07	FINISH DATE: 7/24/07	24 HOUR DTW: NM	ROCK DEPTH: --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	MOI.	OVA RESULTS (ppm) 0 1000 2000 3000 4000	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	ELEVATION
0.0							0.0	LAND SURFACE	
		MOI	▲7.5		SM			Grass/organics. Dark brown fine SAND to SILTY SAND. Loose. No odor. Moist.	
2.0							2.0		
		MOI	▲207.5		SM			Medium gray SILTY SAND. Loose. HCO odor. Moist.	
4.0							4.0		
								Boring Terminated at Depth 4.0 ft Loose SILTY SAND.	

▽ = 0hr. DTW ▼ = 24hr. DTW

CATLIN ENVIRO LOG 205-077 LEJUENE LUR SITES.GPJ CATLIN.GDT 8/21/07

APPENDIX C

LABORATORY ANALYTICAL REPORT AND CHAIN OF CUSTODY DOCUMENTATION

Mr. Shane Chasteen
Richard Catlin & Associates
P.O. Box 10279
Wilmington NC 28404-0279

Report Number: G128-1993

Client Project: Lejuene LUR Sites

Dear Mr. Chasteen:

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 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 SGS/Paradigm at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS/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,
SGS/Paradigm Analytical Laboratories, Inc.

8/10/2007

Laboratory Director — Date
J. Patrick Weaver

List of Reporting Abbreviations and Data Qualifiers

B = Compound also detected in batch blank

BQL = Below Quantitation Limit (RL or MDL)

DF = Dilution Factor

Dup = Duplicate

D = Detected, but RPD is > 40% between results in dual column method.

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

% soilds = 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.

Results for Volatiles
by GC 602

Client Sample ID: USTPP3354-DPT01
Client Project ID: Lejuene LUR Sites
Lab Sample ID: G128-1993-10D
Lab Project ID: G128-1993

Analyzed By: RSB
Date Collected: 7/26/2007 14:45
Date Received: 7/27/2007
Matrix: Water

Analyte	Result ug/L	RL ug/L	MDL ug/L	Dilution Factor	Date Analyzed	Flags
Benzene	BQL	4.00	0.732	4	8/6/2007	
Diisopropyl ether (DIPE)	BQL	4.00	0.916	4	8/6/2007	
Ethylbenzene	**17.0**	4.00	0.724	4	8/6/2007	
Methyl-tert butyl ether (MTBE)	BQL	8.00	1.44	4	8/6/2007	
Naphthalene	**93.3**	4.00	1.74	4	8/6/2007	
Toluene	BQL	4.00	0.628	4	8/6/2007	
m/p-Xylene	**18.8**	8.00	1.92	4	8/6/2007	
o-Xylene	BQL	8.00	2.34	4	8/6/2007	

Surrogate Spike Recoveries	Spike Added	Spike Result	Percent Recovery
Trifluorotoluene	40	40.4	101

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

Reviewed By: GC-VOA_WA

EPH (Aliphatics/Aromatics) Results

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: Lejuene LUR Sites

Sample Information and Analytical Results	
Sample Identification	USTPP3354-DPT01
Sample Matrix	Water
Date Collected	07/26/07
Date Received	07/27/07
Date Extracted	07/31/07
Date Analyzed	08/03/07
Dry Weight	
Dilution Factor	1:1
C_9-C_{18} Aliphatics*	1400 (ug/L)
C_{19}-C_{36} Aliphatics*	< 100 (ug/L)
C_{11}-C_{22} Aromatics*	1300 (ug/L)
Aliphatic Surrogate % Recovery	47
Aromatic Surrogate % Recovery	59
Fractionation Surrogate 1 % Recovery	73

Comments:

* = Excludes any surrogates or internal standards.

Lab info: G128-1993-10G

Reviewed By:

EPH (Aliphatics/Aromatics) Results

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: Lejuene LUR Sites

Sample Information and Analytical Results	
Sample Identification	USTPP3354-DPT02
Sample Matrix	Soil
Date Collected	07/24/07
Date Received	07/27/07
Date Extracted	07/30/07
Date Analyzed	07/31/07
Dry Weight	85.6
Dilution Factor	10:1
C_9-C_{18} Aliphatics*	1900 (mg/Kg)
C_{19}-C_{36} Aliphatics*	310 (mg/Kg)
C_{11}-C_{22} Aromatics*	910 (mg/Kg)
Aliphatic Surrogate % Recovery	NA
Aromatic Surrogate % Recovery	76
Fractionation Surrogate 1 % Recovery	81

Comments:

* = Excludes any surrogates or internal standards.

NA = Non-applicable, surrogate diluted out.

Lab info: G128-1993-11D

Reviewed By:

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: Richard Catlin & Associates

Project Name: Lejuene LUR Sites

Sample Information	
Sample Identification	USTPP3354-DPT01
Sample Matrix	Water
Collection Option (for Soil)*	NA
Date Collected	07/26/07
Date Received	07/27/07
Date Extracted	08/02/07 20:12 - 08/02/07 20:12
Date Analyzed	08/02/07 20:12 - 08/02/07 20:12
Dry Weight	NA
Dilution Factor	1 - 1

Analytical Results			
Analyte	Result µg/L	Report Limit µg/L	Flags
C_5-C_8 Aliphatics**	BQL	100	
C_9-C_{12} Aliphatics**	296	100	
C_9-C_{10} Aromatics**	272	100	

	Percent Recovery	Flags	Limits Lower	Limits Upper
Surrogate % Recovery - PID	110		70	130
Surrogate % Recovery - FID	103		70	130

* = 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 and are unadjusted for individual analytes.

Lab Info: g128-1993-10b	Lab Info: g128-1993-10b
FID Info: VP080207/024F0101.D	PID Info: VP080207/024R0101.D

Reviewed By:

VPH (Aliphatics/Aromatics) Laboratory Reporting Form

Client Name: Richard Catlin & Associates

Project Name: Lejuene LUR Sites

Sample Information	
Sample Identification	USTPP3354-DPT02
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	07/24/07
Date Received	07/27/07
Date Extracted	08/01/07
Date Analyzed	08/02/07 00:50 - 08/02/07 00:50
Dry Weight	85.6
Dilution Factor	1 - 1

Analytical Results			
Analyte	Result mg/Kg	Report Limit mg/Kg	Flags
C_5-C_8 Aliphatics**	17.6	10.0	
C_9-C_{12} Aliphatics**	82.0	10.0	
C_9-C_{10} Aromatics**	103	10.0	

	Percent Recovery	Flags	Limits Lower	Limits Upper
Surrogate % Recovery - PID	123		70	130
Surrogate % Recovery - FID	132	***	70	130

* = 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 and are unadjusted for individual analytes.

*** = High surrogate recovery due to matrix interference.

Lab Info: g128-1993-11b	Lab Info: g128-1993-11b
FID Info: VP080107/036F0101.D	PID Info: VP080107/036R0101.D

Reviewed By:

SGS

CHAIN OF CUSTODY RECORD
SGS Environmental Services Inc.

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- New Jersey
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- West Virginia

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SGS ENVIRONMENTAL SERVICES, INC.

N.C. CERTIFICATION #481

(1) CLIENT: Catlin

CONTACT: Shane Chasteen PHONE NO:(910) 452-5801

PROJECT: Lejeune LUR sites SITE/PWSID#: 205-077

REPORTS TO: Shane Chasteen E-MAIL: FAX NO.:( )

INVOICE TO: Sheila Smith QUOTE # DOD 101 P.O. NUMBER 270726-1

SGS Reference: G128-1993

PAGE 1 OF 2

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	SAMPLE TYPE (C=COMP G=GRAB)	Preservatives Used										REMARKS
							Analysis Required (3)	602 (add Naphthalene)	625 B/N/A + TICS	610	EPH	VPH					
	USTFC46-3-DPT01	7/27/07	1300	W	3	G		1			1	1					* Results in
	USTPP3311-DPT01	7/24/07	1430		5		3				1	1					Simmary + Lejeune
	USTPP3322-DPT01	7/27/07	1015		5		3				1	1					EDD format
	USTPP3326-DPT01	7/26/07	1045		3					1	1	1					
	USTPP3330-DPT01	7/26/07	1145		3					1	1	1					
	USTPP3332-DPT01	7/26/07	1225		3					1	1	1					
	USTPP3340-DPT01	7/27/07	1100		2						1	1					
	USTPP3343-DPT01	7/24/07	1330		2						1	1					
	USTPP3350-DPT01	7/26/07	1400		3					1	1	1					
	USTPP3354-DPT01	7/26/07	1445		5		3				1	1					

(5)

Collected/Relinquished By:(1)	Date	Time	Received By:	Date	Time
Justin Peters	7/27/07	1600		7/27/07	1600
Relinquished By: (2)	Date	Time	Received By:	Date	Time
Relinquished By: (3)	Date	Time	Received By:	Date	Time
Relinquished By: (4)	Date	Time	Received By:	Date	Time

(4)

Shipping Carrier:

Shipping Ticket No:

Samples Received Cold? (Circle) YES NO

Temperature °C: on ice 5.8 5.6 5.9°C

Special Deliverable Requirements:

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

Special Instructions:

Requested Turnaround Time:

☐ RUSH _____ Date Needed ☑ STD

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SGS ENVIRONMENTAL SERVICES, INC.

N.C. CERTIFICATION #481

(1)

CLIENT: Catlin

CONTACT: Shane Chasteen PHONE NO:(910) 452.5861

PROJECT: Lejeune LU2 sites SITE/PWSID#: 205-077

REPORTS TO: Shane Chasteen E-MAIL:

FAX NO.:( )

INVOICE TO: Sheila Smith QUOTE # DOD 101

P.O. NUMBER 270726-1

SGS Reference:

PAGE 2 OF 2

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	SAMPLE TYPE (C=COMP G=GRAB)	Preservatives Used	HCl	—	MeOH	HCl						
							(3) Analysis Required	602 (add naphthalene)	EPH	VPH	VPH						REMARKS
	USTPP3354-DPTC2	7/24/07	1230	S	13	G			1	2	2						* Results in
	Duplicate	7/27/07	1100	W	5	G		3			2						summary &
																	Lejeune EDD
																	format

(5)

	Date	Time	Received By:	Date	Time
Collected/Relinquished By:(1) Justin Hobbs	7/27/07	1600		7/27/07	1600
Relinquished By: (2)	Date	Time	Received By:	Date	Time
Relinquished By: (3)	Date	Time	Received By:	Date	Time
Relinquished By: (4)	Date	Time	Received By:	Date	Time

(4)

Shipping Carrier:

Shipping Ticket No:

Samples Received Cold? (Circle) YES NO

Temperature °C: ave 5.8 5.6 5.9 °C

Special Deliverable Requirements:

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

Special Instructions:

Requested Turnaround Time:

☐ RUSH _____ Date Needed ☑ STD

SGS

☐ 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
☐ 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557
☐ 1270 Greenbrier Street Charleston, WV 25311 Tel: (304) 346-0725 Fax: (304) 346-0761

White - Retained by Lab
Yellow - Returned with Report
Pink - Retained by Sampler