wood.

North Carolina Department of Transportation
Preliminary Site Assessment
State Project: R-2307B
WBS Element: 37944.1.FR5
Parcel 020
Iredell County

Promenade on the Lake, LLC
1479 NC 150 (River Highway)
Mooresville, North Carolina
January 30, 2019

Wood Environment and Infrastructure Solutions, Inc.
Project: 188322307

John Maas, LG
Senior Geologist

Helen Corley, LG, BCES
Senior Assoc. Hydrogeologist

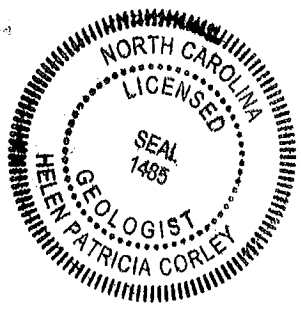


TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Site History 2
1.2 Site Description 3

2.0 GEOLOGY 4

2.1 Regional Geology 4
2.2 Site Geology 4

3.0 FIELD ACTIVITIES 5

3.1 Preliminary Activities 5
3.2 Site Reconnaissance 5
3.3 Geophysics Survey Results and Utility Locating 5
3.4 Soil Sampling 6

4.0 SOIL SAMPLING RESULTS 7

5.0 CONCLUSIONS 8

6.0 RECOMMENDATIONS 9

TABLES

Table 1 Summary of PID Screening Results
Table 2 Summary of Onsite UVF Petroleum Soil Results

FIGURES

Figure 1 Vicinity Map
Figure 2 Site Map with Soil Boring Locations
Figure 3 UVF Petroleum Soil Results 11/12/18
Figure 4 Approximate Areas of Soil Contamination

APPENDICES

Appendix A Historical Reports and Documents
Appendix B Photographic Log
Appendix C Boring Logs
Appendix D Geophysical Report
Appendix E Onsite UVF Hydrocarbon Analytical Results

1.0 INTRODUCTION

In response to the North Carolina Department of Transportation (NCDOT) Request for Proposal, dated September 17, 2018, Wood Environment and Infrastructure Solutions, Inc. (Wood) has performed a Preliminary Site Assessment (PSA) for Parcel 020. The investigation was conducted in accordance with Wood's Technical and Cost proposal dated September 27, 2018. NCDOT contracted Wood to perform the PSA at the parcel, within the area to be affected by future road construction activities, in order to identify potential impacts from the former use of the property.

The parcel is located at on the south side of River Highway and at the intersection of Big Dukes Lane and River Highway, approximately 4.1 miles west of I-77, as shown in the Vicinity Map, **Figure 1**. The parcel is located at 1479 NC 150 (River Highway). The western half of the parcel, west of Big Dukes Lane, is currently vacant and contains concrete pad remnants of a demolished gas station and convenience store. The eastern half of the parcel, east of Big Dukes Lane, is currently occupied by one single story building which houses a golf cart distributor and a marina and campground. It is identified as Parcel 020 and as Promenade on the Lake, LLC (Site) within the NCDOT R-2307B design file. The Site is in Mooresville of Iredell County, North Carolina.

The investigation area initially included the entire width of the parcel adjacent to River Highway. After further review of the parcel and its current and past uses, the area of investigation was limited to the western half of the parcel formerly occupied by the gas station and convenience store. The eastern half of the parcel occupied by the golf cart distributor was removed from the scope as indications of potential environmental concern were not identified in this area. The refined area of investigation (Site) is the portion of the parcel west of Big Dukes Lane, adjacent to River Highway, as shown on **Figure 2**.

The following report summarizes a geophysical survey and describes our subsurface field investigation at the site. The report also presents onsite soil analyses to evaluate potential soil contamination within Parcel 020, the Promenade on the Lake, LLC property.

1.1 Site History

This parcel does not appear on the North Carolina Department of Environment and Quality (NCDEQ) Underground Storage Tank (UST) Section Registry but has two open incidents (incident #8301 and #14975) as discovered in a file review at the NCDEQ Mooresville Regional office. Incident #8301 is located in the southern portion of the parcel by Lake Norman at the Pier Marina & Campground. That incident occurred November 15, 1990 and is located far out of the area of investigation for this PSA.

The second parcel incident, Incident #14975, stems from a gas station formerly located in the southwest quadrant of the intersection of Big Dukes Lane and River Highway. Four USTs were closed by removal in 1995 from two UST beds. Concord Industrial Service Company, Inc. was the tank removal contractor with Boyle Consulting Engineers, PLLC (BCE) as the oversight consultant. BCE's UST Closure Report (August 1995) documented three UST removed from the western tank bed (4,000-gallon Diesel tank, two 4,000-gallon gasoline tanks) and one 1,000-gallon Kerosene tank removed from the eastern UST bed. The eastern tank bed and dispenser island former features are within the area of investigation, while the western former UST bed was predominantly beyond the easement as shown in Figure 2.

Field screening by BCE with a flame ionization detector (FID) identified levels exceeding 10,000 parts per million near the dispenser island. Analytical results for the soil samples at the main tank excavation indicated concentrations ranging from less than 1.0 mg/kg Total Petroleum Hydrocarbons (TPH) to 27 mg/kg.

At the kerosene UST, the samples results indicated a concentration of 14 mg/kg TPH. Analytical results for samples by the line and dispenser indicated notable concentrations from 5,000 to 5,100 mg/kg for volatile organic compounds as analyzed by Method 5030. One of the soil borings was converted to a temporary monitoring well and a groundwater sample was collected. Laboratory analytical results indicated contaminants were not detected above laboratory reporting limits within the groundwater sample.

Per NCDEQ's request, a follow on investigation was conducted by BCE and a resultant Report of Initial Site Characterization was issued in November 1995. BCE advanced nine

soil borings to depths from 16 feet to 49 feet bgs. Nine soil samples and one groundwater sample were analyzed for petroleum hydrocarbon constituents. The groundwater sample contained less than 2 ug/L (parts per billion) of BTEX and VOCs and less than 6 ug/L of total xylenes. BCE conducted a water well receptor survey within 1,500 feet of the subject site. Five private water supply wells were identified within 1,500 feet of the subject site.

Shield Environmental Associates, Inc. (Shield) prepared a May 2000 Subsurface Investigation during which one soil boring near the former UST basin area was conducted. Soil boring GP-1 was advanced to a depth of 28 feet bgs. Groundwater was not encountered. Soil samples from GP-1 were analyzed for VOCs by EPA method 8260, SVOCs by EPA method 8270, and Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) using the Massachusetts Department of Environmental Protection (MADEP) Method. Laboratory analysis indicated concentrations in soil sample GP-1 were above the Soil to Groundwater Maximum Soil Contaminant Concentrations (MSCC). Soil boring GP-1 was sampled at 19 to 20 feet bgs.

In September 2002, a Site Investigation Results was produced by Environmental Science and Technologies (Duke Energy). Duke Energy targeted hot spots of contamination identified from the BCE 1995 reports. In September 2002, Duke Energy advanced seven borings on the site and screened with a PID. Nine soil samples were analyzed for volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC). Laboratory analysis identified high levels of 1,3,5-trimethylbenzene (4500 ug/kg) and p-isopropyltoluene (1100 ug/kg) in the shallow soils (4-8 feet). Other elevated levels of VOCs (2-butanone, MIBK and 2-henanone) were reported as deep as 36 feet bgs indicating vertical contamination migration. Laboratory analysis showed the other soil samples having low to non-detect concentrations, indicating little horizontal contamination migration. Excerpts from the UST Closure report and other related documents are included in **Appendix A**.

1.2 Site Description

The Site is currently vacant and contains concrete pad remnants of a demolished gas station and convenience store. A golf cart distributor is located within a one-story building on the northeastern portion of the parcel and is not within the area of investigation. A

marina, located at the southern tip of the parcel, borders Lake Norman and is also outside the area of investigation.

The Site is located in a mixed-use commercial and residential area of Mooresville in Iredell County and is comprised of approximately 16.6 acres. At the time of the PSA field implementation, the area of investigation consisted of gravel, grass, and the concrete pad remnants of the former gas station and convenience store. The general topography of the Site is sloping toward the south. Photographs taken of the site are included in **Appendix B**.

2.0 GEOLOGY

2.1 Regional Geology

The Site is located within the Charlotte Terrane of the Piedmont Physiographic Province of North Carolina. According to the 1985 State Geologic Map of North Carolina, the area is underlain by massive to weakly foliated granitic rock of Devonian/Ordovician age, locally pinkish and containing the mineral hornblende.

2.2 Site Geology

Site geology was observed through the drilling of 16 shallow direct push probe soil borings and advancement of three hand auger soil borings (P20B1 to P20B19). Figure 2 presents the boring locations and site layout. Borings did not exceed a total depth of 10 feet bgs, with the exception of P20B16 being advanced to 15 feet bgs. Soils encountered in the borings consisted mostly of orange, red to brown silty clay underlain by tan to brown silt. Staining was not observed in the soil borings. Groundwater was not encountered in the soil borings. Based on observations of topography of the site vicinity, the groundwater flow direction is inferred to be generally to the south and southwest toward Lake Norman. Boring logs are presented in **Appendix C**.

3.0 FIELD ACTIVITIES

3.1 Preliminary Activities

Prior to commencing field sampling activities at the site, several tasks were accomplished in preparation for the subsurface investigation. A Health and Safety Plan (HASP) was created including the site-specific health and safety information necessary for the field activities. North Carolina One Call was contacted on November 5, 2018 to report the proposed drilling activities and subsequently notify all affected utilities for the parcel. GEL Solutions (GEL) was procured by Wood to perform utility locating and perform a geophysical survey at the Site. Innovation Environmental Technologies, Inc. (IET) of Concord, North Carolina was retained by Wood to perform the direct push sampling for soil borings and RED Lab instrumentation was scheduled.

Wood understands that acquisition of the right-of-way is necessary for the widening of River Highway. Boring locations were strategically placed within the parcel to maximize the opportunity to encounter potential contaminated soil.

3.2 Site Reconnaissance

Wood personnel performed a site reconnaissance on September 21, 2018. During the site reconnaissance, the area was visually examined for the presence of any areas/obstructions that could potentially affect the subsurface investigation. Significant obstructions were not noted during the reconnaissance.

3.3 Geophysics Survey Results and Utility Locating

The geophysical survey of the site occurred between October 15 and 25, 2018. GEL performed an electromagnetic (EM) survey of the site with a ground penetrating radar (GPR) survey conducted across select EM anomalies. Time domain electromagnetic methodology (TDEM) was also utilized to measure electrical conductivity of subsurface materials. GEL's complete geophysical report is presented as **Appendix D**. GEL identified one subsurface geophysical anomaly within the limits of investigation that indicated a possible UST. This anomaly was found in the southeastern portion of the investigation

area, west of Big Dukes Lane. Soil borings P20B17 through P20B19 were advanced by hand auger by Wood personnel within the anomaly outline. Auger refusal was encountered in soil boring P20B17 at 4.5 feet bgs due to gravel. Soil borings P20B18 and P20B19 were advanced to 5 feet bgs without hindrance. Staining was not observed and petroleum odors were not detected in soils collected from these three hand augered soil borings. Other anomalies represented in the data are indicative of known metallic surface features and/or cultural interference.

In advance of drilling activities, GEL performed utility locating at the site on October 15, 2018 through October 25, 2018. GEL identified gas line and telecommunication utilities in the subsurface at the site along River Highway. Gel also identified an unknown utility by the central portion of the site near the existing concrete pads. Overhead distribution powerlines were located along the northern portion of the site along River Highway.

3.4 Soil Sampling

Wood conducted drilling activities at the site on November 12, 2018. Wood's drilling subcontractor, IET, advanced 16 direct push soil borings across the area of investigation to an approximate depth of 10 feet bgs, with the exception of boring P20B16 which was advanced to a depth of 15 feet bgs. Figure 2 presents the Site Map with boring locations and identifications.

The purpose of soil sampling was to determine if past petroleum releases had impacted the site and if so, to estimate the volume of impacted soil that might require special handling during construction activities. Wood conducted field screening of the soil borings for VOCs with a photoionization detector (PID) at approximate two-foot intervals. The soil interval exhibiting the highest PID reading was retained from each boring for analysis of total petroleum hydrocarbons (TPH)-diesel range organics (DRO), TPH-gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylene (BTEX), total aromatics, and polycyclic aromatic hydrocarbons (PAH) soil via on-site ultraviolet fluorescence (UVF). Twenty-two total samples were collected from the site from the borings for UVF on-site analysis.

Hand augered soil borings P20B17 to P20B19 were advanced by Wood personnel on January 15, 2019 to explore a geophysical anomaly. PID readings and samples were not taken from these borings.

4.0 SOIL SAMPLING RESULTS

Based on PID field screening and UVF hydrocarbon analysis, evidence of petroleum hydrocarbon impacts was identified in one boring (P20B16-13-15) within the area of investigation.

Elevated PID readings, above ten parts per million (ppm), were detected in samples collected from P20B16 between 10 and 12 feet bgs at 25.3 ppm and between 13 to 15 feet bgs at 178.5 ppm. Other PID screening readings did not exceed ten ppm. The PID field screening results are summarized in **Table 1** and provided on the boring logs in Appendix C.

Results from the onsite UVF petroleum soil analyses are presented in **Table 2**, with instrument generated tables in **Appendix E**. Several categories of analyses were measured such as: DRO, GRO, TPH, PAHs, and total aromatics. **Figure 3** presents the GRO and DRO results at each boring.

Elevated TPH values above the NCDEQ Action Limits of 50 milligrams per kilogram (mg/kg) for GRO were detected in one sample P20B16-13-15 (67 mg/kg) from the 16 borings advanced at the site. Elevated TPH values above the NCDEQ Action Limits of 100 milligrams per kilogram (mg/kg) for DRO were detected in the same sample, P20B16-13-15 (334.8 mg/kg). The hydrocarbon analyses results from the QED QROS Hydrocarbon Analyzer are provided in Appendix E.

5.0 CONCLUSIONS

Based on site observations and UVF onsite analysis, petroleum-impacted soil contamination was identified above the NCDEQ Action level of 100 mg/kg for DRO and 50 mg/kg for GRO and the NCDEQ DWM MSCCs at soil boring P20B16 at depth 13 to 15 feet during the field activities.

The following bulleted summary is based upon Wood's evaluation of field observations, and onsite quantitative analyses of samples collected from the Site on November 12, 2018.

- This parcel in the area of proposed highway widening activities has multiple uses. The area of investigation is unoccupied and consists of the concrete remnants of a former gas station and convenience store and a gravel parking lot. A golf cart sales store and marina are located on the parcel, and are to the east outside of the area of investigation of this assessment.

- Results of the geophysical survey identified one geophysical anomaly as a possible UST at the most southeastern portion of the Site, just west of Big Dukes Lane. Three hand augered borings were advanced within the identified boundaries of the anomaly. Stained soils or petroleum odors were not observed in soils collected from these hand auger borings. Metallic objects that could indicate a possible UST were not encountered in these hand auger borings. Wood did not observe evidence for a possible UST at this location through these hand auger borings although a quartz gravel layer was observed.

- Removal of four former USTs was reported in a UST Closure Report obtained from a file review from the NCDEQ Mooresville office. The closure report indicated that four USTs were removed August 1995; one 4,000-gallon Diesel tank, two 4,000-gallon gasoline tank and one 1,000-gallon Kerosene tank for two UST beds.

- For this PSA, 19 soil borings were advanced to an approximate depth of 10 feet bgs, with the exception of shallower hand auger borings P20B16 through P20B19. Groundwater was not encountered in soil borings during this assessment. Samples from the soil borings were screened at two-foot intervals in the field with a PID.

Elevated PID readings, above ten ppm, were identified in two samples in soil boring P20B16. P20B16-13-15 indicated the highest reading at 178.5 ppm.

- Elevated TPH values above the NCDEQ Action Limit of 50 mg/kg for GRO were detected in soil boring P20B16-13-15 (67 mg/kg).
- Elevated TPH values above the NCDEQ Action Limit of 100 mg/kg for DRO were detected in soil boring P20B16-13-15 (334.8 mg/kg).
- The estimated area of impacted soils is shown on **Figure 4**. The estimated impacted soil volume for the area is 37 cubic yards near boring P20B16 at a depth of 13 to 15 feet bgs. Soil contamination may exist beyond 15 feet bgs, however vertical delineation beyond this depth is outside of the scope of this assessment.

6.0 RECOMMENDATIONS

Petroleum impacted soil above the NCDEQ Action Limits for GRO and DRO was identified during the investigation at a depth likely below road construction. However, if petroleum-impacted soil is intercepted during the road construction activities it should be excavated and disposed offsite.

TABLES

Table 1
PID Field Screening Results
R-2307B, Parcel 20, Promenade On The Lake, LLC-Iredell County
Mooresville, North Carolina

SAMPLE ID	Sample Date	Sample Depth (feet bgs)	PID Screening (ppm)
P20B1-0-2	11/12/2018	0-2	0
P20B1-8-10	11/12/2018	8-10	8.3
P20B2-0-2	11/12/2018	0-2	0
P20B2-6-8	11/12/2018	6-8	0
P20B3-2-4	11/12/2018	2-4	0
P20B3-8-10	11/12/2018	8-10	0
P20B4-0-2	11/12/2018	0-2	0
P20B5-2-4	11/12/2018	2-4	0
P20B6-2-4	11/12/2018	2-4	0
P20B7-2-4	11/12/2018	2-4	0
P20B8-4-6	11/12/2018	4-6	1.0
P20B9-2-4	11/12/2018	2-4	0
P20B10-4-6	11/12/2018	4-6	0.1
P20B11-2-4	11/12/2018	2-4	0
P20B12-2-4	11/12/2018	2-4	0
P20B12-8-10	11/12/2018	8-10	6.2
P20B13-2-4	11/12/2018	2-4	0
P20B14-2-4	11/12/2018	2-4	0
P20B15-2-4	11/12/2018	2-4	0
P20B16-2-4	11/12/2018	2-4	0
P20B16-8-10	11/12/2018	8-10	3.1
P20B16-13-15	11/12/2018	13-15	178.5
		Prepared By/Date	DRH 11/28/18
		Checked By/Date	RFS 12/12/18

Notes: PPM = Parts Per Million
ft bgs = feet below ground surface

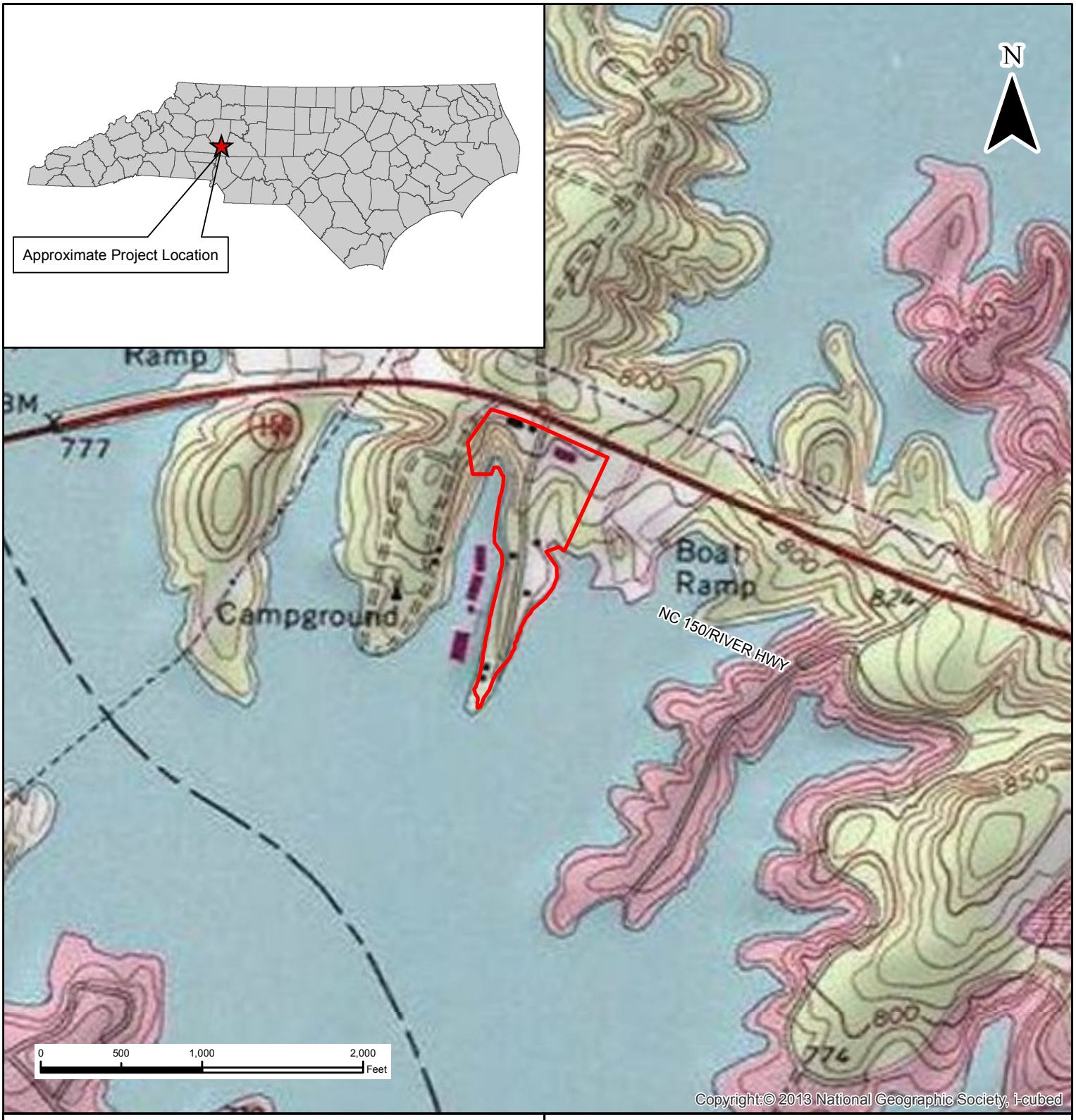
Table 2
UVF Petroleum Soil Results, 11/12/2018
R-2307B, Parcel 20, Promenade On The Lake, LLC-Iredell County
Mooresville, North Carolina

Sample ID Number	Sample Depth (ft bgs)	BTEX (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	PAHs (mg/kg)
NC State Action Level	**NA**	**NA**	**50**	**100**	**NA**
P20B1-0-2	0-2	<0.28	<0.28	0.28	<0.09
P20B1-8-10	8-10	<0.29	1.4	0.9	<0.09
P20B2-0-2	0-2	<0.24	<0.24	<0.24	<0.08
P20B2-6-8	6-8	<0.29	<0.29	<0.29	<0.09
P20B3-2-4	2-4	<0.26	<0.26	<0.26	<0.08
P20B3-8-10	8-10	<0.21	<0.21	<0.21	<0.07
P20B4-0-2	0-2	<0.24	<0.24	<0.24	<0.08
P20B5-2-4	2-4	<0.25	<0.25	0.25	<0.08
P20B6-2-4	2-4	<0.24	<0.24	0.49	<0.08
P20B7-2-4	2-4	<0.21	0.87	0.21	<0.07
P20B8-4-6	4-6	<0.27	<0.27	<0.27	<0.09
P20B9-2-4	2-4	<0.21	<0.21	<0.21	<0.07
P20B10-4-6	4-6	<0.27	<0.27	<0.27	<0.09
P20B11-2-4	2-4	<0.23	<0.23	<0.23	<0.07
P20B12-2-4	2-4	<0.17	<0.17	<0.17	<0.05
P20B12-8-10	8-10	<0.23	1.6	13.8	0.15
P20B13-2-4	2-4	<0.29	<0.29	<0.29	<0.09
P20B14-2-4	2-4	<0.23	<0.23	0.23	<0.07
P20B15-2-4	2-4	<0.31	<0.31	0.83	<0.1
P20B16-2-4	2-4	<0.34	<0.34	<0.34	<0.11
P20B16-8-10	8-10	<0.24	1.4	5.9	<0.08
P20B16-13-15	13-15	<0.27	**67**	**334.8**	0.71

NOTES:
(mg/kg) = Millograms per kilogram
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
PAHs = Polycyclic Aromatic Hydrocarbon
ft bgs = feet below ground surface
Bold font indicates exceedence of NC State Action Levels
NA= Not applicable

Prepared By/Date DRH 11/26/18
Checked By/Date RPD 12/5/18

FIGURES



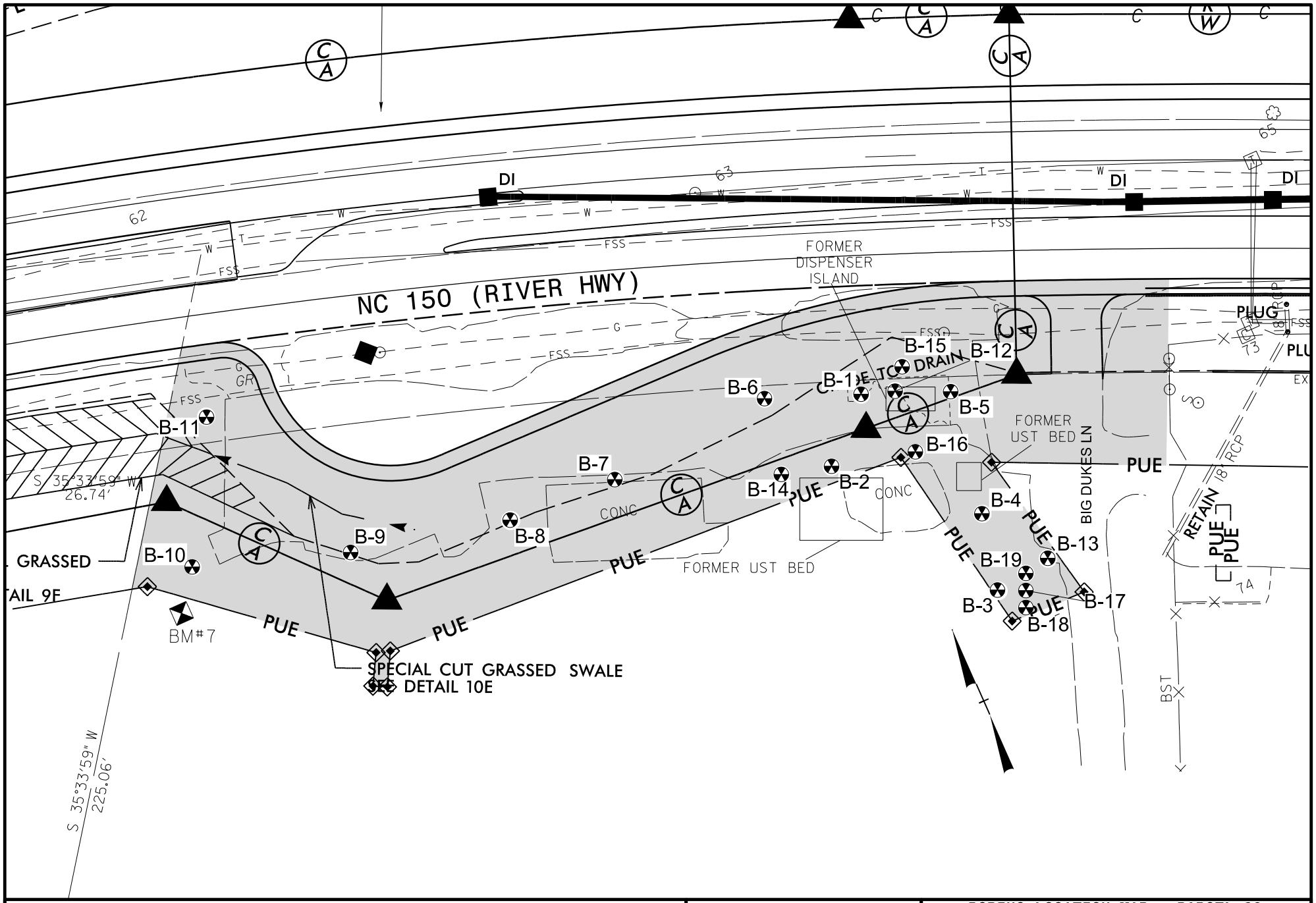
wood.

VICINITY MAP

Parcel 020
Promenade on the Lake, LLC
1479 NC 150 (River Hwy)
Mooresville, North Carolina

Site Boundary

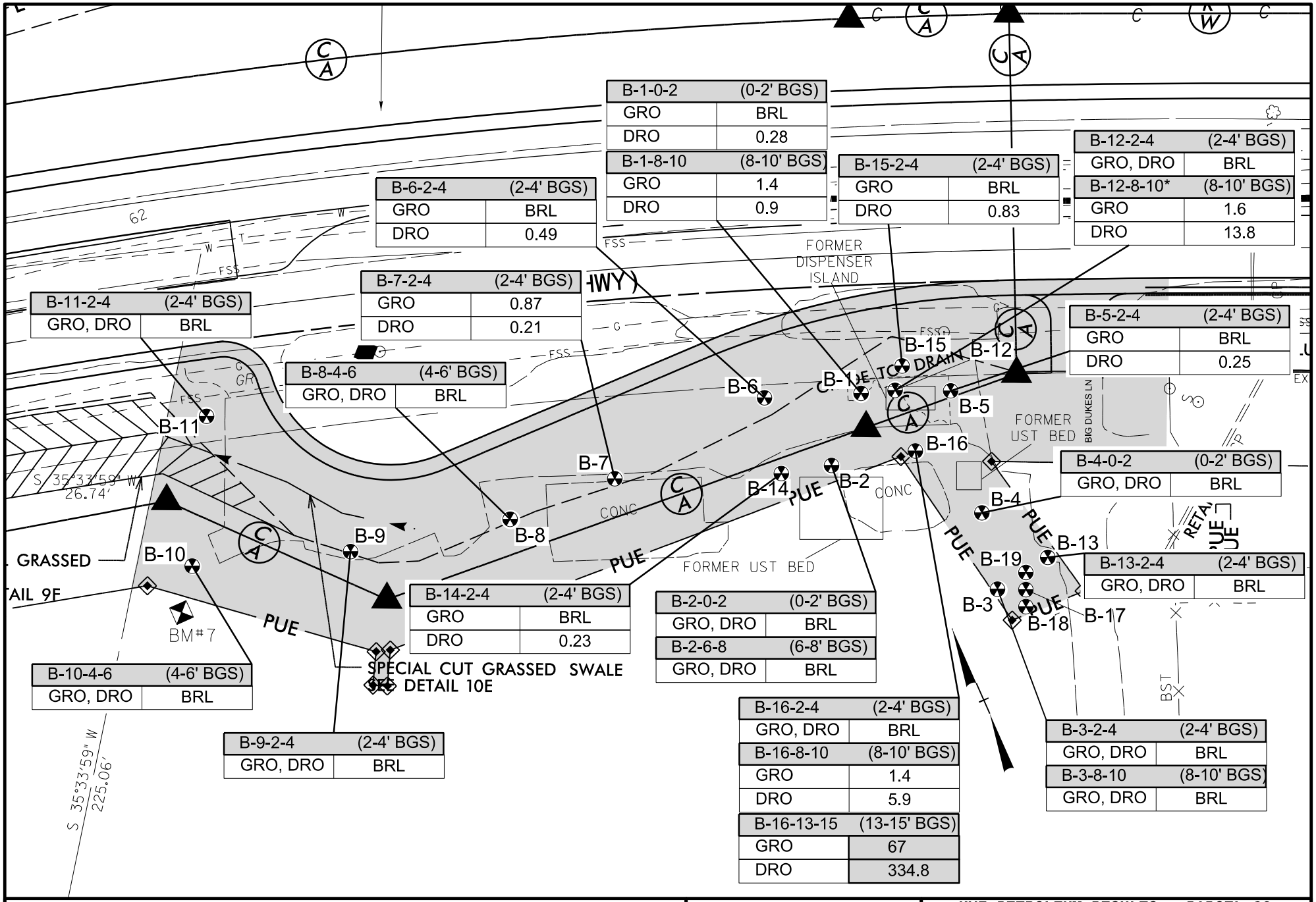
Prepared By: LMM Date: 9/20/2018	Checked By: AJF Date: 9/20/2018	Project No.: 188322307	Figure No.: 1



wood.

BORING LOCATION MAP - PARCEL 20
PROMENADE ON THE LAKE, LLC - R-2307B
1479 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LMM	01/16/19	HPC	01/16/19	188322307	2



AREA OF INVESTIGATION

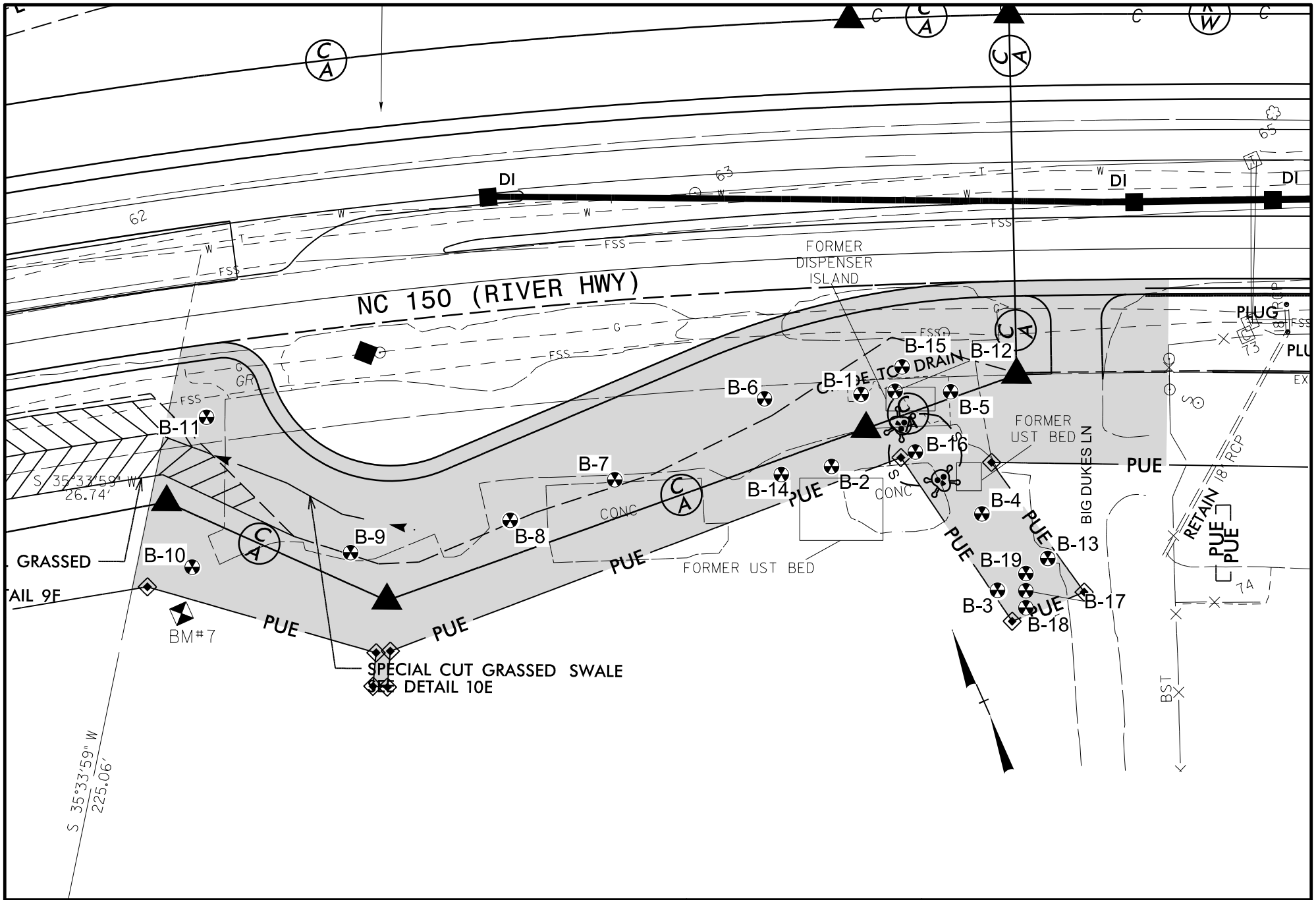
BORING LOCATION
GRO=GASOLINE RANGE ORGANICS
DRO=DIESEL RANGE ORGANICS
PAH=POLYCYCLIC AROMATIC HYDROCARBONS
CONCENTRATIONS SHOWN IN MILLIGRAMS PER KILOGRAMS (mg/kg)
SHADED CONCENTRATIONS EXCEED NCDEQ STATE ACTION LIMITS
BGS=BELOW GROUND SURFACE
BRL=BELOW REPORTING LIMIT

25′ 0′ 25′ 50′
12.5′
(ENGLISH)

wood.

UVF PETROLEUM RESULTS - PARCEL 20
PROMENADE ON THE LAKE, LLC - R-2307B
1479 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LMM	01/30/19	HPC	01/30/19	188322307	3



wood.

KNOWN CONTAMINATION AREA - PARCEL 20
PROMENADE ON THE LAKE, LLC - R-2307B
1479 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LMM	01/30/19	HPC	01/30/19	188322307	4

APPENDIX A
HISTORICAL REPORTS AND DOCUMENTS

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, North Carolina 28210
Phone/Fax (704)552-6740

UNDERGROUND STORAGE TANK CLOSURE REPORT

GW/UST-12

FORMER PIER, MARINA AND CAMPGROUND CONVENIENCE STORE
NC HIGHWAY 150 AT BIG DUKE LANE
MOORESVILLE, NORTH CAROLINA

Prepared for:

KENNEDY COVINGTON LOBDELL & HICKMAN, L.L.P.
CHARLOTTE, NORTH CAROLINA

Prepared by:

BOYLE CONSULTING ENGINEERS, PLLC
CHARLOTTE, NORTH CAROLINA

August 28, 1995

UNDERGROUND STORAGE TANK CLOSURE REPORT

The closure report should contain, at a minimum, the following information. Any other information that is pertinent to the site should be included.

I. General Information

A. Ownership of UST(s)

1. **Name of UST owner:** Mr. Charles Neill (deceased)

2. **Owner address and telephone number:**
Pier Marina, Inc.
509 East Avenue, S.W.
Hickory, NC 28602
No Telephone Number

B. Facility Information

1. **Facility name:** Pier, Marina & Campground

2. **Facility ID #:** None

3. **Facility address, telephone number and county:**
NC Highway 150 @ Big Duke Lane
Mooresville, NC 28115
No Phone Number Available
Iredell County

August 2, 1995

Note: Land Owner is Crescent Resources, Inc.
400 South Tryon Street, Suite 1300
Charlotte, NC 28201-0110
(704) 382-1867

C. Contacts

1. **Name, address, telephone number and job title of primary contact person:**

Mr. Brooks Boyd, Director of Property Management
Crescent Resources, Inc.
400 South Tryon Street, Suite 1300
Charlotte, NC 28201-1003
(704) 382-2387 Phone

2. **Name, address and telephone number of closure contractor:**

Concord Industrial Service Company, Inc.
607 Wateroak Drive
Concord, NC 28027
(704) 788-1787

3. **Name, address and telephone number of primary consultant:**

Boyle Consulting Engineers, PLLC
2610 Merrywood Road, Suite 200
Charlotte, NC 28210
(704) 573-2420 or (704) 552-6740

4. Name, address, telephone number, and State certification number of laboratory:

Prism Laboratories, Inc.
449 Springbrook Road
Charlotte, NC 28217

Post Office Box 240543
Charlotte, NC 28224-0543
(704) 529-6364

State of North Carolina Certification Number: 402

D. UST Information

Tank no.	Installation dates	Size in Gallons	Tank Dimensions	Last Contents	Previous Contents (if any)
S-1	Unknown	4,000	5'4" x 24'	Gasoline/Diesel	
S-2	Unknown	4,000	5'4" x 24'	Gasoline/Diesel	
S-3	Unknown	4,000	5'4" x 10'	Gasoline/Diesel	
S-4	Unknown	1,000	4' x 10'	Kerosene	

E. Site Characteristics

1. Describe any past releases at this site:

Assessment activities conducted in 1990 indicated a release from the UST system at the service station facility. Soil samples were obtained from four borings at the site and submitted for analysis for Total Petroleum Hydrocarbons, volatile and semivolatile constituents. Soil samples were also screened by an Organic Vapor Analyzer (OVA). One of the four soil samples yielded readings greater than 1,000 ppm. Samples from the remaining three soil borings yielded readings less than 10 ppm. No groundwater was encountered during collection of three of the soil samples. One of the soil borings was converted to a temporary observation well. Groundwater was encountered at 47 feet below ground surface. One groundwater sample was collected from the temporary observation well and analyzed for purgable aromatics by EPA Method 602. Laboratory analysis of the groundwater sample did not detect any contaminants. A report entitled "Report of Environmental Consulting Services," dated December 13, 1990, was issued by Law Engineering which summarized the findings.

2. Is the facility active or inactive at this time? If the facility is inactive note the last time the USTs were in operation:

The facility is inactive.

3. Describe surrounding property use (for example, residential, commercial, farming, etc.)

The property surrounding the site is primarily light commercial, residential or undeveloped. The property is bounded on the east by a commercial building and on the south by a trailer park. The property immediately west is undeveloped. Development has recently commenced immediately north of the site.

4. Describe site geology/hydrogeology

The site is located within the Piedmont Physiographic Province of the Central Piedmont of North Carolina. The soils in the area are primarily saprolitic in nature and are underlain by fractured igneous rocks, primarily granites, gabbros and metagabbros. The saprolitic soils are the result of in in-place weathering of bedrock and the subsequent breakdown of associated minerals. Common constituents include clays, from the breakdown of feldspars, mafic and ultramafic minerals and quartz sand.

The soils surrounding the tanks appeared to be native fill materials. The upper four feet of the excavation consisted of a very stiff red clay. Below four feet, weathered saprolite lenses were observed in the main (location of the 4,000 gallon USTs) tank excavation and along the dispenser and line excavation. Saprolite encountered in the line and dispenser excavation contained a relatively larger amount of quartz sand than the saprolite observed in the tank excavation. The excavated soils were yellowish-orange to red moderately fine silty clays in the main tank excavation area. The soil at kerosene tank excavation consisted of a very stiff red clay. The excavated soils at the line and dispenser location were very stiff red clay to four feet below ground surface. Below four feet the soils consisted of a yellowish-orange moderately sandy silt to silty clay.

No groundwater was encountered during our excavation activities.

II. Closure Procedures

A. Describe preparations for closure including the steps taken to notify authorities, permits obtained and the steps taken to clean and purge the tanks

Boyle Consulting Engineers, PLLC (BCE) contacted the Mooresville Regional Office of the North Carolina Division of Environmental Management on June 28, 1995 to inform that office of our intent to close the USTs by removal. Mr. Icenhour submitted, in person, the required GW/UST-3, Notice of Intent: UST Permanent Closure of Change-In-Service form.

BCE contacted the Iredell County Fire Marshall on June 28, 1995 to inform them of our intent to remove underground storage tanks.

BCE contacted Mr. Jean Hesse of the Iredell County Inspections Department on June 28, 1995 and procured the appropriate permits for the UST removal.

BCE contacted ULOCO on June 28, 1995 to arrange for the location of any utilities on-site.

B. Note the amount of residual material pumped from the tank(s):

The USTs were empty at the time of closure. No records regarding when product was last removed from the USTs is available.

C. Describe the storage, sampling and disposal of the residual material:

No information concerning removal and disposal of residual materials from the USTs is available.

D. Excavation

Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" on limiting excavations. The Trust Fund will not pay for excessive excavation unless it is justified and verified by laboratory results.

1. Describe excavation procedures noting the condition of the soils and the dimensions of the excavation in relation to the tanks, piping and/or pumps:

Tanks S-1, S-2 and S-3 were spaced approximately 2.5 feet apart and aligned side-by-side in the same tank pit (Figures 2,3; Photograph 2). Tank S-1 reportedly stored diesel fuel, tanks S-2 and S-3 stored gasoline, and tank S-4 stored kerosene. Excavation proceeded by using a trackhoe to excavate down to the top of the tanks. Soils were removed from around the tanks to allow for removal from the excavation. The soils consisted of yellowish-orange moderate to fine silty clays and very stiff red clays, typical of much of the Piedmont Physiographic Province of North Carolina. Commencement of excavation activities began at the main tank pit area. Upon commencement of excavation activities, no petroleum odors were observed. The depth to the top of tanks S-1, S-2 and S-3 was approximately 3 feet below ground surface (BGS); to the top of Tank S-4, two feet BGS. FID readings from grab samples indicated readings ranging from 10.5 ppm to 63.8 ppm for tanks S-1, S-2 and S-3. FID readings for tank S-4 ranged from 8.3 ppm to 195 ppm. FID samples were also taken immediately below tanks S-1, S-2 and S-3, along the centerline of the former tank locations. Samples were taken at each end of the tank and one sample was taken at the center of the tank. FID readings below Tanks S-1 and S-2 yielded readings ranging from 15.1 ppm to 35.3 ppm. FID readings from the samples taken at tank S-3 yielded readings from 108 ppm to >10,000 ppm, indicating a potential for petroleum contaminated soil. Along the former location of tank S-3 an additional 2 feet of soil was excavated and placed on and covered with plastic sheeting. Three additional FID samples were obtained and analyzed. FID readings ranged from 16.2 ppm to 23.0 ppm. The final dimensions of the excavation for tanks S-1, S-2 and S-2 were approximately 26'W x 32'L x 11'D (Figure 2). The final dimensions for the tank S-4 excavation were 8'W x 12'L x 6'D (Figure 2).

Upon removal of the three, 4,000 gallon USTs, the lines and dispenser pad was removed. Excavation began along the centerline of the former lines and dispenser location (Photograph 6). Two soil samples were obtained at 1 foot BGS and analyzed. FID readings from both the dispenser and lines were greater than 10,000 ppm. The soils from the dispenser and line "trench" were placed on and covered with plastic sheeting. The trench was deepened by one foot with the excavated soils being placed on plastic. Two additional soil samples were obtained and analyzed. FID readings were greater than 10,000 ppm.

A second trench was excavated approximately four feet south and topographically down-gradient of the original trench location. The purpose in excavating this trench was to determine the horizontal extent of the contamination relative to the original trench. Three soil samples were obtained at evenly spaced intervals along the trench and analyzed by FID. These samples were taken approximately 1 foot BGS and yielded readings ranging from 10.2 ppm to 13.9 ppm. The

trench was deepened to 2 feet BGS and sampled at evenly spaced intervals. Three samples analyzed yielded readings ranging from 8.6 ppm to 68.7 ppm

A third trench was excavated north and topographically up-gradient of the original trench location. This trench was excavated to 2 feet BGS and sampled screened at evenly spaced intervals. The three soil samples analyzed yielded readings ranging from 4.6 ppm to 7.0 ppm.

At this point the original trench was deepened to 4 feet BGS and samples were field-screened as indicated previously. Three soil samples analyzed yielded readings greater than 10,000 ppm. Samples taken from the east end of the dispenser wall (DE-1, DE-2, E) yielded readings ranging from 2025 ppm to >10,000 ppm. A noticeable change in lithology was observed at approximately 4.5 feet to 5 feet BGS in the line excavation. The upper 4 four feet of the excavation consisted of a very stiff red clay. Below this interval the lithology consisted of weathered saprolitic soils, containing a high amount of quartz sand (Photograph 6). An additional sample (F) was taken at a depth of approximately 8 feet from the excavated in the area of the original trench with the highest FID readings. This sample yielded a reading of greater than 10,000 ppm. Because of the lithologic variation encountered below four feet BGS and the potential for generating large volumes of soil, excavation was discontinued and the trench and dispenser pad areas backfilled with clean, off-site material.

The final dimensions of the line area were approximately 8'W x 30'L x 5'D.

2. Note the depth of tank burial(s) (from land surface to top of tank):

Tanks S-1, S-2 and S-3 were approximately 3 feet below ground surface. Tank S-4 was approximately 2 feet below ground surface.

3. Quantity of soil removed:

The approximate quantity of soil removed from the excavations was 125 tons.

4. Describe soil type(s):

The soils appeared to be native fill materials and ranged from yellowish-orange moderately fine silty clays to very stiff red clay. Since no attempt was made to extend the excavation beyond the original fill material, geologic logs were not prepared, however, sample descriptions are included in Appendix I.

5. Type and source of backfill used:

Fill materials consisted of uncontaminated soils taken from the excavation and clean fill which was brought from an off-site source. The off-site material consisted of greenish-gray moderately fine silty sand.

E. Contaminated Soil

Note: Suspected contaminated soil should be segregated from soil that appears to be uncontaminated and should be treated as contaminated until proven otherwise. It should not be used as backfill.

1. Describe how it was determined to what extent to excavate the soil:

BCE utilized a Foxboro TVA-1000 Flame Ionization Detector (FID) for screening of soils taken from the excavation. The results of field screening are shown in Figure 3. The results of a Site Sensitivity Evaluation, prepared for the site by BCE, was used to segregate contaminated from uncontaminated soils. The final clean-up target level for low boiling point hydrocarbons (main tank, line and dispenser excavation areas) was 100 parts per million. The final clean-up target level for high boiling point hydrocarbons (kerosene excavation area) was 400 parts per million. Soils exhibiting FID readings above these thresholds were segregated from uncontaminated soils and stored on and covered with plastic sheeting. Excavation was limited to within 5 feet in any direction of the tanks, piping and dispenser as recommended by the March, 1993 *Groundwater Section Guidelines For The Investigation and Remediation of Soils and Groundwater* document.

2. Describe method of temporary storage, sampling and treatment/disposal of soil:

Soil suspected to be contaminated was stored in two stockpiles. These stockpiles were located next to the main tank excavation. The soils were stockpiled on and covered with plastic sheeting and bermed to prevent rainwater run-off from coming in contact with the stockpile. Disposal will be arranged through Cherokee Environmental Group which will arrange for transportation to their facility in Norwood, NC for disposal by incineration.

III. Site investigation

A. Provide information on field screening and observations, include methods used to calibrate field screening instrument(s):

During the excavation process, BCE used a Foxboro TVA-1000 Flame Ionization Detector (FID) to screen soils for the presence of petroleum hydrocarbons. Any staining of soils and odor were noted. The FID measures the amount, in parts per million (ppm) of petroleum and/or solvent vapors in the air. The FID was calibrated by using 500 ppm Methane gas as a standard. The Quality Assurance Data Sheet for the FID calibration is included in Appendix E. Soil samples were taken and placed in a resealable plastic bag an allowed to sit for approximately 10 minutes to allow any petroleum constituents in the soil to partially volatilize, filling the headspace of the plastic bag. The headspace was approximately 25% of the volume of the bag. The actual FID reading is affected by soil characteristics such as moisture, temperature, grain size and by the characteristics of any organic materials present. FID readings are not directly correlatable to laboratory analyses for TPH, however, FID readings typically provide a reasonable relative contamination estimate. Background FID readings are typically less than 50 ppm and readings above this level can be an indication of petroleum contamination. Generally, the higher the FID reading, the higher the concentration of soil contaminants. FID readings, in conjunction with field observations are used to estimate the extent of soil contamination. Soil deemed "contaminated" based on these observations should be stockpiled for proper analytical testing and subsequent disposal, if appropriate.

B. Describe soil sampling points and sampling procedures used, including:
Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" for information about sampling requirements.

- **Location of samples**
- **Type of samples (from excavation, stockpiled soil, etc.)**
- **Sample collection procedures (grab, split spoon, hand auger, etc.)**
- **Depth of soil samples (below land surface)**
- **Whether samples were taken from side or floor of an excavation**
- **Sample identification**
- **Sample analyses**

Soil samples taken for screening by FID and for laboratory analysis were collected for tanks S-1, S-2 and S-3 on July 31, 1995 (Figure 3). Nine soil samples were taken in the main (S-1, S-2 & S-3) tank excavation to be screened by FID. Table 1 lists the sample identifications, sample locations and field screening results. Three equally spaced grab samples were collected at the center line of the excavation floor. Six additional grab samples were collected from the overburden stockpile. The samples are designated by the letters A-N, P. Soil samples were collected on August 1, 1995, for laboratory analysis from the main tank excavation were taken along the center line of the excavation floor, two feet below the former tank locations and between approximately nine to eleven feet below ground surface. Samples were collected by use of a trackhoe. Samples designated for laboratory analysis were labeled T1-1, T1-2, T1-3 for tank S-1; T2-1, T2-2, T2-3 for tank S-2 and T3-1, T3-2, T3-3 for tank S-3 (Figure 4). Samples were analyzed by EPA Methods 5030/3550 for TPH-Gasoline Range Organics (TPH-GRO) and TPH-Diesel Range Organics (TPH-DRO), respectively.

On August 2, 1995, nineteen soil samples were collected along the line and dispenser trenches for field screening by FID. The sample locations and designations are given in Figures 3 & 4 and Table 1. Two soil samples designated D-1 and L-1 were collected from the dispenser and line excavations, respectively. Sample D-1 was taken approximately 4 feet BGS. Sample L-1 was taken approximately 6 feet BGS. These samples were analyzed by EPA Methods 5030/3550 for TPH-Gasoline Range Organics (TPH-GRO) and TPH-Diesel Range Organics (TPH-DRO), respectively.

Four soil samples were collected along the base of the kerosene tank excavation walls for screening by FID. One additional sample was collected from the center line of the former kerosene tank location and similarly screened. These samples are designated KA, KB, KC, KD, and KE and are shown in Figures 3 & 4. One soil sample was obtained for laboratory analysis and designated TK-1. This sample was obtained from the center line of the former tank along the excavation floor and analyzed by EPA Method 3550 for high boiling point fuels. A second soil sample obtained from the floor of the tank excavation was damaged in route to the laboratory and was not submitted for analysis.

C. Describe groundwater or surface water sampling procedures used, including:
Note: Refer to the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" for information about sampling requirements.

- **Location of samples**
- **Sample collection procedures (grab, bailer, etc.)**
- **Sample identification**
- **Sample analyses**

No groundwater was encountered during excavation.

D. Quality control measures

- **Describe sample handling procedures including sample preservation and transportation**
- **Describe decontamination procedures used**
- **Describe time and date samples were collected and date submitted to lab**
- **Describe samples collected for quality control purposes (e.g. duplicates, field blanks, trip blanks, etc.) Include methods used to obtain these samples and analytical parameters.**
- **Discuss how results of quality control samples may have affected your interpretation of soil, groundwater or surface water sample results**

New, clean disposable latex gloves were used in the collection of each soil sample. Samples collected for FID screening were placed in separate, resealable plastic bags. Samples collected for laboratory analysis were placed in laboratory-supplied containers, labeled with the sampler's name, time and date the sample was collected, laboratory analysis to be performed and placed on ice for transportation to a North Carolina certified laboratory for analysis. Proper chain-of-custody procedures were followed. Table 2 summarizes analytical results. Soil samples were collected on August 1 and 2, 1995. No duplicates or field blanks were collected or analyzed. The laboratory data results are consistent with field screening results.

E. Investigation results

- **Describe results of Site Sensitivity Evaluation (SSE), (if SSE was not conducted, explain why not)**
- **Describe methods of analyses used (include U.S. EPA method number)**
- **Describe analytical results for samples; discuss in relation to site specific cleanup level or action level, as appropriate**

A Site Sensitivity Evaluation was completed for the site. A completed copy of the SSE is included in Appendix G. The total site characteristics score was calculated as 20, yielding an initial clean-up level for low boiling point fuels of 100 ppm. The site was classified as a category B site, yielding a final clean-up level of 100 ppm. The final SSE score for high boiling point fuels was calculated at 400 ppm.

Soil samples were analyzed for low boiling point fuels by EPA Method 5030; TPH-Gasoline Rang Organics (TPH-GRO) and for high boiling point fuels by EPA Method 3550; TPH-Diesel Rang Organics (TPH-DRO). Analytical results for the soil samples were consistent with our field screenin results. Table 2 summarizes the laboratory results. Analytical results for soil samples obtained from th main tank excavation ranged from <1.0 mg/kg Total Petroleum Hydrocarbons to 27 mg/kg (parts p million) TPH. The soil sample taken from the kerosene tank excavation was analyzed by EPA Meth 3550 and yielded a reading of 14 mg/kg TPH. Soil samples from the line and dispenser were analyzed Methods 3550/5030 yielded results ranging from 244 mg/kg to 900 mg/kg by Method 3550 and fr 5,000 mg/kg to 5,100 mg/kg by Method 5030.

include probable sources of contamination, further investigation or remediation tasks, or whether no further action is required.

Analytical results from both the main tank excavation and kerosene tank excavation areas indicate no further action is warranted.

Comparison of laboratory analytical results with the SSE final clean-up levels indicates that contaminant levels exceed these target clean-up levels in the line and dispenser areas. The vertical and horizontal extent of soil contamination has not been determined along the former line and dispenser location. Due to the varying subsurface lithology, especially below four feet BGS, we recommend additional soil borings be installed and soil samples analyzed to determine vertical and horizontal extent of contamination to help determine the most technologically and economically feasible method of remediation.

V. Signature of Professional Engineer or Licensed Geologist

☐ **Professional Engineer Registration #:**
☒ **Licensed Geologist License #: 883**

VI. Enclosures

A. Figures

1. **Area Map(s) (can be USGS Topographic Quadrangle) showing:**
   - **Adjacent streets, roads, highways with names and numbers**
   - **Buildings**
   - **Known distance to public water supply well(s)**
   - **Distance to known private water supply well(s)**
   - **Surface water bodies**
   - **Groundwater flow direction (if available)**
   - **Scale**
   - **North arrow**

2. **Site map of UST excavation area drawn to scale, showing:**
   - **Buildings**
   - **Underground utilities such as sewer lines and other conduits**
   - **Orientation of UST(s), pumps, and product lines**
   - **Length, diameter and volume of USTs**
   - **Type of material(s) stored in USTs (currently and previously)**
   - **Sample locations (identified by letter or number)**
   - **Final limits of excavation**
   - **North arrow**
   - **Scale**

3. **Maps depicting analytical results, to include:**

- Orientation of UST(s), pumps, and product lines
- Sample locations, depths, and identifications
- Analytical results
- Final limits of excavation(s)

B. Tables

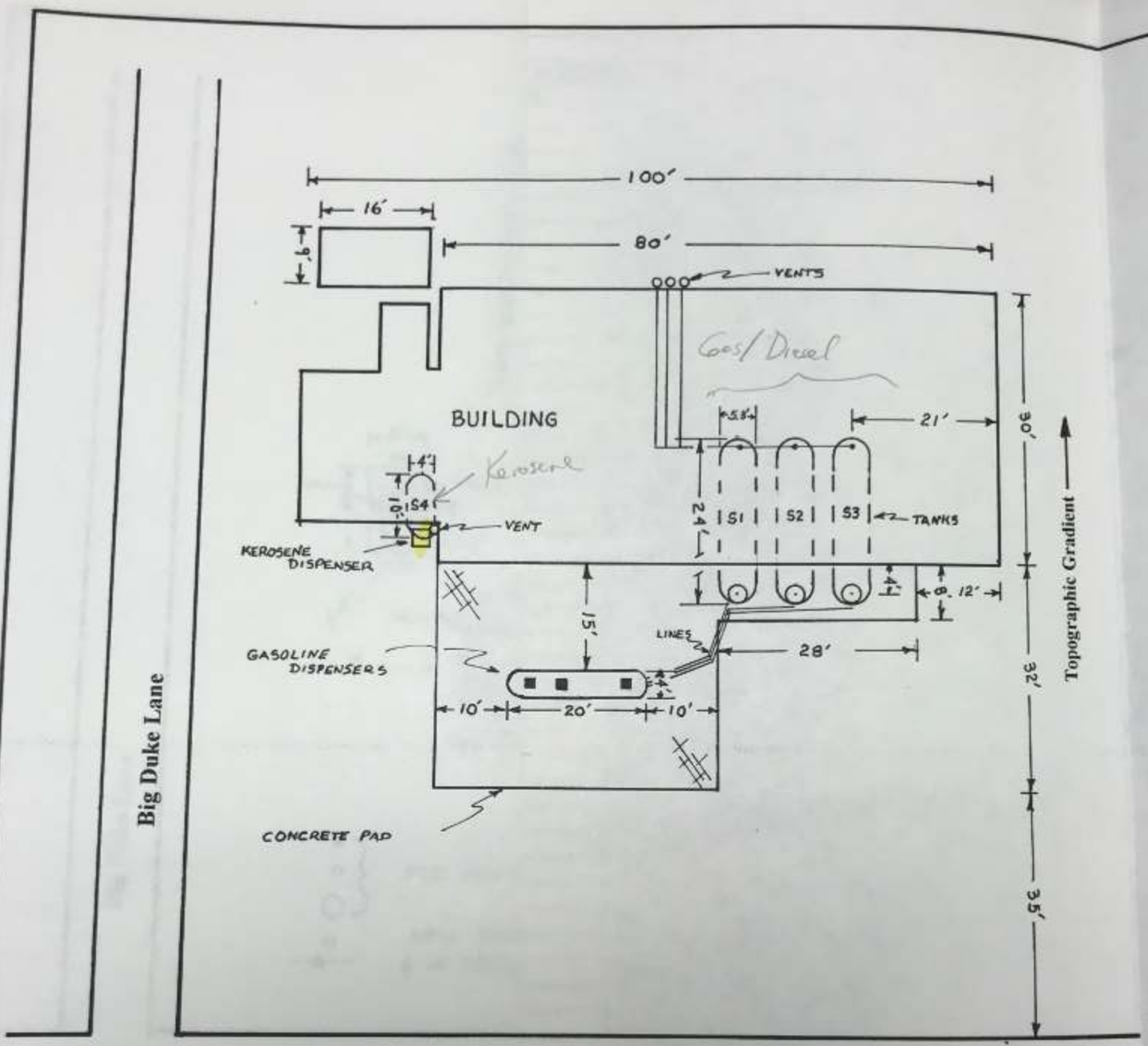
1. Field screening results
2. Sample identifications, depths and analyses
3. Sample identifications with results and dates that samples were taken

C. Appendices

Appendix A: Notification of intent to close (GW/UST-3)
Appendix B: Site Investigation Report for Permanent Closure or Change-in-Service of (GW/UST-2)
Appendix C: Certificate of tank disposal
Appendix D: Soil, water, sludge disposal manifests
Appendix E: Complete chain-of-custody records
Appendix F: Copy of all laboratory analytical records
Appendix G: Site Sensitivity Evaluation (SSE) (if applicable)
Appendix H: Photographs of Closure Activities (optional)
Appendix I: Geologic logs for excavation(s)

TABLE 1 - FIELD SCREENING RESULTS		
SAMPLE ID	**RESULTS - PPM**	**LOCATION**
FID A; T3-1	311; 19.2	9' Below Ground Surface; 11' BGS
FID B; T3-2	>10,000; 16.2	9' Below Ground Surface; 11' BGS
FID C; T3-3	108; 23.0	9' Below Ground Surface; 11' BGS
FID D	35.3	9' Below Ground Surface
FID E	15.1	9' Below Ground Surface
FID F	17.1	9' Below Ground Surface
FID G	28.3	9' Below Ground Surface
FID H	16.4	9' Below Ground Surface
FID I	20.5	9' Below Ground Surface
FID TGS-1	10.2	1' Below Ground Surface
FID TGS-2	13.9	1' Below Ground Surface
FID TGS-3	11.7	1' Below Ground Surface
FID TGS-4	9.3	2' Below Ground Surface
FID TGS-5	8.6	2' Below Ground Surface
FID TGS-6	68.7	2' Below Ground Surface
FID TGS-8	5.2	2' Below Ground Surface
FID TGS-9	7.0	2' Below Ground Surface
FID TGS-10	4.6	2' Below Ground Surface
FID LA	>10,000	1' Below Ground Surface
FID DA	>10,000	1' Below Ground Surface
FID LB	>10,000	2' Below Ground Surface
FID DB	>10,000	2' Below Ground Surface
FID DE-1	3975	2' Below Ground Surface
FID LC	>10,000	3' Below Ground Surface
FID DC	>10,000	3' Below Ground Surface
FID DE-2	>10,000	3' Below Ground Surface
FID E	2025	4' Below Ground Surface
FID F	>10,000	8' Below Ground Surface
FID KA	12.8	3' Below Ground Surface
FID KB	20.9	3' Below Ground Surface
FID KC	8.3	3' Below Ground Surface
FID KD	195	3' Below Ground Surface
FID KE	13.1	6' Below Ground Surface, Bottom of Tank
FID J	16.4	Stockpile, Main Tank Excavation
FID K	10.5	Stockpile, Main Tank Excavation
FID L	63.7	Stockpile, Main Tank Excavation
FID M	63.8	Stockpile, Main Tank Excavation
FID N	46.7	Stockpile, Main Tank Excavation
FID P	11.1	Stockpile, Main Tank Excavation

TABLE 2 - LABORATORY ANALYSIS RESULTS				
SAMPLE ID Date	**TYPE**	**METHOD**	**RESULTS (mg/kg)**	**LOCATION**
T1-1; 8/1/95	Soil	5030	7.0	9' Below Ground Surface
	Soil	3550	<10.0	
T1-2; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T1-3; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-1; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-2; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-3; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T3-1; 8/1/95	Soil	5030	<1.0	11' Below Ground Surface
	Soil	3550	<10.0	
T3-2; 8/1/95	Soil	5030	<1.0	11' Below Ground Surface
	Soil	3550	<10.0	
T3-3; 8/1/95	Soil	5030	27	11' Below Ground Surface
	Soil	3550	27	
L-1; 8/2/95	Soil	5030	5,000	6' Below Ground Surface
	Soil	3550	900	
D-1; 8/2/95	Soil	5030	5,100	4' Below Ground Surface
	Soil	3550	244	
TK-1; 8/2/95	Soil	3550	14	6' Below Ground Surface


100'
16'
6'
80'
VENTS
Gas/Diesel
BUILDING
5.8'
21'
30'
4'
Kerosene
10'
S4
VENT
24'
S1
S2
S3
TANKS
KEROSENE DISPENSER
4'
9'
12'
15'
LINES
28'
GASOLINE DISPENSERS
4'
10'
20'
10'
32'
CONCRETE PAD
35'
Topographic Gradient
Big Duke Lane
NC 150
10'
20'
N

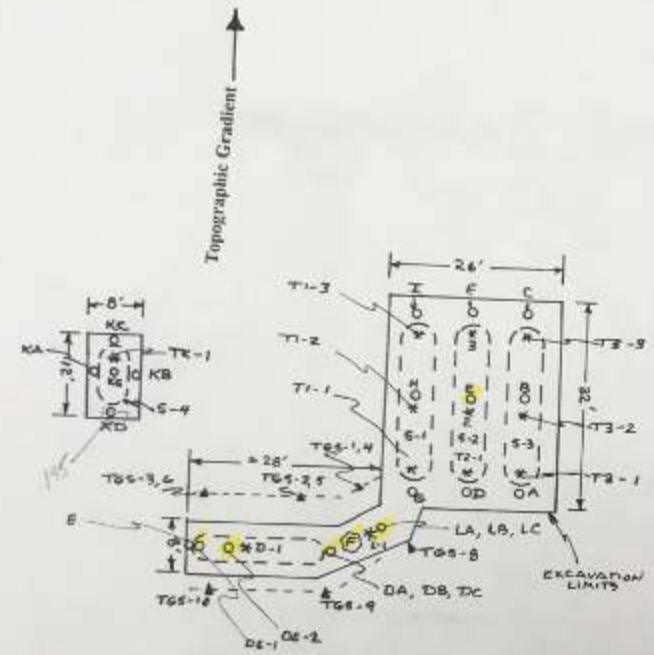


TABLE 1 - FIELD SCREENING RESULTS

SAMPLE ID	RESULTS - PPM	LOCATION
FID A, T3-1	311, 19.2	9' Below Ground Surface, 11' BGS
FID B, T3-2	>10,000, 16.2	9' Below Ground Surface, 11' BGS
FID C, T3-3	108, 23.0	9' Below Ground Surface, 11' BGS
FID D	35.3	9' Below Ground Surface
FID E	15.1	9' Below Ground Surface
FID F	17.1	9' Below Ground Surface
FID G	28.3	9' Below Ground Surface
FID H	16.4	9' Below Ground Surface
FID I	20.5	9' Below Ground Surface
FID TGS-1	10.2	1' Below Ground Surface
FID TGS-2	13.9	1' Below Ground Surface
FID TGS-3	11.7	1' Below Ground Surface
FID TGS-4	9.3	2' Below Ground Surface
FID TGS-5	8.6	2' Below Ground Surface
FID TGS-6	68.7	2' Below Ground Surface
FID TGS-8	5.2	2' Below Ground Surface
FID TGS-9	7.0	2' Below Ground Surface
FID TGS-10	4.6	2' Below Ground Surface
FID LA	>10,000	1' Below Ground Surface
FID DA	>10,000	1' Below Ground Surface
FID LB	>10,000	2' Below Ground Surface
FID DB	>10,000	2' Below Ground Surface
FID DE-1	3975	2' Below Ground Surface
FID LC	>10,000	3' Below Ground Surface
FID DC	>10,000	3' Below Ground Surface
FID DE-2	>10,000	3' Below Ground Surface
FID E	2025	4' Below Ground Surface
FID F	>10,000	8' Below Ground Surface
FID KA	12.8	3' Below Ground Surface
FID KB	20.9	3' Below Ground Surface
FID KC	8.3	3' Below Ground Surface
FID KD	195	3' Below Ground Surface
FID KE	13.1	6' Below Ground Surface, Bottom of Tank
FID J	16.4	Stockpile, Main Tank Excavation
FID K	10.5	Stockpile, Main Tank Excavation
FID L	63.7	Stockpile, Main Tank Excavation
FID M	63.8	Stockpile, Main Tank Excavation
FID N	46.7	Stockpile, Main Tank Excavation
FID P	11.1	Stockpile, Main Tank Excavation

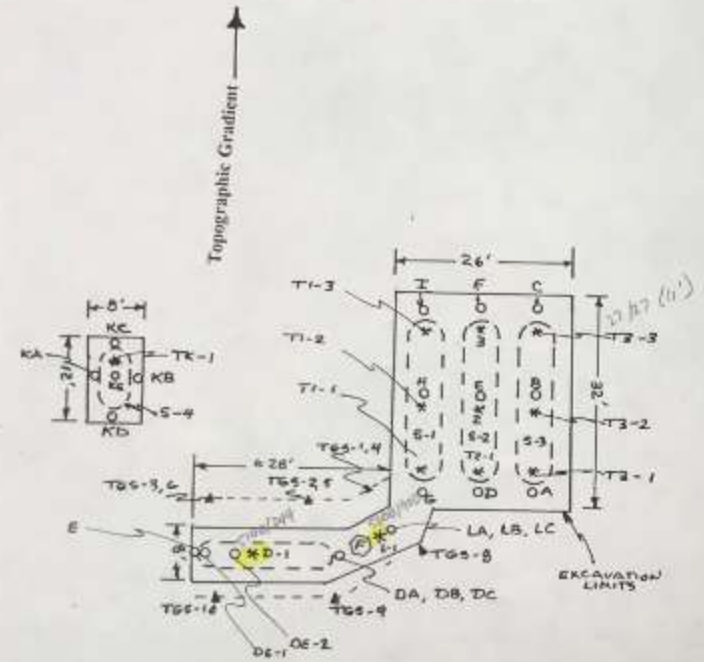
CRESCENT RESOURCES, INC.
Pier & Marina Convenience Store Site UST Removal

SCALE 1" = 20'
DATE August 2, 1995
BCE Job No. 95-145B
DRAWN BY
REVISED

SOIL SAMPLING LOCATIONS & FIELD SCREENING (FID) RESULTS

DRAWING NUMBER 3

BOYLE CONSULTING ENGINEERS, PLLC



Big Duke Lane

NC 150

TABLE 2 - LABORATORY ANALYSIS RESULTS				
SAMPLE ID Date	TYPE	METHOD	RESULTS (mg/kg)	LOCATION
T1-1; 8/1/95	Soil	5030	7.0	9' Below Ground Surface
	Soil	3550	<10.0	
T1-2; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T1-3; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-1; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-2; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T2-3; 8/1/95	Soil	5030	<1.0	9' Below Ground Surface
	Soil	3550	<10.0	
T3-1; 8/1/95	Soil	5030	<1.0	11' Below Ground Surface
	Soil	3550	<10.0	
T3-2; 8/1/95	Soil	5030	<1.0	11' Below Ground Surface
	Soil	3550	<10.0	
T3-3; 8/1/95	Soil	5030	27	11' Below Ground Surface
	Soil	3550	27	
L-1; 8/2/95	Soil	5030	5,000	6' Below Ground Surface
	Soil	3550	900	
D-1; 8/2/95	Soil	5030	5,100	4' Below Ground Surface
	Soil	3550	244	
TK-1; 8/2/95	Soil	3550	14	6' Below Ground Surface

CRESCENT RESOURCES, INC.
Pier & Marina, Convenience Store Site UST Removal

SCALE 1" = 20'	BCE Job No. 95-145B	DRAWN BY
DATE August 2, 1995		REVISED

SOIL SAMPLING LOCATIONS & LABORATORY RESULTS

BOYLE CONSULTING ENGINEERS, PLLC | DRAWING NUMBER

THIS IS AN AMENDED FORM - ORIGINAL SUBMITTED 6-28-95

GW/UST-3

Notice of Intent: UST Permanent Closure or Change-In-Service

FOR TANKS IN **NC**

Return Completed Form To:
The appropriate DEM Regional Office according to the county of the facility's location. [SEE REVERSE SIDE OF OWNER'S COPY (PINK) FOR REGIONAL OFFICE ADDRESS].

State Use Only
I. D. Number
Date Received

INSTRUCTIONS
Complete and return five (5) working days prior to closure or change-in-service.

I. OWNERSHIP OF TANK(S)

Tank Owner Name: DON MATTHEWS
(Corporation, Individual, Public Agency, or Other Entity)
Street Address: ROUTE 8, BOX 646
County: IREDELL
City: MOORESVILLE State: NC Zip Code: 28115
Tele. No. (Area Code): N/A

II. LOCATION OF TANK(S)

Facility Name or Company: PIER MARINA & CAMPGROUND
Facility ID # (if available):
Street Address or State Road: ROUTE 8, BOX 646
County: IREDELL City: MOORESVILLE Zip Code: 28115
Tele. No. (Area Code): NONE

III. CONTACT PERSON

Name: BROOKS BOYD Job Title: DIR. PROPTY. MGMT Telephone Number: (704) 382-2387

IV. TANK REMOVAL, CLOSURE IN PLACE, CHANGE-IN-SERVICE

1. Contact Local Fire Marshall.
2. Plan the entire closure event.
3. Conduct Site Soil Assessments.
4. If Removing Tanks or Closing in Place refer to API Publications 2015 "Cleaning Petroleum Storage Tanks" & 1604 "Removal & Disposal of Used Underground Petroleum Storage Tanks".
5. Provide a sketch locating piping, tanks and soil sampling locations.
6. Fill out form GW/UST-2 "Site Investigation Report for Permanent Closure" and return within 30 days following the site investigation.
7. The **site assessment** portion of the tank closure must be conducted under the supervision of a Professional Engineer or Licensed Geologist. After January 1, 1994, **all closure site assessment reports must be signed and sealed by a P.E. or L.G.**
8. Keep closure records for 3 years.

V. WORK TO BE PERFORMED BY:

(Contractor) Name: CONCORD INDUSTRIAL SERVICES
Address: 607 WATEROAK DR. State: CONCORD, NC Zip Code: 28027
Contact: MALCOLM WHITLEY Phone: (704) 788-1787
Primary Consultant: BOYLE CONSULTING ENGRS Phone: (704) 573-2420

VI. TANK(S) SCHEDULED FOR CLOSURE OR CHANGE-IN-SERVICE

TANK ID#	TANK CAPACITY	LAST CONTENTS	PROPOSED ACTIVITY: CLOSURE – Removal	CLOSURE – Abandonment In Place	CHANGE-IN-SERVICE – New Contents Stored
M-1	4,000 gal	GASOLINE	X		
M-2	4,000	GASOLINE	X		
M-3	4,000	GASOLINE	X		
S-1	4,000	DIESEL	X		
S-2	4,000	GASOLINE	X		
S-3	4,000	GASOLINE	X		
S-4	1,000	KEROSENE	X		

VII. OWNER OR OWNER'S AUTHORIZED REPRESENTATIVE

Print name and official title
GREG D. ICENHOUR, PG MANAGING PRINCIPAL *Scheduled Removal Date: 7/5/95

Signature: Greg D Icenhour Date Submitted: 6-29-95 (ORIGINALLY) RESUBMITTED 8/7/95

*If scheduled work date changes, notify your appropriate DEM Regional Office 48 hours prior to originally scheduled date

GW/UST-3 (Rev. 05/94) White Copy - Regional Office Yellow Copy - Central Office Pink Copy - Owner

Photograph 1: General Site Conditions Prior to Excavation

Photograph 2: Main Tank Excavation, Tanks S-1, S-2 & S-3. Vent piping in background; product lines to far left. View is to the southeast.

ographs taken by Greg Icenhour on August 1, 1995

Photograph 3: Tank S-1 (Diesel)

Photograph 4: Tank S-2 (Gasoline)

Photograph 5: Tank S-3 (Gasoline)

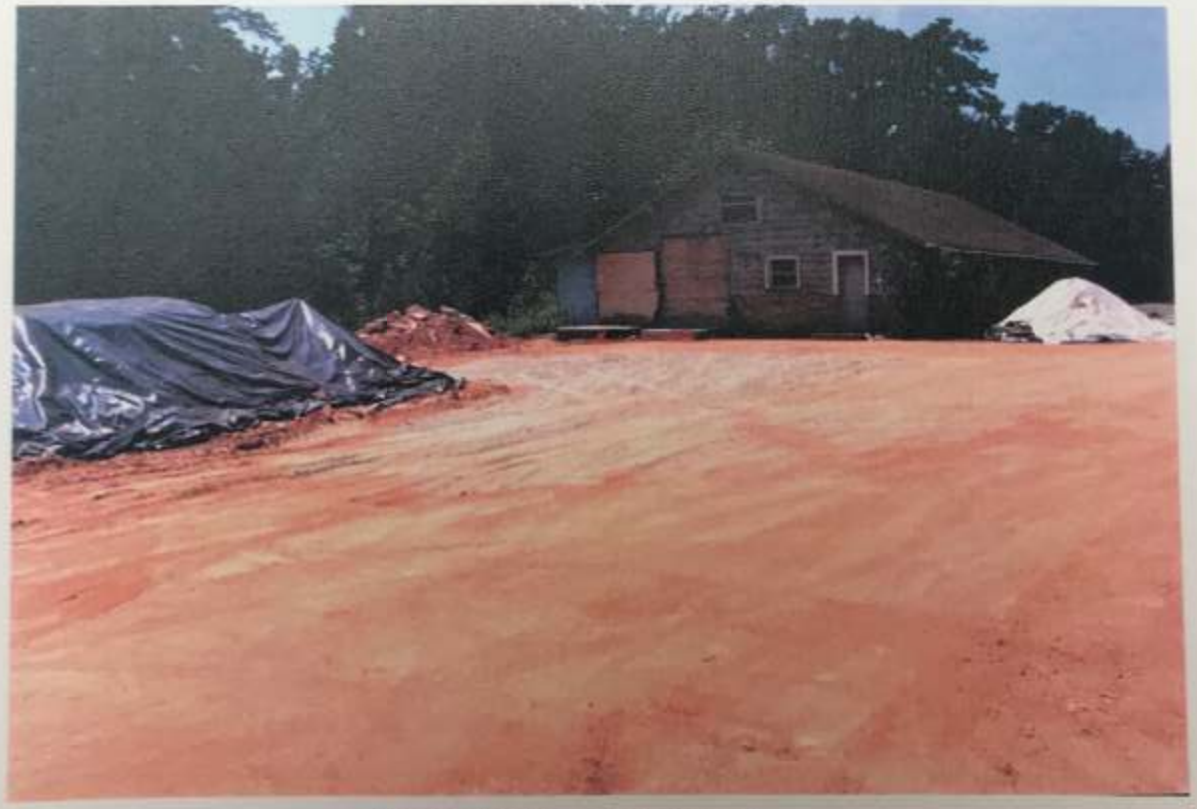
Photographs taken by Malcolm Whitley on August 1, 1995

Photograph 6: Product Lines and Dispenser Excavation

Photograph 7: Tank S-4 (Kerosene) Excavation

Photographs taken by Greg Icenhour on August 2, 1995

Photograph 8: Tank S-4 (Kerosene)



Photograph 9: Final Grade

Photographs taken by Greg Icenhour on August 2 and August 12, 1995

APPENDIX I

GEOLOGIC LOGS FOR EXCAVATIONS (SAMPLE DESCRIPTION)

The following soil sample description is representative of the excavation areas

DEPTH	DESCRIPTION
0" - 4"	asphalt/concrete
4" - 8"	crushed stone
8" - 3.5'	red to orange-red very stiff clay
3.5' - 4.0'	red to yellowish-orange, moderately stiff silty clay
4.0' - 6.0'	yellowish-red to yellowish-orange sandy clay; saprolite lenses, increasing quartz content

State of North Carolina
Department of Environment,
Health and Natural Resources
Mooresville Regional Office

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary

DIVISION OF WATER QUALITY

July 17, 1996

Dear Underground Storage Tank Owner/Operator:

The General Assembly of North Carolina introduced legislation during the 1995 Short Session to address the continued solvency of the Leaking Petroleum Underground Storage Tank Cleanup Funds. The Underground Storage Tank (UST) Senate Bill 1317 (SB 1317) was ratified on June 21, 1996. SB 1317 requires the Department of Environment, Health, and Natural Resources (Department) to rank all UST-related contamination incidents according to the Department's revised Site Priority Ranking System which classifies sites as: A, B (highest priority), C, D or E (lower priority). Further, SB 1317 requires the Department to notify the UST owner, operator and/or other responsible party (RP), as applicable, of the ranking of their site. Please find below a statement notifying you of the priority ranking the Department has assigned to your site.

Your site has been assigned a priority ranking score of:

BROOKS BOYD
Site:PIER MARINA & CAMPGROUND (CONV.
Incident #: 14975 County: IR
Rank: B

SB 1317 temporarily suspends the requirement to cleanup a discharge or release from a petroleum UST for lower priority sites (i.e., those ranked C, D or E). This legislation is effective July 21, 1996. Therefore, costs for site assessment or corrective actions at C, D or E sites which are incurred after July 21, 1996, will not be reimbursed from either the Commercial or

919 North Main Street,
Mooresville, North Carolina 28115
FAX 704-663-6040

DIVISION OF WATER QUALITY

March 17, 1997

MEMORANDUM TO: Bill Reid

FROM: Kevin Mieras

THROUGH: Paul Dahlen

SUBJECT: Responsibility for Underground Storage Tanks
Pier Marina and Campground Convenience Store
(Site A) and Gas Docking Facilities (Site B)
NC Hwy 150, Mooresville
Iredell Co., NC

The MRO is requesting your assistance in determining the parties responsible for the contamination at the subject site. Affidavits and letters are enclosed for your review.

Property Ownership and Lease History

Property is owned by Crescent Land and Timber Corp., now Crescent Resources, Inc.

1/1/72 Crescent Land and Timber Corp. leases the land to Pier Marina, Inc. for a period to end December 31, 1991 with an option to renew for a further term of twenty years. Two items stated in the lease that may be relevant to assigning a responsible party are:

a. lessee may construct improvements upon the leased premises and at the termination of the lease these improvements shall become the property of the lessor; and

b. lessee shall pay to the lessor as additional rental per year the sum of three percent of the dollar sum of all gasoline sales (except this said 3% shall not apply to those sales from the two existing pumps located within 100 feet of NC Highway 150 and incidental to the existing store operation), less only federal and state excise taxes and sales taxes.

9/25/79 Pier Landing, Inc. began operation of the tanks at Site B. Pier Marina, Inc. subleased the property to Pier Landing, Inc.

1/15/91 The MRO received a report of soil and groundwater sampling was conducted at the request of Crescent Resources, Inc. Soil contamination was documented to be present at Site A. Soil and groundwater contamination were documented to be present at Site B. The report does not state whether product was removed from USTs at either site.

2/1/91 The lease with Pier Marina, Inc. was terminated (refer to the enclosed letter dated 2/1/91).

5/15/91 The MRO received from Donald Matthews a signed affidavit. Mr. Matthews stated that on 2/16/82 he purchased stock in Pier Landing, Inc., and that he did not know the installation date of the tanks, but they were on the property when he became a stockholder.

5/31/91 The MRO received from Charles C. Neill a signed affidavit. Mr. Neill stated that he purchased the lease in July 1981, the UST systems at the site were installed prior to his purchase of the lease; at the time he purchased the lease, the facility was subleased by an operator; and he has no record of who installed the USTs, no knowledge of ownership of the USTs, and no knowledge of fuel suppliers.

7/11/95 All three tanks at Site B were permanently closed.

8/1/95 All four tanks at Site A were permanently closed.

1/3/96 The MRO received from Carol Jones Van Buren, on behalf of Crescent Resources, Inc:

a. a letter from George Mathis to Ms. Van Buren stating that Crescent Resources does not appear to be either and owner or operator of USTs at the site, payment of tank operating fees would not be a requirement for accessing the Commercial Fund; the State Trust Fund finds the releases conditionally eligible for reimbursement from the Commercial Trust Fund; and

b. a signed affidavit from Brooks Boyd, on behalf of Crescent Resources, Inc., signed 1/24/94, stating that he did not know when the USTs at the site were last used for storage or dispensing of petroleum products; that Crescent Resources, Inc., the property owner, has not introduced petroleum

products in the USTs, removed petroleum product from the USTs, or used the USTs for storage of petroleum products at any time, specifically including the time since use of the USTs was terminated by their owner; that the lease with Pier Marina, Inc. terminated on 2/1/91; that as far as he knows, no measurable amount of petroleum product was stored in any of the USTs after the tenants ceased use of the USTs.

The UST registration database does not show that any of the seven tanks at subject site have been registered. The position of Carol Jones Van Buren, on behalf of Crescent Resources, Inc. is that the tanks at Site A are "orphan" tanks since Mr. Charles Neill is deceased, and the tanks at Site B are owned by Mr. Donald Matthews.

On November 20, 1995 this office submitted an affidavit request (enclosed) to Crescent Resources, Inc. asking Crescent to address the topics of the history of the property, and ownership and operation of the tanks. Ms. Van Buren responded in a letter dated January 3, 1996 (enclosed) stating that the information requested in the affidavit request is not readily available to Crescent, but the information contained in the affidavit dated January 24, 1994 was readily available. The January 24, 1994 document provides little information regarding the history of the property and USTs.

On March 28, 1996, Mr. Matthews called in response to a letter sent to him from this office dated March 20, 1996 (enclosed). Mr. Matthews stated that Pier Landing, Inc. ran a gas docking facility on the property, and that a percentage of the sales went to Crescent Resources. I instructed Mr. Matthews to respond in writing to the letter submitted by this office dated March 20, 1996. To date, no written response from Mr. Matthews has been received by the MRO.

****

Site History

On November 9, 1990 a site assessment was performed by Law Engineering on behalf of Crescent Resources, Inc. The assessment was documented in the December 13, 1990 report submitted to the DEM. Soil samples taken in the area four USTs at Site A, three 4,000-gallon gasoline/diesel, and one 1,000-gallon kerosene UST showed the concentration of diesel fuel as high as 1,500 ppm. Groundwater was not encountered during sampling at Site A. Soil and groundwater samples were taken around the three 4,000-gallon gasoline tanks located at Site B. Concentrations as high as

2,400 ppm for gasoline are documented. Two borings were made for obtaining groundwater samples. A sample taken from one borehole contained benzene at a concentration of 15,000 ppb, toluene at 38,000 ppb, ethylbenzene at 3,700 ppb and xylene at 21,000 ppb.

A Notice of Federal Requirements and Notice of Violation were issued to Donald Matthews on March 12, 1991 in response to the elevated levels of soil and groundwater contamination at Site B of the property.

A Notice of Federal Requirements and Notice of Violation were issued to Charles Neill on March 12, 1991 in response to the elevated levels of soil contamination at Site A of the property.

Both Mr. Neill and Mr. Matthews subsequently responded with letters and affidavits denying ownership and operation of the tanks (ref. enclosures dated 4/4/91, 4/11/91, 5/3/91, 5/13/91 and 5/30/91).

A file note dated 9/3/92 indicates that Arlen Burney was to meet with representatives of Crescent Resources, Inc. to discuss options available to Crescent. It also states that to date a clear determination of owner and operator has not been determined.

During the months of July and August 1995 Boyle Consulting Engineers, PLLC, on behalf of Crescent Resources, Inc. removed tanks from Sites A and B and submitted closure reports to the MRO. Soil samples taken from Site A showed concentrations of gasoline as high as 5,100 ppm along lines and dispensers. Grab samples were taken from water that infiltrated the excavations at Site B. The concentration of benzene was reported as high as 9,400 ppb, toluene as high as 14,200 ppb, ethylbenzene as high as 1,400 ppb, xylene as high as 8,500 ppb, MTBE as high as 4,500 ppb, and lead as high as 44 ppb. Concentrations of all of these constituents exceed groundwater standards.

After a review of available records, it is my belief that Pier Marina, Inc. and Pier Landing, Inc. were operators of tanks at Sites A and B respectively, and are at least partially responsible for releases from the tanks. Pier Marina, Inc. is not registered as a North Carolina corporation, and as previously mentioned, Charles Neill is deceased. Pier Landing Inc. is a registered corporation, but was administratively dissolved in 1993.

Crescent Resources, while apparently not involved in the daily operation of the tanks during the term of the lease, did receive a percentage of the gasoline sales. The lease entered into January 1, 1972 states that, in addition to improvements becoming the property of the lessor at the termination of the lease, the improvements must be approved of by the lessor prior

to commencement of construction plans. It is reasonable to question the January 3, 1996 letter from Ms. Van Buren in which she states that the information requested in the November 20, 1995 affidavit request is not readily available to Crescent.

It is my belief that Crescent Resources, Inc. should be considered a responsible party to the USTs systems previously located at the subject site, and at least partially responsible for releases from those USTs.

Should you have any questions, please call me at (704) 663-1699, ext. 239.

Enclosures

- Lease agreement between Crescent Land and Timber Corp., now Crescent Resources, Inc. and Pier Marina, Inc. including the amendment
- Letter dated 1/11/91 from Crescent Resources, Inc. to Brenda Smith
- Letter dated 2/1/91 from Crescent Resources to Charles Neill
- Record of Meeting dated 4/4/91
- Letter dated 4/11/91 from Daniel Oakley, representing Donald Matthews, to Jesse Wells
- Letter dated 5/3/91 from Jesse wells to Charles Neill
- Affidavit submitted by Donald Matthews dated 5/13/91
- Affidavit submitted by Charles Neill dated 5/30/91
- Letter dated 6/4/92 from Crescent Resources, Inc. to Arlen Burney
- File note dated 9/3/92
- Letter dated 1/3/96 from Carol Jones Van Buren to Kevin Mieras, including as exhibit A a letter dated 11/22/94 from George Mathis to Carol Jones Van Buren, and as exhibit B an affidavit submitted by Brooks Boyd, on behalf of Crescent Resources, Inc. dated 1/24/94
- Letter dated 3/20/96 from Kevin Mieras to Donald Matthews

NAME :	LOCATION :	CO :	INCIDENT #	ASS :	RANK :	PHAS
PIER MARINA & CAMPGROUND (CONV.	NC 150 @ BIG DUKE LN MRSV	IR	14975	KM	B	FU

QUAD NO.	LAT :	LONG :	GW CONTAM (Y/N)	SOURCE	STATUS :	DATE RPTD :	OCCURRED	RESPONSE :
			N	U	ADDINF	8/30/95	11/15/90	11/17/95

RESPONSIBLE PARTY :	COMPANY :	TELEPHONE :	COMM :	# TANKS :	REG	STF (Y/N)
BROOKS BOYD	CRESCENT RESOURCES, INC.	704-382-2387	Y	4	Y	

LSA DUE:	PHASE	CSA RECV :	CSA REV :	RISK:	CONFRISK:	NEXT ACTION :	NEXT DUE
				H		ASSIGN RP	

LSAREC :	90REC :	CAP RECV :	CAP APP :	INTERCO N:	RBCA:		

LSAREV :	90REV :	TYPE CAP	CAP IMP (Y/N/U)	CLOSE-OUT :	CLOSREQSD	OTHER DUE :	MON RPT :

COMMENTS :

SOIL CONTAM ONLY; ORIG. PIRF BASED ON A SINGLE ANALYSIS . . .

Stanford Beard (704) 331-7595
Feb. req. from Karen for more info from Crescent
Need extension

4/12/94 1:50pm
Called Karen and she said give 30 days - OK.

So I called Stanford to give him a verbal 30 day ext.
Due May 15. CSF

NAME :	LOCATION :	CO :	INCIDENT #	ASS :	RANK :	PHAS
PIER MARINA & CAMPGROUND (LANDI	HWY 150 WEST	IR	08301	KWC	060B	FU

QUAD NO.	LAT :	LONG :	GW CONTAM (Y/N)	SOURCE	STATUS :	DATE RPTD :	OCCURRED	RESPONSE :
M67T	35/36/20	80/55/58	Y	U	AFFIDAV	11/15/90	11/15/90	

RESPONSIBLE PARTY :	COMPANY :	TELEPHONE :	COMM :	# TANKS :	REG	STF (Y/N)
BROOKS BOYD	CRESCENT RESOURCES	704-382-2387	Y	3	Y	

LSA DUE:	PHASE	CSA RECV :	CSA REV :	RISK:	CONFRISK:	NEXT ACTION :	NEXT DUE
				H		SUBMIT AFFIDAVITS	4/18/99

LSAREC :	90REC :	CAP RECV :	CAP APP :	INTERCO N:	RBCA:		

LSAREV :	90REV :	TYPE CAP	CAP IMP (Y/N/U)	CLOSE-OUT :	CLOSREQSD	OTHER DUE :	MON RPT :

COMMENTS :

FOLLOW UP WITH AFFIDAVITS PER MEMO FROM RUTH STRAUS. W . . .

Stanford Beard (704) 331-7595 "requested info letter" needs extension.
gave 30 days per Karen 7/13/99 1:50 pm. CSF

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, North Carolina 28210
Phone/Fax (704)552-6740

REPORT OF INITIAL SITE CHARACTERIZATION

FORMER PIER, MARINA & CAMPGROUND SERVICE STATION

NC HIGHWAY 150

MOORESVILLE, NORTH CAROLINA

Prepared for:

KENNEDY COVINGTON LOBDELL & HICKMAN
CHARLOTTE, NORTH CAROLINA

Prepared by:

BOYLE CONSULTING ENGINEERS, PLLC
CHARLOTTE, NORTH CAROLINA

Boyle Consulting Job Number 95-176

January 29, 1996

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, North Carolina 28210
Phone/Fax (704)552-6740

January 29, 1996

Via Certified Mail - Return Receipt Requested

Mr. Kevin Mieras
North Carolina Department of
Environment, Health and Natural Resources
Division of Environmental Management
919 North Main Street
Mooresville, North Carolina 28105

Subject: **Submittal of Revised Report**
Initial Site Characterization
Crescent Resources, Inc.
Former Pier, Marina and Campground Service Station
NC Highway 150, Mooresville, North Carolina
Boyle Consulting Job Number: 95-176

Dear Mr. Mieras:

In accordance with your letter dated November 17, 1995 to Crescent Resources, Inc., Boyle Consulting Engineers, PLLC (BCE) submits our revision of our original Report of Initial Site Characterization, dated January 17, 1996. Our revised report, dated January 29, 1996, replaces in its entirety our January 17, 1996 submittal and corrects the misunderstanding concerning the units reported for the laboratory data. Our original report mistakenly reported ug/kg (parts per billion) as mg/kg (parts per million).

Changes are reflected in the Executive Summary, pages 3-3, 4-2, 5-1,Table 2, Figures 4 and 5 and Appendix B. The remainder of the report remains as previously submitted.

Please contact Mr. Greg D. Icenhour, P.G., if you have any questions concerning our submittal. Thank you.

Sincerely,

BOYLE CONSULTING ENGINEERS, PLLC

Greg D. Icenhour, P.G. #883
Managing Principal

cc: Carol A. Jones Van Buren, Esquire
Kennedy Covington Lobdell & Hickman

Mr. Brooks Boyd
Crescent Resources, Inc.

EXECUTIVE SUMMARY

Boyle Consulting Engineers, PLLC (BCE) was contracted by Crescent Resources, Inc. to perform additional subsurface investigation of petroleum contaminated soils at the former Pier, Marina & Campground Service Station. This additional investigation was undertaken to comply with a request for additional information from the Mooresville Regional Office of the North Carolina Department of Environment, Health and Natural Resources - Division of Environmental Management (NCDEHNR-DEM). This request was made by Mr. Kevin Mieras on November 17, 1995.

BCE utilized Geoprobe® technology to advance nine soil borings to depths ranging from 16 feet to 49 feet below ground surface. Nine soil samples and one groundwater sample were analyzed for petroleum hydrocarbon constituents. The soil samples were analyzed for total petroleum hydrocarbons - gasoline range organics (TPH-GRO) by EPA Method 5030. The groundwater sample was analyzed for benzene, ethylbenzene, toluene and xylenes (BTEX) by EPA Method 602 and for Volatile Organics by EPA Method 601. Soil sample B3-A contained petroleum constituents greater than the Site Sensitivity Evaluation targeted final clean-up level of 60 mg/kg (parts per million). Seven of the remaining eight soil samples contained less than 1 mg/kg of petroleum constituents, with sample B9-B containing 50.1 mg/kg of petroleum constituents. Laboratory analysis indicates an isolated area of soil contamination generally between 12 feet and 18 feet below ground surface in the area formerly occupied by the UST lines and dispensers. Soil contamination is believed to be contained on-site. The groundwater sample contained less than 2 ug/l (parts per billion) of BTEX and volatile organics and less than 6 ug/l of total xylenes.

1.0 INTRODUCTION

BCE was contracted by Crescent Resources, Inc. to perform additional subsurface investigation at the former Pier, Marina and Campground Service Station located south of the intersection of Big Duke Lane and N.C. Highway 150 in Mooresville, North Carolina (Figure 1). The additional assessment was undertaken to comply with a request by the NCDEHNR-DEM on November 17, 1995. The request was made by Mr. Kevin Mieras of the Mooresville Regional Office after review of an Underground Storage Tank (UST) Closure Report prepared by BCE in August, 1995.

The following information was requested:

- The horizontal and vertical extent of soil contamination along the former line and dispenser location
- The distance from the deepest contamination to the water table
- A sketch showing distances to public and private water supply wells
- A Site Sensitivity Evaluation in accordance with the "Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater" (June, 1993), using information contained in #1 and #2

BCE prepared a scope of work to comply with the request.

2.0 CONTRACTED SCOPE OF WORK

BCE was contracted by Crescent Resources, Inc. to perform the following scope of work as outlined in our Proposal Number 95-176 dated November 28, 1995 and accepted on December 22, 1995:

- Advance several soil borings around the former UST excavation and dispenser lines. These borings will be advanced to between 15 and 25 feet below ground surface. Whole cores will be obtained in six of the borings to better characterize subsurface stratigraphy. Discrete interval samples will be obtained in the remaining wells to further characterize soil types and stratigraphy. These samples will be obtained by use of Geoprobe® technology.

- Field screen soil samples from each boring with an Organic Vapor Analyzer device (OVA)

- Collect the appropriate number of soil samples for laboratory analysis by EPA Method 5030. The number of samples will be determined by Mr. Greg Icenhour, a North Carolina licensed Professional Geologist, who will conduct the field activities. We anticipate between 8 and 10 samples will be required.

- Determine the distance from the deepest soil contamination to the water table as required
- Prepare a Site Sensitivity Evaluation based on additional field data
- Conduct a well receptor survey within 1500 feet of the subject property and prepare a map showing the locations of public and private water supply wells within this radius
- Prepare a written report summarizing our findings. The report will include the appropriate maps and figures as required.

Our observations and findings are documented in the following sections.

3.0 FIELD ACTIVITIES

BCE conducted the following field activities to complete the required scope of work.

3.1 Well Receptor Survey

BCE conducted a water well receptor survey within 1500 feet of the subject site. This survey was conducted using accessible, public and private streets including NC Highway 150, Big Duke Lane and Pinnacle Point Drive. Five private water wells are located within 1500 feet of the subject site. A sketch locating these wells is included as Figure 2. According to Mr. David Duqueman, an adjacent business owner, two abandoned water wells are located on the subject site. BCE could not verify the existence of or location of these wells. One well is supposedly located immediately south of the former convenience store building; another well is supposedly located in the general vicinity of the campground. According to Mr. Duqueman, both of these wells are abandoned. There is the possibility that other wells exist within the search radius which could not be verified by our reconnaissance. New construction of private single-family residences is currently underway immediately north of the subject site. These residences may obtain potable water from newly installed water wells. Municipal water and sewer service is not available in the immediate area.

3.2 Subsurface Investigation

On December 28, 1995, BCE's Mr. Greg Icenhour located 9 boring locations designated as B-2 through B-10 (Figures 3, 4) to determine the vertical and horizontal extent of soil contamination along the former line and dispenser areas. On December 29, 1995, BCE utilized Geoprobe® technology to advance the soil borings to between 16 feet below ground surface (BGS) and 49 feet BGS. Continuous cores were obtained from soil borings B-4, B-5, B-8 and B-10. Discrete interval samples were obtained from soil borings B-2, B-3, B-6, B-7 and B-9. Samples from multiple depths in each boring were screened for the presence of petroleum hydrocarbons. Soil samples used for screening were obtained from various subsurface intervals from the plastic Geoprobe® core barrels. Samples were collected using new, clean disposable latex gloves. Soil samples collected for OVA screening were placed in separate, resealable plastic bags and allowed to sit for 10-15 minutes to allow petroleum constituents in the soil to volatilize. BCE utilized a Foxboro OVA 128 to conduct field screening activities. Table 1 summarizes our field screening results.

BCE collected 9 soil samples for laboratory analysis for gasoline range organics (GRO) by EPA Method 5030. EPA Method 5030 was used due to relatively high GRO analytical results from the UST Closure activity. Since gasoline range organics were the predominant contaminants, the use of Method 5030 yields analytical results which gives an adequate understanding of subsurface impact. Samples were collected from soil borings B-3, B-5, B-6 and B-9 in intervals exhibiting relatively high OVA readings. Samples were collected from the plastic core barrels of the borings using new, clean disposable latex gloves. Soil samples were placed in laboratory-supplied glassware, properly labeled and placed on ice for delivery to a North Carolina certified laboratory for analysis. Chain-of-custody was maintained by BCE until delivered to the laboratory. Laboratory data sheets and chain-of-custody records are included as Appendix A. Table 2 summarizes the laboratory analytical results.

BCE collected one groundwater sample from soil boring B-5. The sample was obtained from approximately 45 feet BGS and placed in laboratory-supplied glassware for analysis of BTEX and volatile organics by EPA Methods 601/602. Laboratory data sheets and chain-of-custody records are included in Appendix A. The laboratory analytical results are summarized in Table 2.

Upon completion of sample acquisition, each boring was filled to surface with clean, on-site fill material. Borings advanced in areas covered by asphalt were grouted at the surface. BCE completed field activities on December 29, 1995.

3.3 Subsurface Geology and Site Characterization

BCE examined the whole cores and discrete interval samples from each boring. Thirty-six soil samples were obtained from these cores and analyzed in the field utilizing an OVA. OVA readings ranged from 0 parts per million (ppm) to >1,000 ppm. Soils from each boring were characterized and range from clays to silty clays and clayey silts. Sand "stringers" were noted in several cores. Relict textures in several saprolitic soils were noted. Vertical foliation planes consisting predominantly of ferromagnesium mineralization were observed in several cores. The soils are variegated in color, ranging from pinkish-brown silty clays to orange brown clayey silts. In general, the orange-brown clayey silts contained more ferromagnesium minerals; the pinkish-brown silty clays contained a higher percentage of feldspars and quartz. Saprolitic intervals contained a slightly higher percentage of sand compared to the clayey silts or silty clays. BCE constructed two isoconcentration contour maps using data generated from the field screening and laboratory analytical results. Figure 3 is based on TPH values from field screening results from the 12' to 18' intervals in each boring. Figure 4 is based on values from laboratory analytical results for TPH-GRO from the 12' to 18' sampling interval. The correlation between maps using the OVA and laboratory analytical data is good. There is no apparent correlation between soil type and amount of contamination.

BCE prepared a Site Sensitivity Evaluation in accordance with NCDEHNR *Groundwater Section Guidelines For The Investigation and Remediation of Soils and Groundwater, March, 1993* based on the soil characterization. A copy of this evaluation is included as Appendix B. BCE calculated a Total Site Characteristics Score of 70. The site is a Category B site, yielding a final clean-up level of 60 parts per million for total petroleum hydrocarbons (TPH).

Generally, OVA field screening readings and laboratory analysis results compared favorably; i.e., higher OVA readings correlated with higher concentrations of petroleum hydrocarbons in soil sample laboratory analytical results. One soil sample yielded analytical results greater than the Site Sensitivity Evaluation target clean-up level of 60 ppm. Soil sample B3-A yielded results of 99.7 milligrams per kilogram (mg/kg) of TPH; soil sample B9-B yielded results of 50.1 mg/kg of TPH. The remaining seven soil samples yielded analytical results of less than 1 mg/kg of TPH. One groundwater sample was obtained at 45 feet BGS and analyzed for BTEX and volatile organics. Laboratory analytical results from this sample yielded readings for all constituents, except total xylenes, (which yielded a reading of less than 6 ug/l) of less than 2 ug/l.

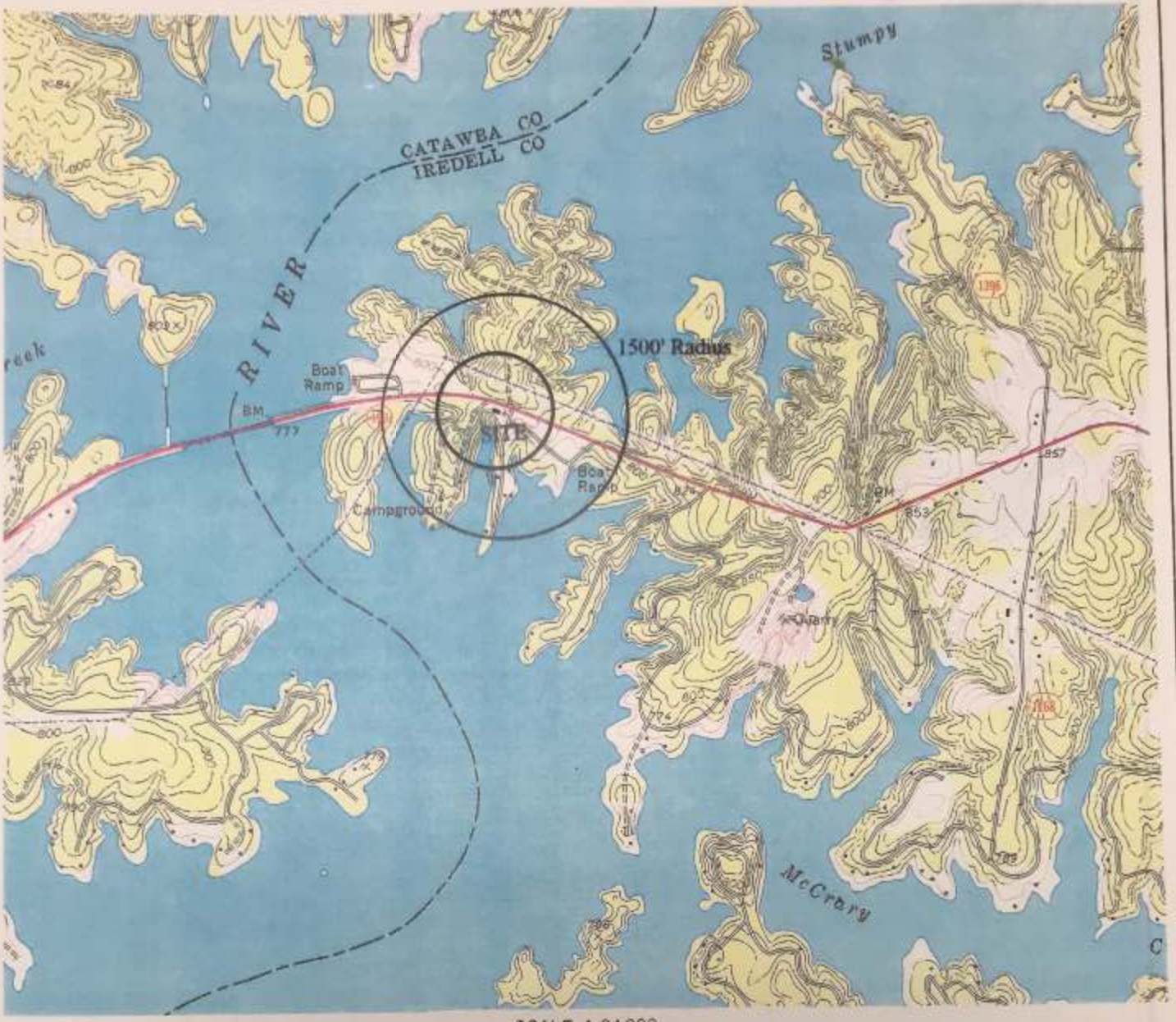
4.0 PREVIOUS ASSESSMENT

BCE reviewed a portion of a report entitled "Report of Environmental Consulting Services", dated December 13, 1990, prepared by Law Engineering. Assessment activities conducted in 1990 indicated a release from the UST system at the service station facility. Soil samples were obtained from four borings at the site and submitted for analysis for Total Petroleum Hydrocarbons, volatile and semivolatile constituents. Soil samples were also screened by an Organic Vapor Analyzer (OVA). Soil sample B-2 yielded field screening results of greater than 1,000 ppm in the interval from 6.0 feet to 20.0 feet. Analytical results from a soil sample taken in the 18.5 - 20.0 foot depth in boring B-2 yielded analytical results of 1,500 ppm TPH. This boring was located in the UST fill port area and would be located within the area of the contaminant plume identified in Figures 3 and 4. correspond to Samples from the remaining three soil borings yielded readings less than 10 ppm. No groundwater was encountered during collection of three of the soil samples. One of the soil borings was converted to a temporary observation well. Groundwater was encountered at 47 feet below ground surface. One groundwater sample was collected from the temporary observation well and analyzed for purgable aromatics by EPA Method 602. Laboratory analysis of the groundwater sample did not detect any contaminants.

5.0 DATA EVALUATION AND CONCLUSIONS

As summarized in Table 2, BCE has documented a release of petroleum hydrocarbons to the environment, determined the vertical and horizontal extent of the release, prepared a Site Sensitivity Evaluation based on our additional assessment and conducted a well receptor survey within a 1,500 foot radius of the subject site.

Laboratory analysis from soil samples obtained from one of nine soil borings indicate that the release is in violation of Title 15A NCAC Subchapter 2N *Criteria and Standards Applicable to Underground Storage Tanks*. Laboratory analyses from nine soil samples indicates an isolated area of soil contamination exists generally between 12 feet to 18 feet below ground surface in the area formerly occupied by UST lines and dispensers. Soil contamination is believed to be contained on-site. Based on laboratory analytical results, groundwater has not been impacted by the release. In-place petroleum-impacted soils should be considered a secondary source of soil contamination.



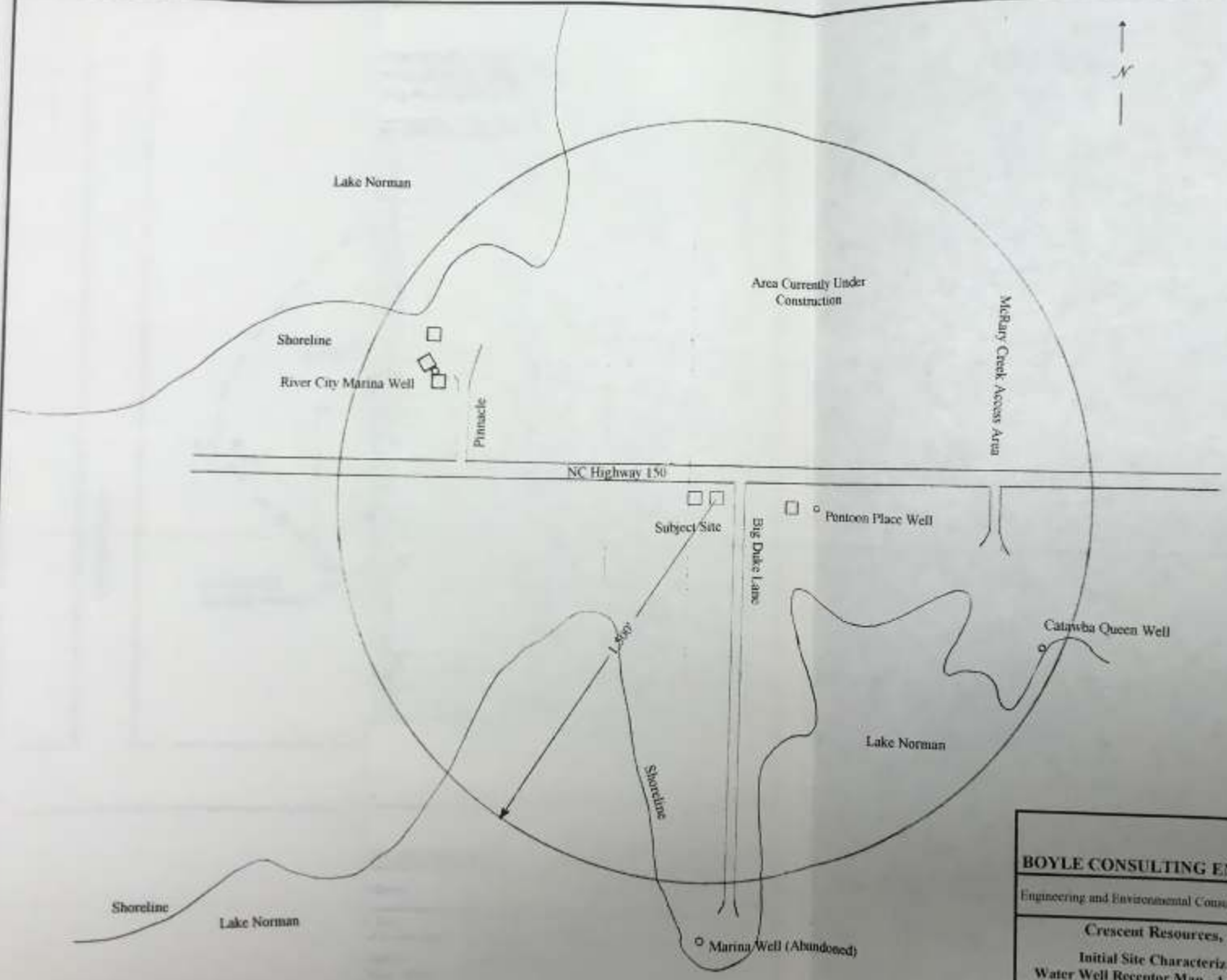
BOYLE CONSULTING ENGINEERS, PLLC

Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, North Carolina 28210
(704) 522-6740

Crescent Resources, Inc. **Former Pier, Marina & Campground Initial Site Characterization** **Site Location & Topographic Map** BCE Job No. 95-176	**DATE:** January 12, 1996 **DRAWN BY:** Greg Icenhour	**FIGURE 1** **SCALE:** 1: 2000

Treatment



BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

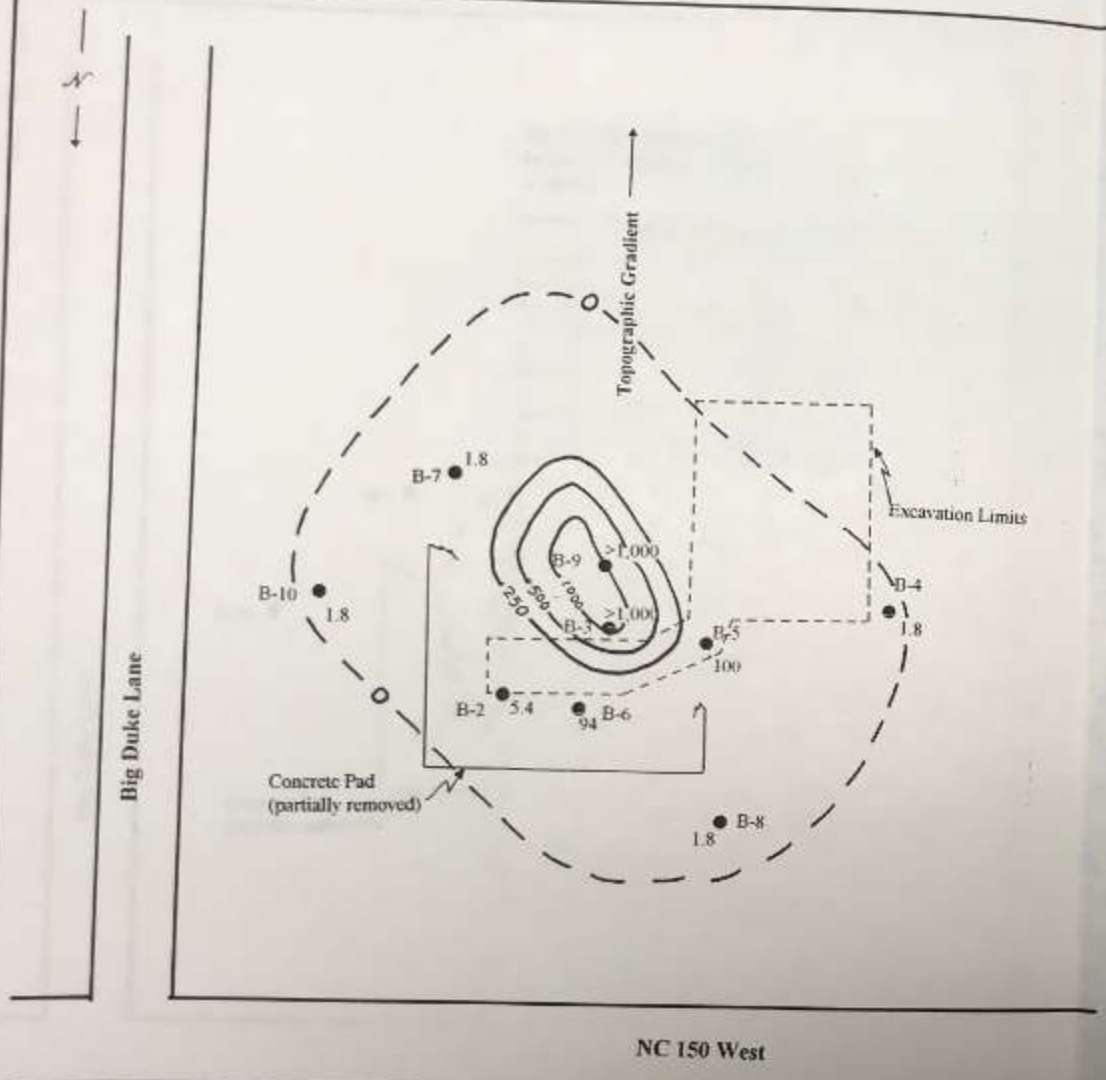
2610 Merrywood Road, Suite 200
Charlotte, NC 28210
(704) 552-6740

Crescent Resources, Inc.
Initial Site Characterization
Water Well Receptor Map - 1,500' Radius

Boyle Consulting Job No. 95-176

DATE: January 15, 1996
DRAWN BY: BCE
SCALE: 1" = 400'

FIGURE 2



OVA FIELD SCREENING RESULTS
CRESCENT RESOURCES INITIAL SITE CHARACTERIZATION
Boyle Consulting Job Number 95-176

Sample Identification	Sample Location (Feet Below Ground Surface - BGS)	OVA Reading (parts per mil
Soil Boring B-2	10-12	
	16-18	7.50
	24-26	5.40
Soil Boring B-3	10-12	2.40
	16-18	18
	24-26	>1,000
Soil Boring B-4	3-3.75	100
	6.5-7.75	1.30
	11-11.75	1.40
	15-15.75	1.70
Soil Boring B-5	6.5-6.75	1.80
	9.5-10.5	32
	12-13.5	47
	16-17.5	150
	20-21.5	100
	24-25.5	170
	28-29.5	500
	32.5-33.5	24
	36-37.5	120
Soil Boring B-6	10-12	260
	16-18	50
	24-26	94
Soil Boring B-7	8-8	42
	12-13	2.3
	14.5-15.75	2.0
Soil Boring B-8	8-9.5	1.8
	14.3-15.75	0
Soil Boring B-9	9-10	1.8
	12-13	360
	16-18	>1,000
	26-22	>1,000
	24-26	560
Soil Boring B-10	2.75-3.75	100
	7-7.75	1.2
	11-11.75	1.0
	15-15.75	1.8
		1.8

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

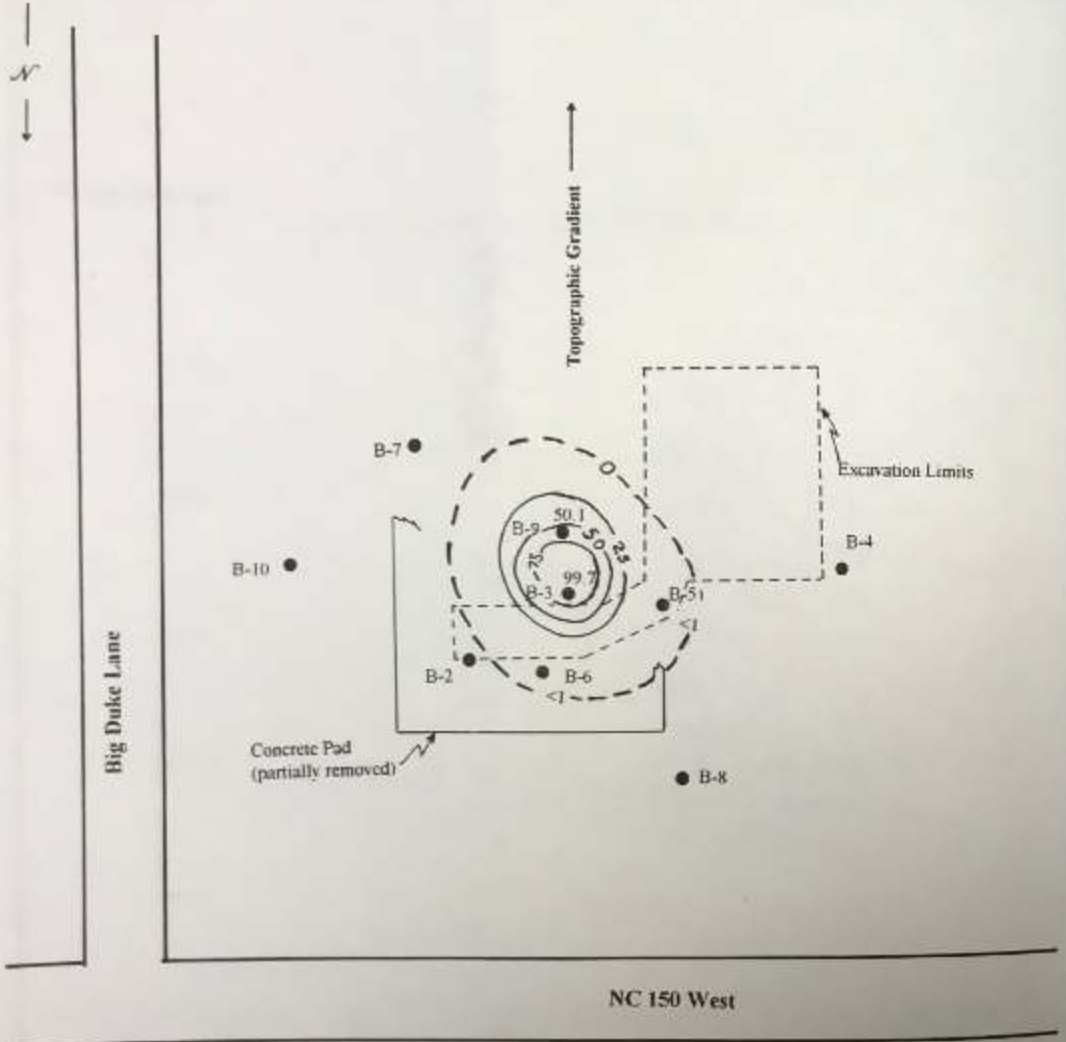
2610 Merrywood Road, Sui
Charlotte, NC 28210
(704) 552-6740

Crescent Resources, Inc.
Former Pier, Marina and Campground Service Station

Initial Site Characterization
Isoconcentration Contour Map - TPH
From OVA Field Screening Results
Boyle Consulting Job No. 95-176

DATE: January 15, 1996
DRAWN BY: CDE
SCALE: 1" = 10'
Contour Interval = 250 ppm

FIGUR



LABORATORY ANALYTICAL RESULTS - SOIL SAMPLES
Crescent Resources, Inc. - Former Pier, Marina & Campground Service Station
BCE Job No. 95-176

SAMPLE IDENTIFICATION	Sample Depth (Feet BGS)	Analytical Results - Method 5030 (mg/kg)
B-3A	16-18	99.7
B-3B	24-26	<0.02
B-5A	12-13.5	<0.02
B-5B	24-25.5	<0.02
B-5C	36-37.5	<0.02
B-6A	16-18	<0.02
B-9A	9-10	<0.02
B-9B	12-14	50.1
B-9C	24-26	<0.02

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

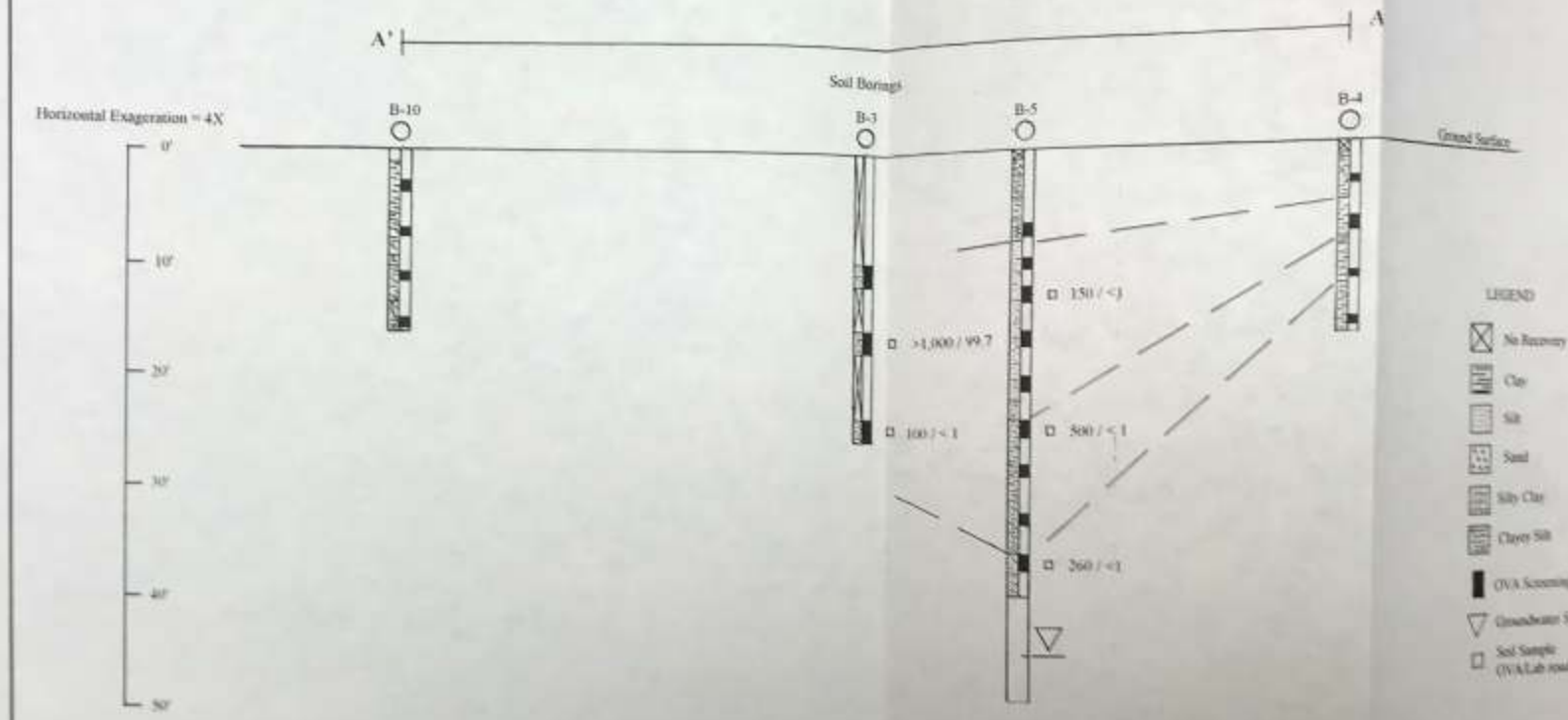
2610 Merrywood Road, Suite 20
Charlotte, NC 28210
(704) 552-6740

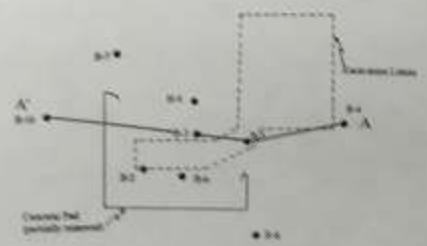
Crescent Resources, Inc.
Former Pier, Marina and Campground Service Station
Initial Site Characterization
Isoconcentration Contour Map - TPH-GRO
From 12' - 18' Soil Sample Analytical Results

Boyle Consulting Job No. 95-176

DATE: January 29, 1996
DRAWN BY: BDB
SCALE: 1" = 10'
Contour Interval = 25 ppm

FIGURE





BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, NC 28210
(704) 552-6740

Crescent Resources, Inc.
Initial Site Characterization
Stratigraphic Cross Section A - A'

Boyle Consulting Job No. 95-178

DATE: January 29, 1996
DRAWN BY:
SCALE: 1" = 10'

FIGURE 5

BOYLE CONSULTING ENGINEERS, PLLC
Engineering and Environmental Consultants

2610 Merrywood Road, Suite 200
Charlotte, North Carolina 28210
Phone/Fax (704)552-6740

Paul,
I think there is a file on this already. lc

August 3, 1995

Mr. Paul Dahlen, P.G.
North Carolina Department of Environment,
Health and Natural Resources
Division of Environmental Management
919 North Main Street
Mooresville, North Carolina 28115

Subject: **Removal of USTs**
Former Deck Restaurant, Highway 150
Iredell County
Letter Dated July 31, 1995 to Mr. Brooks Boyd, Crescent Resources

Dear Mr. Dahlen:

I am submitting this letter in response to your July 31, 1995 correspondence to my client, Mr. Brooks Boyd of Crescent Resources. This letter will update you on our activities and clarify questions you indicated in your letter to Mr. Boyd.

Three, 4,000 gallon USTs were removed from the above referenced site during the week of July 2, 1995. The tanks were removed from the property on July 6, 1995. Stockpiled soils suspected to be contaminated were removed from the site on July 21, 1995 and sent to Cherokee Environmental Group. Approximately 158 tons of material was disposed of by incineration.

On June 28, 1995, I visited the Mooresville Regional Office and completed the GW/UST-3 form at that time. I returned the form to the groundwater section secretary. The form contains information on seven tanks which were located on the property; three at the marina and four USTs located immediately south of Highway 150 at a former tavern/convenience store.

I have subsequently learned that the owner which I listed in Section I of this form is incorrect. While the *land owner* is Crescent Resources, Inc., the owner of the USTs is Mr. Don Matthews, Route 8, Box 646, Mooresville, NC 28115. I do not have a current telephone number for Mr. Matthews. I will be submitting an amended GW/UST-3 form listing Mr. Matthews as the UST owner. Crescent Resources, Inc. has *never* been an owner or operator of the tanks located at this site.

A draft closure report is currently under review by Crescent Resources, Inc. and their attorney, Carol A. Jones Van Buren, Esquire of Kennedy Covington Lobdell & Hickman. A final report will be forwarded to your office in the near future. If you have any questions, please contact me at (704) 573-2420. Thank you.

POLLUTION INCIDENT/U.S.T. LEAK REPORTING FORM

Department of Environment, Health, Natural Resources
Division of Environmental Management
GROUNDWATER SECTION

Confirm. GW Contamination (Y/N) Y
Major Soil Contamination (Y/N) ____
Minor Soil Contaminatin (Y/N) ____

Incident # 8301

Date Incident Occured or Leak Detected 11/15/90

INCIDENT DESCRIPTION

Incident Location/Name: Pies Store / Marina / Campground
Address: Hwy 150 W
City/Town: Mooresville | County: Iredell | Region: MRO
Briefly Describe Incident: Crescent Resources, lessor of the property detected petroleum contamination during a routine Site assessment. Follow-up monitor wells confirmed groundwater contamination.

POTENTIAL SOURCE OWNER-OPERATOR

Potential Source Owner-Operator: Crescent Resources Inc. | Telephone: (704) 382-2387
Company: Crescent Land & Timber | Street Address: 400 S. Tryon Street
City: Charlotte | County: Mecklenburg | State: North Carolina | Zip Code: 28201-1003

OWNERSHIP
0. N/A 1. Municipal 2. Military 3. Unknown (4. Private) 5. Federal 6. County 7. State

OPERATION TYPE
0. N/A 1. Public Service 2. Agricultural 3. Residential 4. Educational/Relig 5. Industrial (6. Commercial) 7. Mining

POLLUTANTS INVOLVED

MATERIALS INVOLVED	AMOUNT LOST	AMOUNT RECOVERED
petroleum	unk	unk

"landing area"

SOURCE OF POLLUTION

PRIMARY SOURCE OF POLLUTION (Select one)

1. Intentional dump
2. Pit, pond, lagoon
3. Leak-underground
4. Spray irrigation
5. Land application
6. Animal feedlot
7. Source unknown
8. Septic tank
9. Sewer line
10. Stockpile
11. Landfill
12. Spill-surface
13. Well
14. Dredge spoil
15. Nonpoint source

[illegible] waste
3. Gasoline/diesel
4. Heating oil
5. Other petroleum prod.
6. Sewage/septage
7. Fertilizers
8. Sludge
9. Solid waste leachate
10. Metals
11. Other inorganics
12. Other organics

LOCATION
(1. Facility)
2. Railroad
3. Waterway
4. Pipeline
5. Dumpsite
6. Highway
7. Residence
8. Other

SETTING
1. Residential
2. Industrial
3. Urban
(4. Rural)

Site Priority Ranking: 85

D.E.M. Regional Contact: Arlen Burney / Mark Norris
Signature: Mark Norris
Date: 6/19/92

GW-61 Revised 3/92

Crescent Resources
Pier, Marina / Former Tavern & Service Station Site
September 2002 Soil Samples / Method 8260 Analysis Results

Location	Depth	Odors Petroleum	PID Reading	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	m-p-xylene (ug/kg)	o-xylene (ug/kg)	Naphthalene (ug/kg)	MTBE (ug/kg)	1,3,5-trimethylbenzene (ug/kg)	1,2,4-trimethylbenzene (ug/kg)	p-isopropyltoluene (ug/kg)	acetone (ug/kg)	2-butanone (ug/kg)	4-methyl-2-pentanone (MIBK) (ug/kg)	2-hexanone (ug/kg)
DK-GP1	0'-4'	very slight	9.5														
	4'-8'	moderate	1383	< 250	< 250	< 250	< 510	< 250	< 250	< 250	4500	< 250	1100	< 2500	< 630	< 250	< 250
	8'-12'	strong	1540														
	12'-16'	strong	1720														
	16'-20'	strong	>2000	< 2	< 2	< 2	< 5	55	8.7	< 2	190	36	31	< 20	< 6	< 2	< 2
	20'-24'	strong	>2000														
	24'-28'	strong	721														
	28'-32'	moderate	306														
	32'-36'	moderate	184	< 7	< 7	< 7	< 14	< 7	34	< 7	< 7	< 7	< 7	550	180	23	140
DK-GP2	0'-4'	none	> 2000														
	4'-8'	slight	> 2000														
	8'-12'	moderate	1745	< 5	< 5	< 5	< 9	< 5	8.1	< 5	< 5	< 5	< 5	< 50	< 11	< 5	< 5
	12'-16'	moderate	101														
	16'-20'	moderate	135														
DK-GP3	0'-4'	none	125														
	4'-8'	none	521	< 3	< 3	< 3	< 7	< 3	< 3	< 3	< 3	< 3	< 3	< 30	< 8	< 3	< 3
	8'-12'	none	67.8														
	12'-16'	none	0														
	16'-20'	none	0														
DK-GP4	0'-4'	none	106														
	4'-8'	slight	130														
	8'-12'	slight	80.1														
	12'-16'	moderate	81.2	< 3	< 3	< 3	< 7	< 3	< 3	< 3	< 3	< 3	< 3	< 30	< 8	< 3	< 3
DK-GP5	0'-4'	none	0														
	4'-8'	none	0														
	8'-12'	none	0														
	12'-16'	none	0	< 3	< 3	< 3	< 7	< 3	< 3	< 3	< 3	< 3	< 3	< 30	< 8	< 3	< 3
DK-GP6	0'-4'	none	115														
	4'-8'	none	140														
	8'-12'	slight	158	< 3	< 3	< 3	< 7	< 3	< 3	< 3	< 3	< 3	< 3	< 30	< 8	< 3	< 3
	12'-16'	slight	130														
	16'-20'	slight	102														
DK-GP7	0'-4'	none	300	< 3	< 3	< 3	< 7	< 3	< 3	< 3	< 3	< 3	< 3	37	< 8	< 3	< 3
	4'-8'	none	34														
	8'-12'	none	10.4														

Duke Energy

Duke Energy Corporation
Energy Center
P.O. Box 1006
Charlotte, NC 28201-1006

September 26, 2002

Mr. Brooks Boyd
Vice President Commercial Development
Crescent Resources, Inc.

Re: Former Pier, Marina & Campground Properties
N.C. Highway 150, Mooresville, North Carolina
September 2002 Site Investigation Results

On September 3 and 4, 2002, Tim Hunsucker and Chuck Campbell of Duke Energy, Environmental Science and Technologies conducted a limited site investigation of the above property. The purpose of the investigation was to provide an evaluation of the extent of soil contamination relating to former underground storage tanks (USTs) which were removed in 1995.

Background site information was obtained from 1995 UST Closure Reports issued by Boyle Consulting Engineers, PLLC. Initial sample locations were selected based on "hot-spots" identified in the 1995 reports.

The investigation of the property was divided into two segments: Former Tavern & Service Site and Former Deck Restaurant Site.

Soil Sampling Methods:

Soil samples were collected using Geoprobe ® direct push methods. Continuous soil cores were collected in 4-foot increments using a dual-tube sample system which prevents cross contamination between sample depths. Each successive 4-foot core was collected in a new, clean core liner.

Field Screen Methods:

Each 4-foot core was field-screened using a PhotoVac® photoionization detector (PID) for the detection of hydrocarbons associated with petroleum products. PID measurements along with odor observations directed the selection of sample submittal for laboratory analysis.

Results:

Former Tavern & Restaurant Site

Seven locations were sampled as indicated on Figure 1. Table 1 provides a summary of field observations and laboratory sample submittals. All soils observed in this area appeared to be highly permeable silty, fine to medium sands. Table 3 provides a summary of laboratory analysis results. Copies of the laboratory analysis reports are included in Appendix I.

Laboratory analysis results indicate limited soil contamination due to the former USTs. Soil samples collected in the area of the former dispenser island (DK-GP1, DK-GP2, DK-GP4) indicate that contaminant migration was primarily vertical with very little horizontal migration.

Notes:

Odor and high field-screen (PID) results observed in the soil samples are likely due to substituted benzene compounds as indicated in the laboratory Tentatively Identified Compounds Report.

Additionally, problems were experienced with the PID instrument used for field screening in this area. These instrument problems may have contributed to the high observed readings but should not have affected relative readings between samples so that laboratory sample selections based on PID readings are still valid.

Former Deck Restaurant Site

Seven locations were sampled as indicated on Figure 2. Table 2 provides a summary of field observations and laboratory sample submittals. Table 4 provides a summary of laboratory analysis results. Copies of the laboratory analysis reports are included in Appendix 1.

Depth to groundwater was measured in a source area monitoring well to be 9' below ground surface. Because the depth of the bottom of the former USTs would have been at or below the groundwater elevation, no horizontal migration of contaminants would be expected except in the direction of the groundwater flow. Field observations and laboratory analysis results appear to support this assumption.

Note:

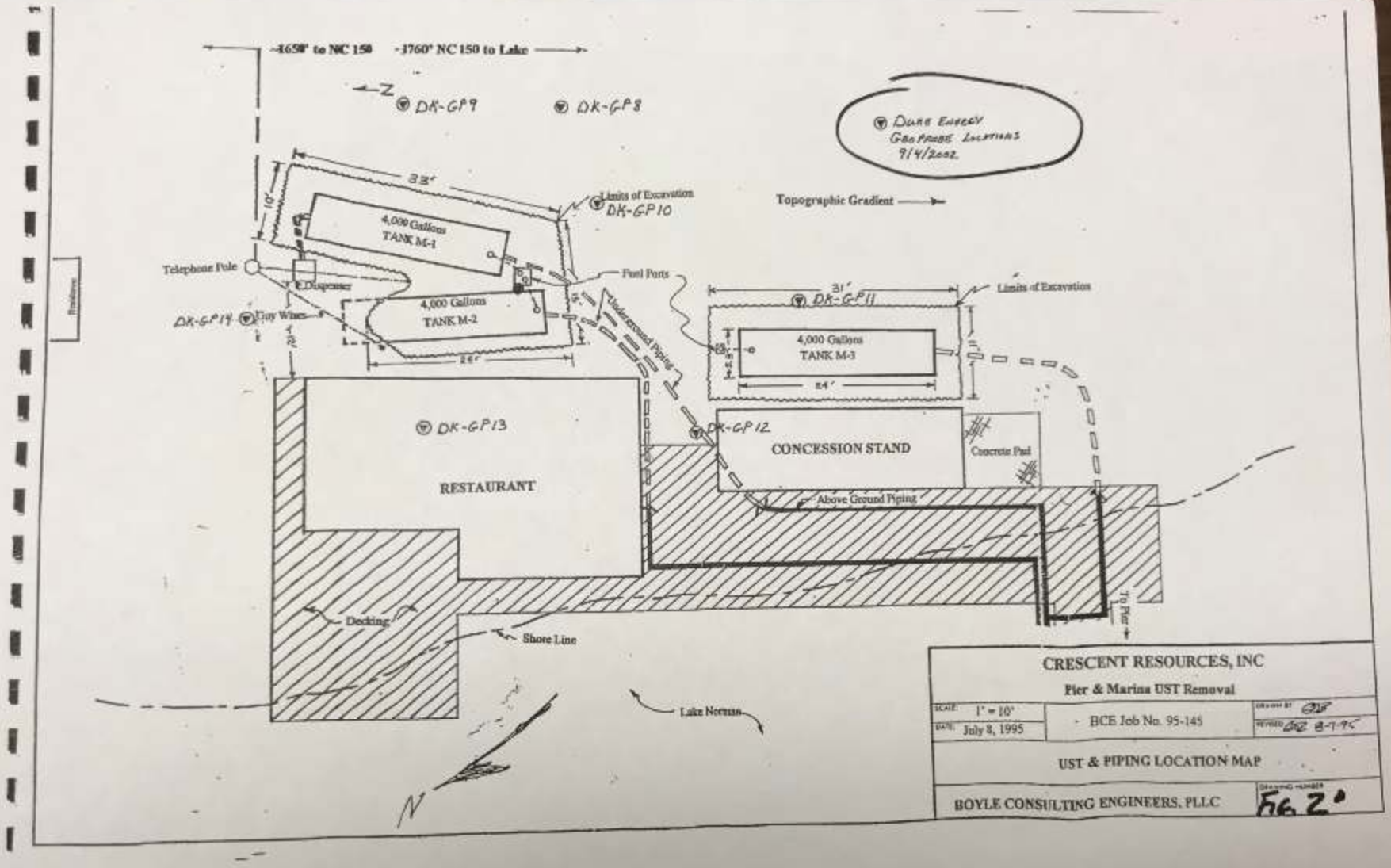
A different PID instrument was used to field-screen soil samples in this area.

Crescent Resources
Pier,Marina & Campground / Former Deck Restaurant Site
September 2002 Soil Samples / Method 8260 Analysis Results

:ation	Depth	Odors Petroleum	PID Reading	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	m-p-xylene (ug/kg)	o-xylene (ug/kg)	p-propyl benzene (ug/kg)	Naphthalene (ug/kg)	MTBE (ug/kg)	1,3,5-trimethylbenzene (ug/kg)	1,2,4-trimethylbenzene (ug/kg)	p-isopropyltoluene (ug/kg)	acetone (ug/kg)	2-butanone (ug/kg)	4-methyl-2-pentanone (MIBK) (ug/kg)	2-hexanone (ug/kg)
:-GP8	0'-4'	none	7															
	4'-8'	none	4.6															
	8'-12'	none	4.7															
:-GP9	0'-4'	moderate	2.2															
	4'-8'	moderate	91.7	43	110	43	94	83	17	45	80	39	90	< 8	< 80	< 19	< 8	< 8
-GP10	0'-4'	moderate	7.7															
	4'-8'	slight	18.7	< 4	< 4	< 4	< 7	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 40	< 9	< 4	< 4
-GP11	0'-4'	slight	1.5															
	4'-8'	none	0.9															
-GP12	0'-4'	none	0															
	4'-8'	none	0															
GP13	0'-4'	slight	3.9															
	4'-8'	none	0															
GP14	0'-4'	slight	47.6	< 3	< 3	< 3	< 6	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 30	< 6	< 3	< 3
	4'-8'	none	1.9															

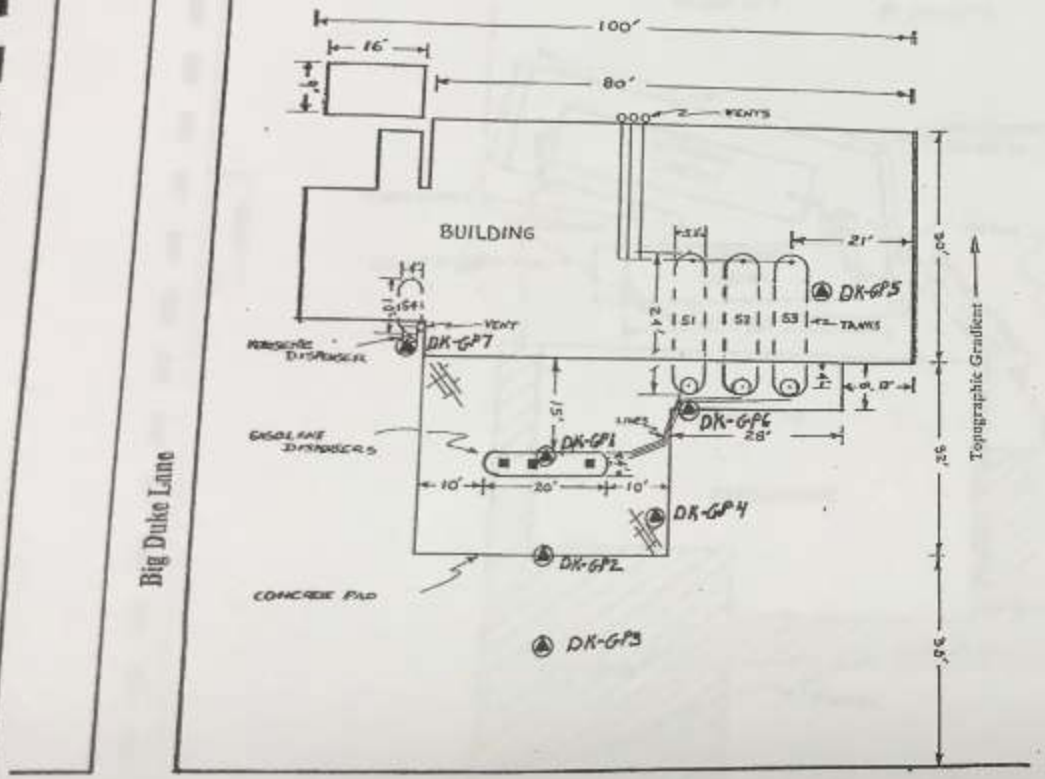
Crescent Resources
Pier, Marina / Former Tavern & Service Station Site
September 2002 Soil Samples

Location	Depth	Odors Petroleum	PID Reading	Lab Samples Collected	Notes
DK-GP1	0'-4'	very slight	9.5		
	4'-8'	moderate	1383	8260, 8270	Soil at 32'-36' was moist but not wet. A temoporary well screen was driven to refusal depth. Bottom of screen at 47.65' with water level at 47.35' after 4.5 hours. Not enough well volume to collect groundwater sample.
	8'-12'	strong	1540		
	12'-16'	strong	1720		
	16'-20'	strong	>2000	8260, 8270	
	20'-24'	strong	>2000		
	24'-28'	strong	721		
	28'-32'	moderate	306		
	32'-36'	moderate	184	8260, 8270	
DK-GP2	0'-4'	none	> 2000		
	4'-8'	slight	> 2000		High PID readings in upper 8' of soil may be due to vapors traped below asphalt pavement
	8'-12'	moderate	1745	8260, 8270	
	12'-16'	moderate	101		
	16'-20'	moderate	135		
DK-GP3	0'-4'	none	125		
	4'-8'	none	521	8260, 8270	
	8'-12'	none	67.8		
	12'-16'	none	0		
	16'-20'	none	0		
DK-GP4	0'-4'	none	106		
	4'-8'	slight	130		
	8'-12'	slight	80.1		
	12'-16'	moderate	81.2	8260, 8270	
DK-GP5	0'-4'	none	0		
	4'-8'	none	0		
	8'-12'	none	0		
	12'-16'	none	0	8260, 8270	
DK-GP6	0'-4'	none	115		Started experiencing problems with PID calibration. Concentration readings are questionable but should be relative from one sample to the next.
	4'-8'	none	140		
	8'-12'	slight	158	8260, 8270	
	12'-16'	slight	130		
	16'-20'	slight	102		
DK-GP7	0'-4'	none	300	8260, 8270	
	4'-8'	none	34		
	8'-12'	none	10.4		


~4650' to NC 150
~1760' NC 150 to Lake
DK-GP9
DK-GP8
Duke Energy
GeoProbe Locations
9/4/2002
Limits of Excavation
DK-GP10
Topographic Gradient
4,000 Gallons
TANK M-1
Telephone Pole
Dispenser
DK-GP14
Guy Wire
4,000 Gallons
TANK M-2
Fuel Ports
Underground Piping
DK-GP11
Limits of Excavation
4,000 Gallons
TANK M-3
DK-GP13
RESTAURANT
DK-GP12
CONCESSION STAND
Concrete Pad
Above Ground Piping
To Pier
Decking
Shore Line
Lake Norman
N
CRESCENT RESOURCES, INC
Pier & Marina UST Removal
SCALE: 1" = 10'
DATE: July 8, 1995
BCE Job No. 95-145
DRAWN BY: GJB
REVISED: GJB 8-7-95
UST & PIPING LOCATION MAP
BOYLE CONSULTING ENGINEERS, PLLC
DRAWING NUMBER
56.2

Crescent Resources
Pier,Marina & Campground / Former Deck Restaurant Site
September 2002 Soil Samples

Location	Depth	Odors Petroleum	PID Reading	Lab Samples Collected	Notes
DK-GP8	0'-4'	none	7		Approxamate water table at 9'
	4'-8'	none	4.6		
	8'-12'	none	4.7		
DK-GP9	0'-4'	moderate	2.2		
	4'-8'	moderate	91.7	8260	
DK-GP10	0'-4'	moderate	7.7		
	4'-8'	slight	18.7	8260	
DK-GP11	0'-4'	slight	1.5		
	4'-8'	none	0.9		
DK-GP12	0'-4'	none	0		Below building slab
	4'-8'	none	0		
DK-GP13	0'-4'	slight	3.9		
	4'-8'	none	0		
DK-GP14	0'-4'	slight	47.6	8260	
	4'-8'	none	1.9		



Duke Energy
Geoprobe Sample Locations
9/3/2002 - 9/4/2002

10' 0 20'

N

CRESCENT RESOURCES, INC.
Pier & Marina, Convenience Store Site UST Removal

SCALE: 1" = 20'	BCE Job No. 95-145B	DRAWN BY: BDS
DATE: August 2, 1995		REVISED

TANK LOCATION MAP

BOYLE CONSULTING ENGINEERS, PLLC

DRAWING NUMBER: Fig. 1

SUBSURFACE INVESTIGATION
FORMER PIER, MARINA, AND
CAMPGROUND SERVICE STATION
MOORESVILLE, NORTH CAROLINA

PREPARED FOR:

CRESCENT RESOURCES, INC.
P.O. BOX 1003
CHARLOTTE, NC 28201-1003

Prepared by:

SHIELD ENVIRONMENTAL ASSOCIATES, INC.
Carolina Business Center
2848 I-85 South
Charlotte, North Carolina 28208

Shield Project No. 1002026-01

MAY 2000

SHIELD
ENVIRONMENTAL ASSOCIATES, INC.

Via: Certified Mail

May 17, 2000

Mr. Brooks Boyd
Crescent Resources, Inc.
P.O. Box 1003
Charlotte, North Carolina 28201-1003

Re: Subsurface Investigation
The Former Pier, Marina, and Campground Service Station
Mooresville, North Carolina
Shield Project No. 1002026-01

Dear Mr. Boyd:

Shield Environmental Associates, Inc. (Shield) is herein submitting this letter/report which summarizes our subsurface investigation completed at the above mentioned site. This work was conducted as outlined in our proposal dated March 14, 2000. All work performed by Shield followed the North Carolina Department of Environment and Natural Resources (NCDENR) *Groundwater Section Guidelines For The Investigation and Remediation of Soils and Groundwater*.

Field Work

Shield supervised the advancement of one GeoProbe™ soil boring (GP-1) near the former UST basin area at the former service station and ten GeoProbe™ soil borings (GP-2 through GP-11) near the former USTs basin area at the former Pier. GP-1 was advanced to a depth of 28 feet below grade. GP-2 was advanced to a depth of 12 feet below grade. GP-3 through GP-11 were advanced to eight feet below grade. No groundwater was encountered during the advancement of GP-1. Groundwater was encountered from five to eight feet below grade in GP-2 through GP-11. The approximate locations of the soil borings can be seen on Figures 1 and 2.

Soil samples were collected from each soil boring. The suspected most contaminated soil sample (based on field observations) from each boring was submitted to a North Carolina certified laboratory for analyses. The soil samples from GP-1 were analyzed using United States Environmental Protection Agency (USEPA) Methods 8260 and 8270, and Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) using the

Charlotte
Carolina Business Center
2848 I-85 South
Suite F
Charlotte, NC 28208
Telephone 704.394.6913
Toll Free 800.395.5220
Fax 704.394.6968
www.shieldenv.com

Atlanta, GA
Lexington, KY
Pittsburgh, PA

Massachusetts Department of Environmental Protection (MADEP) Method. The soil samples from GP-2, GP-3, GP-5, GP-6, GP-7, GP-8, GP-9, and GP-10 were analyzed using USEPA Method 5030. The soil samples from GP-4 and GP-11 were analyzed using USEPA Method 8260, and VPH using the MADEP Method.

Groundwater samples were collected from GP-5 and GP-10, and submitted to a North Carolina certified laboratory for analyses. The groundwater samples were analyzed using USEPA Method 602 plus Isopropyl Ether (IPE), Methyl Tert-Butyl Ether (MTBE), and Xylenes, VPH using the MADEP Method and Lead using USEPA Method 3030c.

Groundwater samples were also collected from the supply well (PW-1) which is not in-use near the former pier and from the supply well (DW-1) which is in-use near Dukes Marina at Highway 150. The groundwater samples were analyzed using USEPA Method 602 plus Isopropyl Ether (IPE), Methyl Tert-Butyl Ether (MTBE), and Xylenes and Lead using USEPA Method 3030c.

The soil and groundwater samples were transported to, and analyzed by Prism Laboratories, Inc. (North Carolina Certification No. 402). The laboratory reports are included in Appendix A. Tables 1 and 2 summarizes the soil and groundwater results. The Boring Log/Well Construction records are included in Appendix B.

Results

Based on the laboratory results for the soil samples collected, soil contamination was detected above the Maximum Soil Contaminant Concentrations (MSCC) (Soil to Groundwater) in GP-1 and no soil contamination was detected above the MSCC (Soil to Groundwater) in GP-2 through GP-11. See Table 1 for a summary of the soil analytical results.

Based on the laboratory results for the groundwater samples collected, no groundwater contamination was detected from the samples collected from supply well, DW-1. The only contamination detected from supply well PW-1 was Lead which was above the North Carolina Administrative Code (NCAC), 15A 2L .0202 Class GA Standards (2L Standards). Groundwater contamination was detected above the 2L Standards from groundwater samples collected from GP-5 and GP-10. See Table 2 for a summary of the groundwater analytical results.

Limitations

These environmental services for the Former Pier, Marina, and Campground Service Station project have been performed for the exclusive use of Crescent Resources, Inc. and their agents for specific application to the referenced project. These services have been performed in accordance with generally accepted environmental practices. No warranty, expressed or implied is made. Although we cannot be responsible for the accuracy of the data provided to us by others, we have no reason to suspect that any of the information provided is inaccurate unless it has been otherwise noted. Our observations are based upon conditions readily visible at the site at the time of our site visit.

Chemical analyses were performed on selected samples to determine the presence and concentrations of chemicals and associated parameters. Selection of specific chemical test parameters is based upon suspected contamination as Shield reviewed with Crescent Resources, Inc. and it's legal counsel. Shield, by virtue of providing the services described in this report, does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, State or Federal public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety, or the environment.

If you have any questions regarding the above, please give us a call at (704)394-6913.

Sincerely,

SHIELD ENVIRONMENTAL ASSOCIATES, INC.

Kevin A. Simpson
Project Manager

Greg D. Icenhour, P.G., MBA
Principal

Attachments:

Table 1 - Summary of Soil Analytical Results
Table 2 - Summary of Groundwater Analytical Results
Figure 1 - Former Service Station
Figure 2 - Former Pier Marina Area
Appendix A - Laboratory Results
Appendix B - Boring Log/Well Construction Record

cc: File
FC:\My Documents\1002026-01report

5-18-00

SHIELD

TABLE 1

SUMMARY OF SOIL ANALYTICAL RESULTS

In parts per million (ppm)

Boring / Depth	GP-1 19-20'	GP-2 4-5'	GP-3 3-4'	GP-4 3-4'	GP-5 3-4'	GP-6 3-4'	GP-7 3-4'	GP-8 2-3'	GP-9 2-3'	GP-10 2-3'	GP-11 3-4'	MSCC Soil to GW
TPH 5030	NA	2.5	BDL	NA	BDL	BDL	BDL	BDL	BDL	BDL	NA	10
VPH (C5-C8)	BDL	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	72
VPH +EPH (C9-C18)	92	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	3255
EPH (C19-C36)	BDL	NA	NA	NA	NA	NA	NA	NA	NA	NA	BDL	Immobile
VPH +EPH (C9-C22)	**340**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	4.1	34
Benzene	BDL	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	0.0056
N-Butylbenzene	2	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	4
Sec-Butylbenzene	1.6	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	3
P-Isopropyltoluene	**2.4**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	*
Naphthalene - (EPA 8260)	**6.9**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	0.042	0.58
1,2,4 - Trimethylbenzene	**16**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	0.013	8
1,3,5 - Trimethylbenzene	**19**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	7
Xylenes	**7.2**	NA	NA	BDL	NA	NA	NA	NA	NA	NA	BDL	5
MTBE (Methyl Tertiary Butyl Ether)	BDL	NA	NA	0.074	NA	NA	NA	NA	NA	NA	0.025	0.92
2-Methyl Naphthalene	**10**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
Naphthalene - (EPA 8270)	**3.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.58

Notes:

1) BDL = None detected above Method detection limit

2) NA = Not analyzed

3) MSCC = Maximum Soil Contaminant Concentrations

* - No specific standard available

Bold data above MSCC.

Checked by KAS

TABLE 2 - GP-5

SUMMARY OF CHEMICAL TEST RESULTS

SAMPLE LOCATION	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES	TOTAL BTEX	MTBE	IPE	C5-C8 ALIPHATICS	C9-C12 ALIPHATICS	C9-C10 AROMATICS	Lead
NCDENR Standards	1	1000	29	530	NA	200	70	420	4200	210	15
GCL	5000	257500	29000	87500	NA	200000	70000	-	-	-	15000
03/15/00	3400	8700	1800	7800	21700	810	140	26000	11000	5300	400

NOTES:

BDL - Contamination not detected
NA - Not available or not analyzed
ppb - Results are in parts per billion
BTEX - Benzene, Toluene, Ethylbenzene and Xylenes
GCL - Gross Contaminant Levels

NCDENR Standards - North Carolina Administrative Code Title 15A Subchapter 2L Class GA Groundwater Standards
MTBE - Methyl Tertiary Butyl Ether
IPE - Isopropyl ether

TABLE 2 - GP-10

SUMMARY OF CHEMICAL TEST RESULTS

SAMPLE LOCATION	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES	TOTAL BTEX	MTBE	IPE	C5-C8 ALIPHATICS	C9-C12 ALIPHATICS	C9-C10 AROMATICS	Lead
NCDENR Standards	1	1000	29	530	NA	200	70	420	4200	210	15
GCL	5000	257500	29000	87500	NA	200000	70000	-	-	-	15000
03/15/00	500	BDL	BDL	BDL	500	390	BDL	2700	BDL	370	330

NOTES:

BDL - Contamination not detected
NA - Not available or not analyzed
ppb - Results are in parts per billion
BTEX - Benzene, Toluene, Ethylbenzene and Xylenes
GCL - Gross Contaminant Levels

NCDENR Standards - North Carolina Administrative Code Title 15A Subchapter 2L Class GA Groundwater Standards
MTBE - Methyl Tertiary Butyl Ether
IPE - Isopropyl ether

NCDENR

JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
MOORESVILLE REGIONAL OFFICE

DIVISION OF WASTE MANAGEMENT
February 15, 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Phil A. Lipe, Inc.
509 First Avenue S.W.
Hickory, North Carolina 28502

RE: Request for Information
Pier Marina Campground Convenience Store
Pollution Incident #14975 and
Pier Landing Area (Gas Docking Area)
Pollution Incident #8301
Iredell County, N.C.

Dear Mr. Lipe:

A recent review of the incident files for the above referenced sites indicated that additional information is necessary for this office to determine the party or parties responsible for the contamination at the sites. You are requested to complete that attached affidavit by providing the following:

1. Any information you might have regarding who installed the underground storage tanks at the referenced sites;

2. Any information you might have regarding who owned the underground storage tanks at the referenced sites; and

3. Any information you might have regarding the operators of the underground storage tanks at the referenced sites.

In addition, please submit the following:

4. Copies of lease agreements with all operators (including Pier Landing);

5. Copies of all plans for improvements or additions submitted to Crescent; and

6. Copies of all of Crescent's responses to the plans for improvements or additions.

The requested information should be received by the Mooresville Regional Office within 60 days of your receipt of this letter. Should you have any questions, please call me at (704) 663-1699, ext 243.

Sincerely,

Karen Connell, P.G.
Hydrogeologist

Attachment: Affidavit

KWC

919 NORTH MAIN STREET, MOORESVILLE, NORTH CAROLINA 28115
PHONE 704-663-1699 FAX 704-663-6040

State of North Carolina
Department of Environment,
Health and Natural Resources
Mooresville Regional Office

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary

KM

DEHNR

DIVISION OF ENVIRONMENTAL MANAGEMENT

November 20, 1995

Crescent Resources, Incorporated
400 South Tryon Street
Suite 1300
Charlotte, North Carolina 28201
Attention: Mr. Brooks Boyd

RE: Affidavit Request
Former Pier Marina and Campground
NC Highway 150 @ Big Duke Lane, Mooresville
Iredell County, N.C.

Dear Mr. Boyd:

We received your UST Closure Reports for the landing area of the subject site dated August 14, 1995, and for the bar/store area on August 29, 1995. The landing area report states that the tank owner is Mr. Don Matthews, and the bar/store area report states that the tank owner is the deceased Mr. Charles Neill. I last spoke with Ms. Carol Jones Van Buren of the firm Kennedy Covington Lobdell & Hickman, L.L.P., on November 15, 1995, regarding the reports and ownership of the USTs at the site. To date, the Division has insufficient information to identify the owner(s) of the USTs. Information on file does indicate that Mr. Donald Matthews was a stockholder in the company that had operated the landing area of the property.

For our records, please address the following topics in the enclosed affidavit concerning the former Pier Marina and Campground:

1. History of tank ownership for the landing and the bar/store areas of the property.

2. History of tank usage and operation for each area, including the date the USTs were last used.

3. Owners/operators of the USTs at the site preceding Mr. Charles Neill and Mr. Donald Matthews.

NCDENR

JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

FILE COPY

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
MOORESVILLE REGIONAL OFFICE

DIVISION OF WASTE MANAGEMENT
February 15, 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Crescent Resources, Inc.
Post Office Box 1003
Charlotte, North Carolina 28201-1003
Attention: Brooks Boyd

RE: Request for Information
Pier Marina Campground Convenience Store
Pollution Incident #14975 and
Pier Landing Area (Gas Docking Area)
Pollution Incident #8301
Iredell County, N.C.

Dear Mr. Boyd:

A recent review of the incident files for the above referenced sites indicated that additional information is necessary for this office to determine the party or parties responsible for the contamination at the sites. You are requested to provide the following information to the Mooresville Regional Office within 60 days of your receipt of this letter.

1. The terms of the 1972 lease agreement with Pier Marina indicate that Pier Marina could construct improvements on the leased property, but that Pier Marina must first submit "plans for all improvements and additions" for approval by Crescent. Please submit all plans for improvements and additions that were submitted by Pier Marina and/or Pier Landing between 1972 and 1991 pursuant to the terms and conditions of the lease agreement.

2. Provide copies of Crescent's responses to the plans submitted by Pier Marina and/or Pier Landing.

Should you have any questions, please call me at (704) 663-1699, ext. 243.

Sincerely,

R + B KC for

Karen Connell, P.G.
Hydrogeologist

30 DAY EXT

cc: Carol Jones Van Buren - Kennedy Covington Lobdell & Hickman, L.L.P.

KWC

919 NORTH MAIN STREET, MOORESVILLE, NORTH CAROLINA 28115
PHONE 704-663-1699 FAX 704-663-6040

TABLE 2 - DW-1 SUMMARY OF CHEMICAL TEST RESULTS								
SAMPLE LOCATION	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES	TOTAL BTEX	MTBE	IPE	Lead
NCDENR Standards	1	1000	29	530	NA	200	70	15
GCL	5000	257500	29000	87500	NA	200000	70000	15000
03/15/00	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

NOTES:
BDL - Contamination not detected
NA - Not available or not analyzed
ppb - Results are in parts per billion
BTEX - Benzene, Toluene, Ethylbenzene and Xylenes
GCL - Gross Contaminant Levels

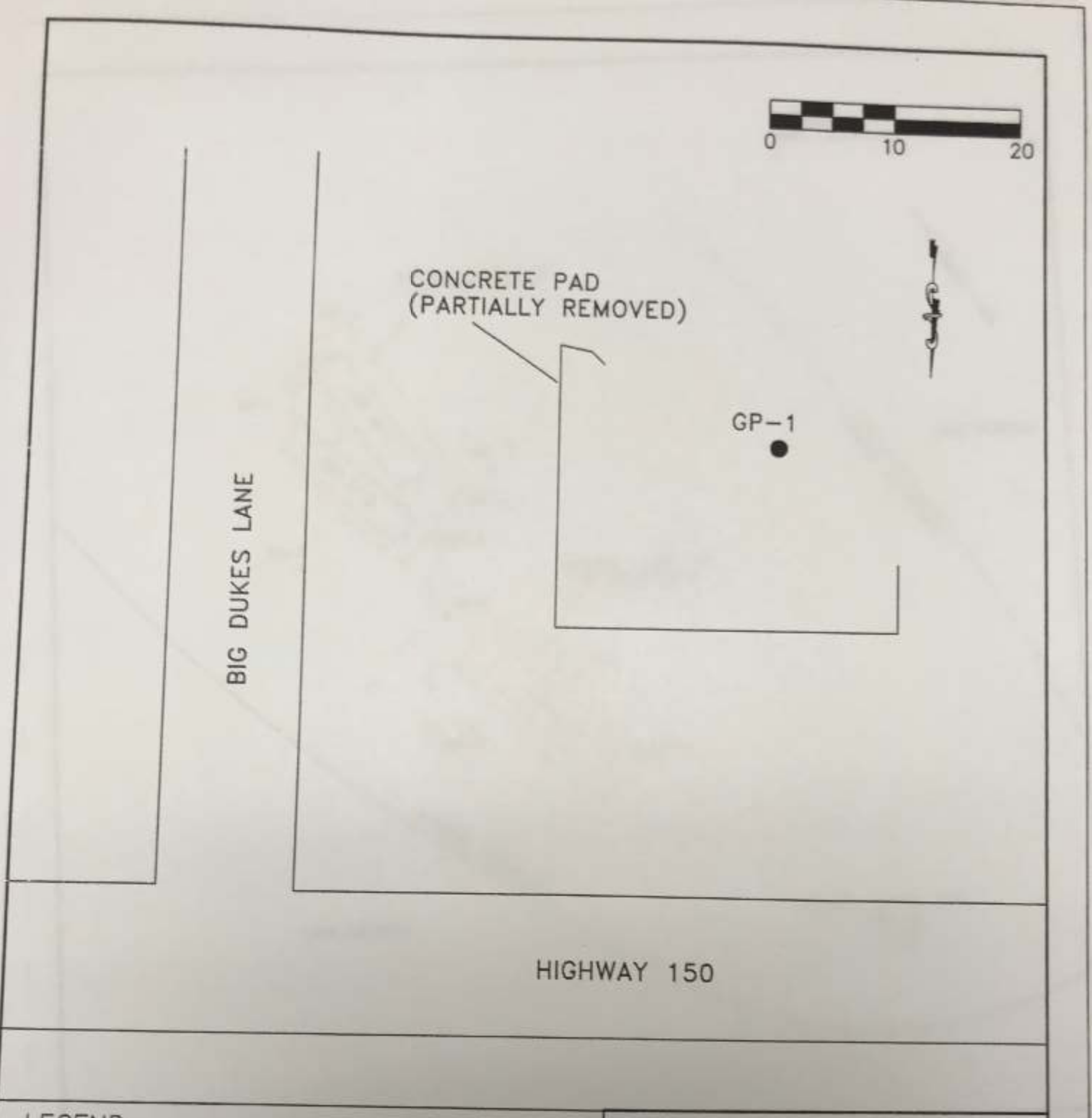
NCDENR Standards - North Carolina Administrative Code Title 15A Subchapter 2L Class GA Groundwater Standards
MTBE - Methyl Tertiary Butyl Ether
IPE - Isopropyl ether

TABLE 2 - PW-1 SUMMARY OF CHEMICAL TEST RESULTS								
SAMPLE LOCATION	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES	TOTAL BTEX	MTBE	IPE	Lead
NCDENR Standards	1	1000	29	530	NA	200	70	15
GCL	5000	257500	29000	87500	NA	200000	70000	15000
03/15/00	BDL	BDL	BDL	BDL	BDL	BDL	BDL	97

NOTES:

BDL - Contamination not detected
NA - Not available or not analyzed
ppb - Results are in parts per billion
BTEX - Benzene, Toluene, Ethylbenzene and Xylenes
GCL - Gross Contaminant Levels

NCDENR Standards - North Carolina Administrative Code Title 15A Subchapter 2L Class GA Groundwater Standards
MTBE - Methyl Tertiary Butyl Ether
IPE - Isopropyl ether



LEGEND

- APPROX. LOCATION OF GEOPROBE BORING

FORMER PIER MARINA & CAMPGROUND
LAKE NORMAN, NORTH CAROLINA

FORMER SERVICE STATION

PROJECT #1002026-01	DATE: 4/00	PROJECT MGR: G.D.L.
		DESIGN BY:
		DRAWN BY:
		SCALE: AS SHOWN

SHIELD
ENVIRONMENTAL ASSOCIATES INC.
11704 REAMES ROAD, CHARLOTTE, NC 28269-7637
PHONE (704)596-6788 FAX (704)596-6770

FIGURE 1

P:\PROJ\2000\1002026\SITEMAP2

APPENDIX B
PHOTOGRAPH LOG

PHOTO 1:

View northeast along River Highway. Ground cover is comprised of asphalt, concrete and grass.

Photo taken 9/21/18.

PHOTO 2:

View south of River Highway. Remnants of old grocery store and gas station. Broken concrete pad is location of former pump island.

Photo taken 9/21/18

PHOTO 3:

View of Big Dukes Lane, facing southeast. Area of possible UST.

Photo taken 10/15/18

PHOTO 4:

View of soil borings B-17, B-18 and B-19, facing north. These borings were placed within the “Possible-UST” geophysical anomaly.

Photo taken 1/15/19.

APPENDIX C
BORING LOGS

SOIL BORING FIELD WORKSHEET

BORING #	**B-1**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	Sample taken at 0-2'
4	0.0	Orange Red, Clayey SILT	
6	2.0		
8	4.1	Orange tan, SILT	
10	8.3		Sample taken at 8-10'
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-2**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	Sample taken at 0-2'
4	0.0	Tan, silty SAND	
6	0.0		Sample taken at 6-8'
8	0.0	Orange tan, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-3**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Orange, red, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, clayey SILT	
10	0.0		Sample taken at 8-10'
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-4**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Orange, red, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0		
8	0.0	Orange tan, clayey SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-5**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	
4	0.0	Orange Red, Clayey SILT	Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-6**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	Sample taken at 2-4'
6	0.0		
8	0.0	Pale orange with some white and black, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-7**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	Sample taken at 2-4'
6	0.0		
8	0.0	Pale orange with some white and black, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-8**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	
6	0.0		Sample taken at 4-6'
8	0.0	Pale orange with some white and black, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-9**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	Sample taken at 2-4'
6	0.0		
8	0.1	Pale orange with some white and black, SILT	
10	0.1		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-10**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	
6	0.1		Sample taken at 4-6'
8	0.0	Pale orange with some white and black, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-11**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Asphalt	
4	0.0	Orange red, SILT, mica	Sample taken at 2-4'
6	0.0		
8	0.0	Pale orange with some white and black, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-12**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	
4	0.0	Orange Red, Clayey SILT	Sample taken at 2-4'
6	0.3		
8	1.5	Orange tan, SILT	
10	6.2		Sample taken at 8-10'
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-13**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Orange, red, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, clayey SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-14**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	
4	0.0	Tan, silty SAND	Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-15**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	
4	0.0	Orange Red, Clayey SILT	Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-16**	BORING DEPTH (ft)	**15**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**11/12/2018**			WEATHER CONDITIONS	**Rain, 30-40s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gravel	
4	0.0	Orange Red, Clayey SILT	Sample taken at 2-4'
6	0.0		
8	0.0	Orange tan, SILT	
10	3.1		Sample taken at 8-10'
12	25.3		
14	178.5		
15			Sample taken at 13-15'
		Boing terminated at 15'	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-17**	BORING DEPTH (ft)	**4.5**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**1/15/2019**			WEATHER CONDITIONS	**Cloudy, 40-50s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**Hand Auger**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
1		Gravel	
2		Red brown, clayey SILT, mica, moist	
3		Red brown, sandy CLAY, moist	
4			
5		Quartz gravels, refusal	
		*Boring terminated at 4.5'	
		No PID readings were taken.	

Log Completed By: **JRM**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-18**	BORING DEPTH (ft)	**5**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**1/15/2019**			WEATHER CONDITIONS	**Cloudy, 40-50s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**Hand Auger**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
1		Gravel	
2		Red brown, clayey SILT, mica, some gravels, moist	
3		Red brown, sandy CLAY, moist	
4			
5			
		*Boring terminated at 5' No PID readings were taken.	

Log Completed By: **JRM**

SOIL BORING FIELD WORKSHEET

BORING #	**B-19**	BORING DEPTH (ft)	**5**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 20**
DATE DRILLED	**1/15/2019**			WEATHER CONDITIONS	**Cloudy, 40-50s**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**Hand Auger**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
1		Gravel	
2		Red brown, clayey SILT, mica, some gravels, moist	
3		Red brown, sandy CLAY, moist	
4			
5			
		*Boring terminated at 5' No PID readings were taken.	

Log Completed By: **JRM**

APPENDIX D
GEOPHYSICAL REPORT

GEL Solutions

55 Shiloh Road, Suite 6
Asheville, NC 28803
P 828.782.3523

www.gel-solutions.com

November 2, 2018

Mr. John Maas, PG
Wood, PLC
2801 Yorkmont Road, Suite 100
Charlotte, NC 28208

Re: Report for Geophysical Survey to Identify Underground Storage Tanks
And Underground Utilities
Parcel #020
1479 NC 150 (River Highway)
Mooresville, North Carolina 28117

Dear Mr. Maas,

GEL Solutions appreciates the opportunity to provide Wood with this report of our geophysical investigation for the referenced project. This investigation was designed to determine the potential presence of underground storage tanks (USTs) at the site and underground utilities that would obstruct drilling activities at the site. The geophysical field investigation was successfully performed on October 15, 2018 through October 25, 2018.

1.0 Summary of Results

One subsurface anomaly was identified in the geophysical data. Figure 1 depicts the approximate location and size of the anomaly as well as the known metallic surface objects present at the time of the investigation. The anomaly was denoted as "Possible UST" with respect to the UST level of confidence rating. Any anomalies not denoted with the UST level of confidence rating in post processed data (Figure 1) are consistent with known metallic surface objects, utilities, and/or cultural interference. Although geophysical methods provide a high level of assurance for the location of subsurface objects, the possibility exists that not all features can or will be identified. Therefore, due caution should be used when performing any subsurface excavation, and GEL Solutions, LLC will not be liable for any damages that may occur. Descriptions of the technologies employed during this geophysical investigation are provided below.

2.0 Overview of Geophysical Investigation

The geophysical evaluation included the deployment of radio-frequency electromagnetic (EM), ground penetrating radar (GPR) and time-domain electromagnetic (TDEM) technologies to the site. These technologies were used in concert with one another in order to identify the presence of potential underground utilities and USTs at the site. A brief description of each technology is presented in the following paragraphs.

Radio-Frequency Electromagnetic

Radio-Frequency Electromagnetic (EM) utility locating equipment consists of a transmitter and a dual-function receiver. The receiver can be operated in a "passive" mode or in an "active" mode. The two modes of operation provide various levels of detection capabilities depending on the specific target or application.

The EM system is operated in the "active" mode by either inducting or conducting a signal into the underground utility to be traced. A transmitter is placed over and in line with a suspected buried utility. The transmitter induces a signal, which propagates along the buried utility. As the receiver is moved back and forth across the suspected path of the utility, the trace signal induces a signal into the receiver's coil sensor. A visual and audio response indicates when the receiver is directly over the buried utility.

Another means of detecting in the "active" mode utilizes a method to "conduct" a signal within the buried utility. To accomplish this, a cable from the transmitter is clamped onto an exposed section of the buried utility and a signal propagates along the buried line. This technique minimizes any interference caused by parasitic emissions from adjacent cables in congested areas. When the system is utilized in the "passive" mode, the receiver is responding to a 60 Hertz cycle current energized by underground utilities.

Interference can and may occur when buried utilities intersect or are adjacent to each other. This effect referred to as "bleed-off" may provide a false response to the identification of the tracked utility. "Bleed-off" is caused by utilities that may be energized in the "active" or "passive" mode.

Ground Penetrating Radar Methodology

A RAMAC digital radar control system configured with a 450-Megahertz (MHz) antenna array was used in this investigation. GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver, a digital control unit which both generates and digitally records the GPR data, and a color video monitor to view data as it is collected in the field.

The transmitter radiates repetitive short-duration electromagnetic waves (at radar frequencies) into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver from the interface of materials with different dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material through which the wave is traveling, and the frequency of the signal.

Subsurface features that commonly cause such reflections are: 1) natural geologic conditions, such as changes in sediment composition, bedding, and cementation horizons and voids; or 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines, and utilities. The digital control unit processes the signal from the receiver and produces a continuous cross-section of the subsurface interface reflection events.

GPR data profiles were collected along transects covering the entire rights of ways. Depth of investigation of the GPR signal is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays, brackish groundwater, or groundwater with a high dissolved solid content from natural or manmade sources. Signal attenuation is lowest in relatively low conductivity materials such as dry sand or rock. Depth of investigation is also dependent on the antenna's transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased. The average depth of penetration at this site was approximately 2-5 feet below the surface.

The GPR antenna used at this site is internally shielded from aboveground interference sources. Accordingly, the GPR response is not affected by overhead power lines, metallic buildings, or nearby objects.

Time Domain Electromagnetic Methodology

TDEM methods measure the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time or frequency-varying magnetic field and measuring (with a receiver) the amplitude and phase shift of an induced secondary magnetic field. The secondary magnetic field is created by subsurface conductive materials behaving as an inductor as the primary magnetic field is passed through them.

The Geonics EM-61 system used in this investigation operates within these principles. However, the EM-61 TDEM system can discriminate between moderately conductive earth materials and very conductive metallic targets. The EM-61 consists of a portable coincident loop time domain transmitter and receiver with a 1.0-meter by 0.5-meter coil system. The EM-61 generates 150 pulses per second and measures the response from the ground after transmission or between pulses. The secondary EM responses from metallic targets are of longer duration than those created by conductive earth materials. By recording the later time EM arrivals, only the response from metallic targets is measured, rather than the field generated by the earth material.

3.0 Field Procedures and Results

The geophysical field investigation was successfully performed on October 15 through October 25, 2018 at the 11 DOT parcels located in the immediate vicinity of Highway 150 in Mooresville, NC. Interpretation of the GPR data was conducted in the field and any potential anomalies were marked in the field. GPR data processing typically included band pass filtering, background removal, horizontal smoothing, and gain adjustments. TDEM was also used to scan the project site. Any electromagnetic anomalies detected during field activities that were indicative of buried metallic objects were also marked in the field.

One subsurface geophysical anomaly was detected during the investigation of Parcel #020 as depicted in Figure 1. The anomaly was indicative of a "Possible UST" with respect to the UST level of confidence rating system based on TDEM and GPR investigation. A significant portion of Parcel #020 could not be investigated with geophysical methods due to obstructions. Figure 1 depicts the approximate location and size of the anomaly as well as the known metallic surface objects present at the time of the investigation. Known metallic surface objects in Figure 1 are noted with a brief identifiable description.

The UST level of confidence rating system was developed by NCDOT in May 2009 ("Known UST," "Probable UST," "Possible UST," or "No Confidence") and was used in the interpretation and presentation of this report.

Additional TDEM responses were present in the data but correlated to surface metallic debris and/or above ground metal structures and are not considered to be representative of "Potential USTs."

The locations of underground utilities were designated using EM and GPR equipment, and their locations were marked with paint on the land surface, and additionally shown in Figure 1. Positioning data was obtained using a Trimble R10 GPS antenna.

4.0 Closing

GEL Solutions appreciates the opportunity to assist Wood with this project. If you have any questions or need further information regarding the project, please do not hesitate to call me at (828) 782-3523.

Yours very truly,

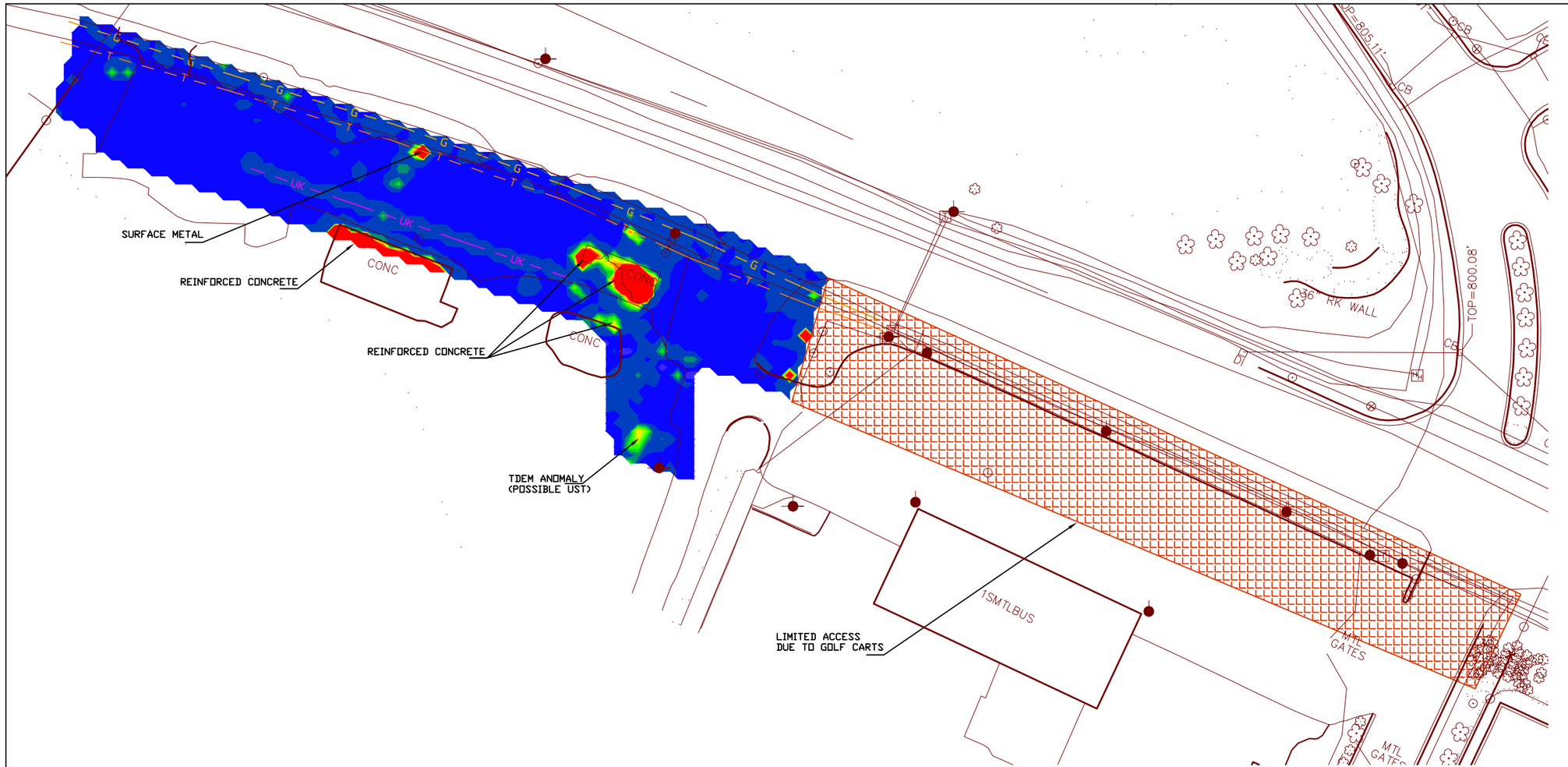
William R. Adgate
Senior Project Manager

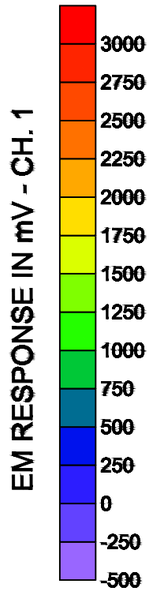
Enclosures
fc: 020.AMEC01118.Report.pdf

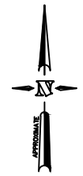
Site Photos

Photo 1: Looking east from west edge

Photo 2: Anomalous area







LEGEND

- UK — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND UNKNOWN UTILITY LINE
- W — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND WATER LINE
- E — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND ELECTRICAL POWER LINE
- G — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND GAS LINE
- T — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND COMMUNICATIONS LINE
- LIMITED ACCESSIBILITY

GRAPHIC SCALE

0 30 60 120 240

(IN FEET)

1 inch = 60 ft.

NOTES

1) UNDERGROUND FEATURES WERE LOCATED USING VISUAL EVIDENCE, GROUND PENETRATING RADAR (GPR), AND TIME DOMAIN ELECTROMAGNETIC (TDEM) METHODS. OTHER BURIED UTILITIES AND STRUCTURES MAY EXIST BUT WERE NOT DETECTED DUE TO LIMITATIONS OF THE GEOPHYSICAL METHODS, SITE ACCESS, AUTHORIZED SCOPE-OF-WORK, AND/OR HIGH TARGET CONGESTION. THEREFORE, DUE CAUTION SHOULD BE USED WHEN PERFORMING SUBSURFACE EXCAVATION ACTIVITIES WHERE POTENTIAL CONFLICTS EXIST. GEL SOLUTIONS IS NOT RESPONSIBLE FOR DAMAGES THAT MAY OCCUR. IDENTIFYING THE LOCATION OF SOME UTILITIES AND STRUCTURES MAY ONLY BE POSSIBLE WITH VACUUM OR OTHER EXCAVATION METHODS.
2) FIELD SURVEY CONDUCTED ON 10.15.2018 - 10.24.2018.
3) GEOPHYISICAL DATA GENERATED USING MALA GEOSCIENCE GPR SYSTEM CONFIGURED WITH A 450MHZ ANTENNA AND A GEONICS EM-61 TDEM SYSTEM. APPROXIMATE POSITIONING WAS PROVIDED USING TRIMBLE RTK/GPS.
4) GEL SOLUTIONS IS NOT LIABLE FOR ACCURACY OF BASE MAP PROVIDED BY WOOD.

GEL SOLUTIONS
55 SHILOH ROAD, SUITE 6
ASHEVILLE, NC 28803
(828) 782-3523
WWW.GEL-SOLUTIONS.COM

PROJECT: AMEC01118

GEOPHYSICAL INVESTIGATION FOR USTs
PARCEL #020
1479 NC 150 (RIVER HIGHWAY)
MOORESVILLE, NORTH CAROLINA

RESULTS OF GEOPHYSICAL INVESTIGATION

FIGURE 1

DATE: 10/30/18

DRAWN BY: JAT APPRV. BY: WRA

APPENDIX E
RESULTS FROM ONSITE UVF SOIL ANALYSES

North Carolina Department of Transportation
Preliminary Site Assessment
State Project: R-2307B
WBS Element: 37944.1.FR5
Parcel 037 Iredell County

Kath & Macasieb Property
1258 NC 150 (River Highway)
Mooresville, North Carolina
January 7, 2019

Wood Environment and Infrastructure Solutions, Inc.
Project: 188322307

John Maas, LG
Senior Geologist

Helen Corley, LG, PG
Senior Assoc. Hydrogeologist

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Site History 1
1.2 Site Description 2

2.0 GEOLOGY 2

2.1 Regional Geology 2
2.2 Site Geology 2

3.0 FIELD ACTIVITIES 3

3.1 Preliminary Activities 3
3.2 Site Reconnaissance 3
3.3 Geophysics Survey Results and Utility Locating 3
3.4 Soil Sampling 4

4.0 SOIL SAMPLING RESULTS 5

5.0 CONCLUSIONS 5

6.0 RECOMMENDATIONS 6

TABLES

Table 1 Summary of PID Screening Results
Table 2 Summary of Onsite UVF Petroleum Soil Results

FIGURES

Figure 1 Vicinity Map
Figure 2 Site Map with Soil Boring Locations
Figure 3 UVF Petroleum Soil Results 11/13/18

APPENDICES

Appendix A Photographic Log
Appendix B Boring Logs
Appendix C Geophysical Report
Appendix D Onsite UVF Hydrocarbon Analytical Results

1.0 INTRODUCTION

In response to the North Carolina Department of Transportation (NCDOT) Request for Proposal, dated September 17, 2018, Wood Environment and Infrastructure Solutions, Inc. (Wood) has performed a Preliminary Site Assessment (PSA) for Parcel 037. The investigation was conducted in accordance with Wood's Technical and Cost proposal dated September 27, 2018. NCDOT contracted Wood to perform a PSA at the parcel within the area to be affected by future road construction activities to identify potential impacts from the former use of the property.

The parcel is located on the north side of River Highway across from the Quiet Cove Road intersection, approximately 3.2 miles west of I-77, as shown in the Vicinity Map, **Figure 1**. The parcel, which is located at 1258 NC 150 (River Highway), is currently comprised of one occupied commercial building and a lay-down yard. It is identified as Parcel 037, the James A. and Nancy J. Kath and Wendy S. Macasieb property (Kath and Macasieb property), within the NCDOT R-2307B design file. The parcel is in Mooresville of Iredell County, North Carolina. The area of investigation within Parcel 037 (Site) is shown on **Figure 2**.

The following report summarizes a geophysical survey and describes our subsurface field investigation at the Site. The report also presents onsite soil analyses to evaluate potential soil contamination within Parcel 037, the Kath and Macasieb property.

1.1 Site History

The Site is occupied by a one-story, single-unit commercial building constructed in 1952 along River Highway. Wood interviewed the HydroHoist manager, Mr. Greg Carpenter, in person on September 21, 2018. Mr. Carpenter stated that the current owners have occupied the Site since approximately 2010 or 2011, and that the property is on a private water supply well and septic system. The water supply well is located by a fence north of the building. The septic tank was not found during the reconnaissance, but Mr. Carpenter believes it to be approximately 5-10 feet behind the building near the rear exit. This parcel does not appear on the UST Section Registry nor are any groundwater incidents known to be associated with this location. No files associated with the Site were available for review on the NCDEQ Laserfiche website.

1.2 Site Description

The Site is located in a mixed-use commercial and residential area of Mooresville in Iredell County and covers approximately 0.93 acres. At the time of the PSA field implementation, the small single-unit commercial building was occupied by HydroHoist of the Carolinas, a distributor of floating pontoon boat lifts. Most of the Site consists of a gravel lay-down yard to the rear of the building and a gravel parking lot in front of the building. The parcel is generally sloping north. Photos of the Site are presented in **Appendix A**.

2.0 GEOLOGY

2.1 Regional Geology

The Site is located within the Charlotte Terrane of the Piedmont Physiographic Province of North Carolina. According to the 1985 State Geologic Map of North Carolina, the area is underlain by massive to weakly foliated granitic rock of Devonian/Ordovician age, which is locally pinkish and contains the mineral hornblende.

2.2 Site Geology

Site geology was observed through the drilling of eight (8) shallow direct push probe soil borings (P37B1 to P37B8). Figure 2 presents the boring locations and Site layout. Borings did not exceed a total depth of 10 feet bgs. Soils encountered in the borings consisted mostly of orange to red to brown silty clay underlain by tan to brown silt and fine-grained sand, appearing to be saprolitic soils. Gray silty sand fill material was observed to a depth of two feet bgs at boring P37B3. Staining was not observed in the borings. Groundwater was not encountered in the borings. Based on observations of topography of the Site vicinity, the groundwater flow direction is inferred to be generally to the north. Boring logs are presented in **Appendix B**.

3.0 FIELD ACTIVITIES

3.1 Preliminary Activities

Prior to commencing field sampling activities at the Site, several tasks were accomplished in preparation for the subsurface investigation. A Health and Safety Plan (HASP) was created including the site-specific health and safety information necessary for the field activities. North Carolina One Call was contacted on November 5, 2018 to report the proposed drilling activities and subsequently notify all affected utilities for the parcel. GEL Solutions (GEL) was procured by Wood to perform utility locating and perform a geophysical survey at the Site. Innovation Environmental Technologies, Inc. (IET) of Concord, North Carolina was retained by Wood to perform the direct push sampling for soil borings.

Wood understands that acquisition of the expanded right-of-way is necessary for the widening of NC 150. Boring locations were strategically placed within the parcel to maximize the opportunity to encounter potentially contaminated soil. Boring depths were extended to approximately 10 feet bgs.

3.2 Site Reconnaissance

Wood personnel performed a site reconnaissance on September 21, 2018. During the site reconnaissance, the area was visually examined for the presence of any areas/obstructions that could potentially affect the subsurface investigation. Commercial merchandise, fencing, and landscaped areas were noted to be obstructing access to some areas during the reconnaissance.

3.3 Geophysics Survey Results and Utility Locating

The geophysical survey and utility locating of the Site occurred from October 15 to 25, 2018. The geophysical evaluation included the deployment of radio-frequency electromagnetic (EM), ground penetrating radar (GPR), and time-domain electromagnetic (TDEM) technologies to the Site. Their complete geophysical report is presented as **Appendix C**. GEL reported no subsurface geophysical anomalies detected within the limits

of investigation that indicated the presence of USTs. The anomalies represented in the data are indicative of known metallic surface features and/or cultural interference.

In advance of drilling activities, GEL performed utility locating at the Site. The locations of underground utilities were designated using EM and GPR equipment, and their locations were marked with paint on the land surface, as well as shown in Appendix C. Positioning data were obtained using a Trimble R10 GPS antenna. Overhead distribution powerlines were located along the southern portion of the Site along River Highway. A large transmission line corridor trending northwest is located adjacent to and west of the Site.

3.4 Soil Sampling

Wood conducted drilling activities at the Site on November 13, 2018. Wood's drilling subcontractor, IET, advanced eight (8) direct push soil borings across the area of investigation to an approximate depth of 10 feet bgs. Figure 2 presents the Site Map with boring locations and identifications. Boring locations targeted subsurface design features in the area of investigation dependent on utility clearance.

The purpose of soil sampling was to determine if a petroleum release had impacted the Site and if so, to estimate the volume of impacted soil that might require special handling during construction activities. Soil sampling was performed utilizing direct push methods accompanied by field screening. Wood conducted field screening of the soil borings with a PID that was used to screen recovered soil at approximate two-foot intervals. The interval of the soil boring exhibiting the greatest PID reading was selected for analysis of total petroleum hydrocarbons (TPH), diesel range organics (DRO), gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylene (BTEX), total aromatics, and polycyclic aromatic hydrocarbons (PAH) in soil via onsite ultraviolet fluorescence (UVF). Eight total samples were collected from the Site from the borings for UVF onsite analysis.

4.0 SOIL SAMPLING RESULTS

Based on PID field screening and UVF hydrocarbon analysis, evidence of petroleum hydrocarbon impacts was not identified within the area of investigation.
There were no elevated PID readings, above ten parts per million (ppm), detected in the borings. A sample collected from P37B7 between two to four feet bgs indicated a PID reading of 0.12 ppm and is not considered a concern for the Site. There were no other volatiles detected utilizing the PID. The PID field screening results are summarized in **Table 1** and provided on the boring logs in Appendix B.

Results from the onsite UVF petroleum soil analyses are presented in **Table 2**, with instrument generated tables in **Appendix D**. Several categories of analyses were measured including DRO, GRO, TPH, PAHs, and total aromatics. **Figure 3** presents the GRO and DRO results at each boring.

Elevated TPH values above the NCDEQ Action Limits of 50 milligrams per kilogram (mg/kg) for GRO were not detected in samples from the eight (8) borings advanced at the Site. One detection for DRO was measured at 0.74 mg/kg in sample P37B3 2-4 feet bgs, which is significantly below the NCDEQ DRO Action Limit of 100 mg/kg. The hydrocarbon analysis results from the QED QROS Hydrocarbon Analyzer are provided in Appendix D.

5.0 CONCLUSIONS

Based on Site observations and UVF onsite analysis, petroleum-impacted soil contamination was not identified above the NCDEQ Action level of 100 mg/kg for DRO and 50 mg/kg for GRO and the NCDEQ DWM MSCCs during the field activities.

The following bulleted summary is based upon Wood's evaluation of field observations, and onsite quantitative analyses of samples collected from the Site on November 13, 2018.

- This parcel in the area of proposed highway widening activities contains a small, single-unit commercial building currently occupied by HydroHoist of the Carolinas, a

distributor of floating pontoon boat lifts. Most of the Site consists of a gravel lay-down yard in the rear of the building and a gravel parking lot in front of the building.

- Results of the geophysical survey did not report any probable USTs or subsurface magnetic anomalies at the Site.

- No former USTs were identified during a review of the NCDEQ storage tank databases.

- Eight soil borings were advanced to an approximate depth of 10 feet bgs. Groundwater was not encountered in any of the borings. Samples from each boring were screened at two-foot intervals in the field by a PID. One sample from each boring was selected for onsite UVF Hydrocarbon analysis.

- Elevated TPH values above the NCDEQ Action Limit of 50 mg/kg for GRO were not detected in the samples from eight (8) borings advanced at the Site.

6.0 RECOMMENDATIONS

Based on these PSA results, Wood does not recommend further assessment or soil sampling in the area of investigation.

TABLES

Table 1
PID Field Screening Results
R-2307B, Parcel 037, J.A. & N.J. Kath; A.W & W.S. Macasieb-Iredell County
Mooresville, North Carolina

SAMPLE ID	Sample Date	Sample Depth (feet bgs)	PID Screening (ppm)
P37B1-2-4	11/13/2018	2-4	0
P37B2-2-4	11/13/2018	2-4	0
P37B3-2-4	11/13/2018	2-4	0
P37B4-2-4	11/13/2018	2-4	0
P37B5-2-4	11/13/2018	2-4	0
P37B6-2-4	11/13/2018	2-4	0
P37B7-2-4	11/13/2018	2-4	0.1
P37B8-2-4	11/13/2018	2-4	0

Prepared By/Date DRH 11/27/18
Checked By/Date RFS 12/4/18

Notes: PPM = Parts Per Million
ft bgs = feet below ground surface

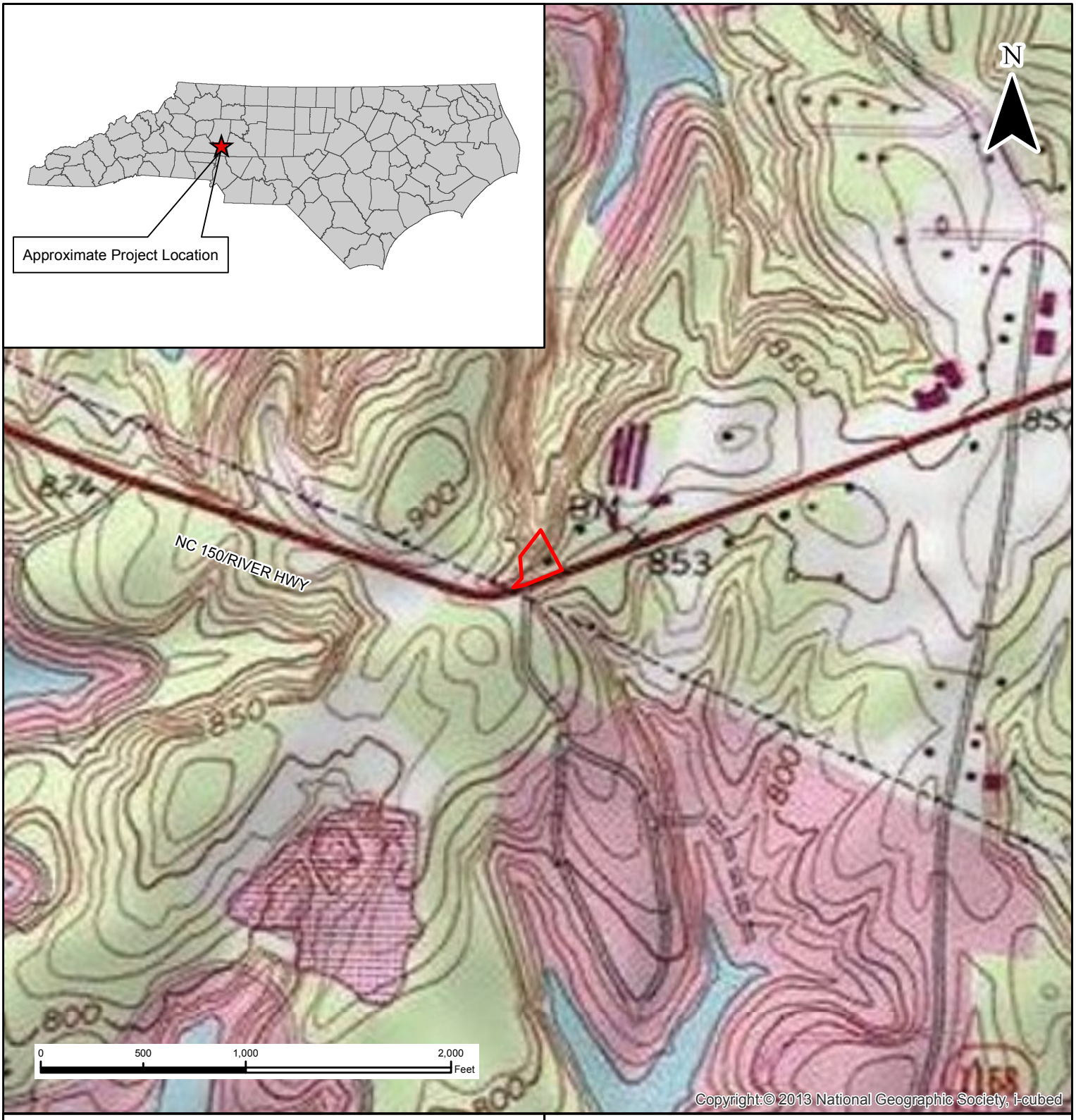
Table 2
UVF Petroleum Soil Results, 11/13/2018
R-2307B, Parcel 37, J.A. & N.J. Kath; A.W. & W.S. Macasieb-Iredell County
Mooresville, North Carolina

Sample ID Number	Sample Depth (ft bgs)	BTEX (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	PAHs (mg/kg)
NC State Action Level	**NA**	**NA**	**50**	**100**	**NA**
P37B1-2-4	2-4	<0.23	<0.23	<0.23	<0.07
P37B2-2-4	2-4	<0.28	<0.28	<0.28	<0.09
P37B3-2-4	2-4	<0.23	<0.23	0.74	<0.07
P37B4-2-4	2-4	<0.23	<0.23	<0.23	<0.07
P37B5-2-4	2-4	<0.21	<0.21	<0.21	<0.07
P37B6-2-4	2-4	<0.3	<0.3	<0.3	<0.1
P37B7-2-4	2-4	<0.21	<0.21	<0.21	<0.07
P37B8-2-4	2-4	<0.22	<0.22	<0.22	<0.07

NOTES:
(mg/kg) = Millograms per kilogram
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
PAHs = Polycyclic Aromatic Hydrocarbon
ft bgs = feet below ground surface
NA= Not applicable

Prepared By/Date DRH 11/26/18
Checked By/Date RFS 12/4/18

FIGURES



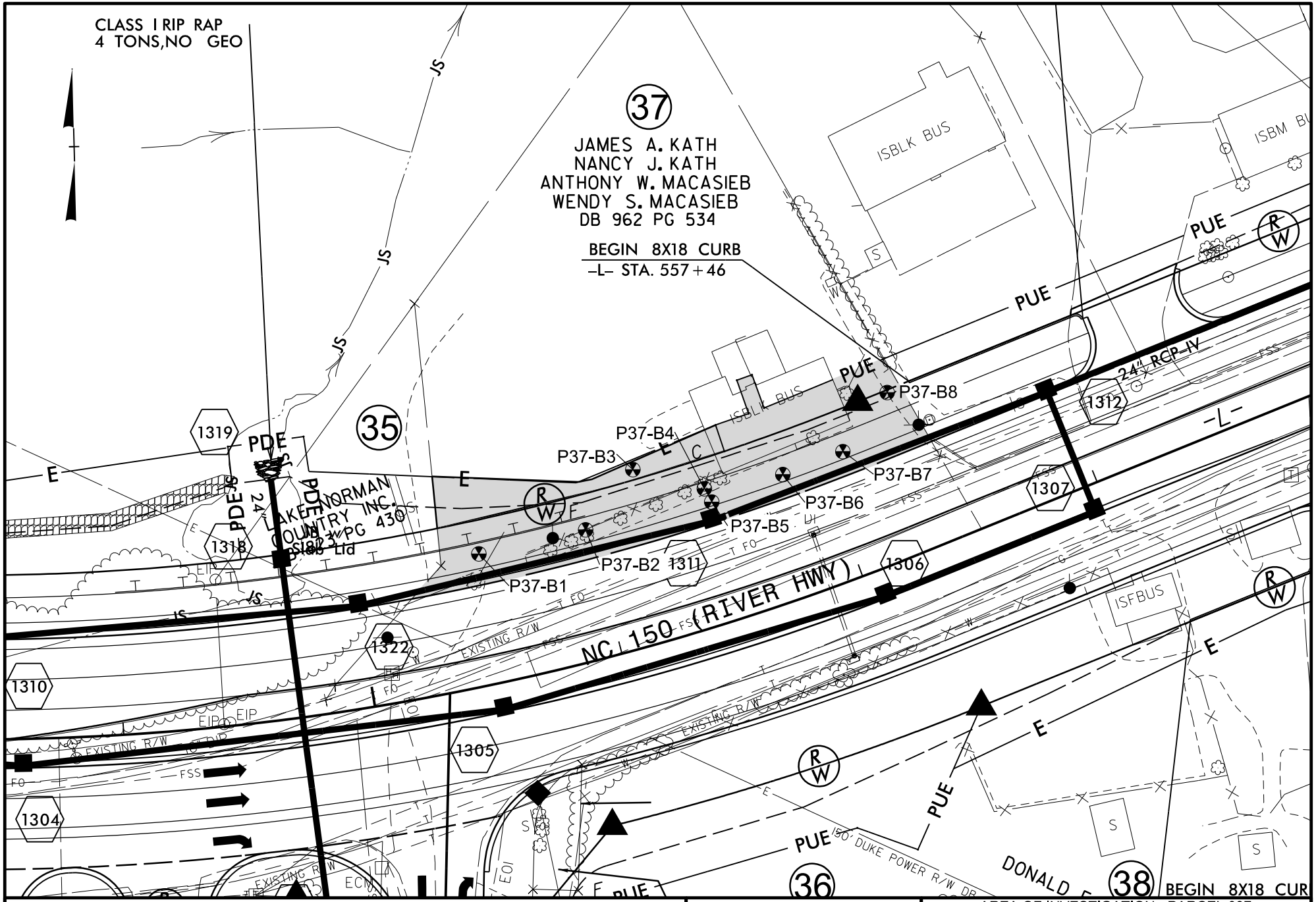
wood.

VICINITY MAP

Parcel 037
J.A. & N.J. Kath; A.W.& W.S. Macasieb
1258 NC 150 (River Hwy)
Mooresville, North Carolina

Site Boundary

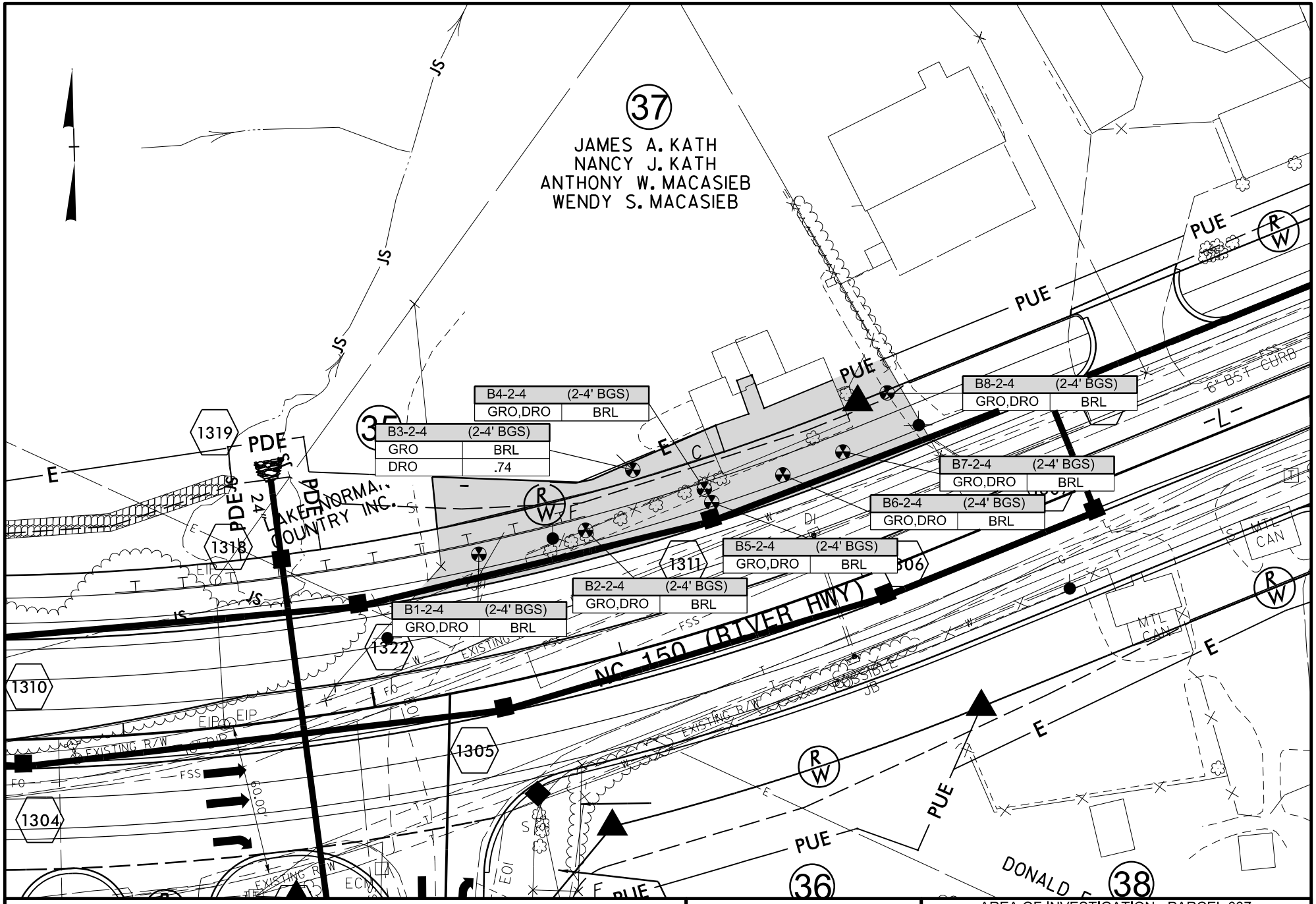
Prepared By: LMM Date: 9/20/2018	Checked By: AJF Date: 9/20/2018	Project No.: 188322307	Figure No.: 1



wood.

AREA OF INVESTIGATION - PARCEL 037
J.A. & N.J. KATH; A.W. & W.S. MACASIEB
R-2307B 1258 NC 150((RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LPL	1/3/19	HPC	1/3/2019	188322307	2



AREA OF INVESTIGATION
BORING LOCATION
GRO = GASOLINE RANGE ORGANICS
DRO = DIESEL RANGE ORGANICS
BRL = BELOW REPORTABLE LIMITS
* PAH CONCENTRATION DETECED. SEE TABLE 2 FOR ADDITIONAL INFORMATION

25′ 0′ 25′ 50′
12.5′
(ENGLISH)

wood.

AREA OF INVESTIGATION - PARCEL 037
J.A. & N.J. KATH; A.W. & W.S. MACASIEB
R-2307B 1258 NC 150((RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LPL	1/3/19	HPC	1/3/2019	188322307	3

APPENDIX A
PHOTOGRAPH LOG

PHOTO 1:

View of the south portion of the property.

Photo taken 9/21/18.

PHOTO 2:

The business onsite is a boat lift distributor, facing southeast.

Photo taken 9/21/18.

PHOTO 3:

Private water supply well found behind the building, facing south.

Photo taken 9/21/18.

PHOTO 4:

View of the fence that separates the parking lot and the rear gravel boat lift yard, looking south. West of the HydroHoist building.

Photo taken 9/21/18.

PHOTO 5:

Potential area of private septic system, facing east.

Photo taken 9/21/18.

APPENDIX B
BORING LOGS

SOIL BORING FIELD WORKSHEET

BORING #	**B-1**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Tan Orange Sandy SILT w/Clay	
4	0.0	Orange Tan Brown Silty SAND	Sample taken 2-4'
6	0.0		
8	0.0		
10	0.0	Light Tan Silty SAND	
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

wood.

SOIL BORING FIELD WORKSHEET

BORING #	**B-2**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Tan Orange Sandy SILT w/Clay	
4	0.0	Red Brown Sandy Clay	Sample taken at 2-4'
6	0.0		
8	0.0	Red Tan & Gray Sandy SILT	
10	0.0		
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-3**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Gray Silty SAND (fill)	
4	0.0	Tan Brown Sandy SILT	Sample taken at 2-4'
6	0.0		
8	0.0		
10	0.0	Tan Silty SAND	
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-4**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red Orange Sandy SILT w/Clay	
4	0.0	Red Silty CLAY	Sample taken at 2-4'
6	0.0		
8	0.0	Tan Brown Sandy SILT	
10	0.0	Tan Silty SAND	
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-5**	BORING DEPTH (ft)	**4**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**Hand Auger**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red Orange Sandy SILT w/Clay	
4	0.0	Red Silty CLAY	Sample taken at 2-4'
		*Boring terminated at 4'.	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-6**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red Brown Sandy SILT w/Clay	
4	0.0	Red Silty Clay	Sample taken at 2-4'
6	0.1		
8	0.3		
10	0.1	Orange Tan Brown Sandy SILT	
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-7**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red Orange Silty Clay	
4	0.1		Sample taken at 2-4'
6	0.1		
8	0.1	Tan Orange Sandy SILT, large quartz grains	
10	0.0		
		*Boring terminated at 10'.	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-8**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 37**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 47˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red Brown Silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	White Orange Pink Coarse SAND	
8	0.0		
10	0.0		
		*Boring terminated at 10'.	

Log Completed By: **DRH**

Page: **1**

APPENDIX C
GEOPHYSICAL REPORT

GEL Solutions

55 Shiloh Road, Suite 6
Asheville, NC 28803
P 828.782.3523

www.gel-solutions.com

November 2, 2018

Mr. John Maas, PG
Wood, PLC
2801 Yorkmont Road, Suite 100
Charlotte, NC 28208

Re: Report for Geophysical Survey to Identify Underground Storage Tanks
And Underground Utilities
Parcel #037
1258 NC 150 (River Highway)
Mooresville, North Carolina 28117

Dear Mr. Maas,

GEL Solutions appreciates the opportunity to provide Wood with this report of our geophysical investigation for the referenced project. This investigation was designed to determine the potential presence of underground storage tanks (USTs) at the site and underground utilities that would obstruct drilling activities at the site. The geophysical field investigation was successfully performed on October 15, 2018 through October 25, 2018.

1.0 Summary of Results

No subsurface anomalies were identified in the geophysical data that indicated the presence of USTs. The anomalies represented in Figure 1 are consistent with known metallic surface objects, utilities, and/or cultural interference. Although geophysical methods provide a high level of assurance for the location of subsurface objects, the possibility exists that not all features can or will be identified. Therefore, due caution should be used when performing any subsurface excavation, and GEL Solutions, LLC will not be liable for any damages that may occur. Descriptions of the technologies employed during this geophysical investigation are provided below.

2.0 Overview of Geophysical Investigation

The geophysical evaluation included the deployment of radio-frequency electromagnetic (EM), ground penetrating radar (GPR) and time-domain electromagnetic (TDEM) technologies to the site. These technologies were used in concert with one another in order to identify the presence of potential underground utilities and USTs at the site. A brief description of each technology is presented in the following paragraphs.

Radio-Frequency Electromagnetic

Radio-Frequency Electromagnetic (EM) utility locating equipment consists of a transmitter and a dual-function receiver. The receiver can be operated in a “passive” mode or in an “active” mode. The two modes of operation provide various levels of detection capabilities depending on the specific target or application.

The EM system is operated in the “active” mode by either inducting or conducting a signal into the underground utility to be traced. A transmitter is placed over and in line with a suspected buried utility. The transmitter induces a signal, which propagates along the buried utility. As the receiver is moved back and forth across the suspected path of the utility, the trace signal induces a signal into the receiver’s coil sensor. A visual and audio response indicates when the receiver is directly over the buried utility.

Another means of detecting in the "active" mode utilizes a method to "conduct" a signal within the buried utility. To accomplish this, a cable from the transmitter is clamped onto an exposed section of the buried utility and a signal propagates along the buried line. This technique minimizes any interference caused by parasitic emissions from adjacent cables in congested areas. When the system is utilized in the "passive" mode, the receiver is responding to a 60 Hertz cycle current energized by underground utilities.

Interference can and may occur when buried utilities intersect or are adjacent to each other. This effect referred to as "bleed-off" may provide a false response to the identification of the tracked utility. "Bleed-off" is caused by utilities that may be energized in the "active" or "passive" mode.

Ground Penetrating Radar Methodology

A RAMAC digital radar control system configured with a 450-Megahertz (MHz) antenna array was used in this investigation. GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver, a digital control unit which both generates and digitally records the GPR data, and a color video monitor to view data as it is collected in the field.

The transmitter radiates repetitive short-duration electromagnetic waves (at radar frequencies) into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver from the interface of materials with different dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material through which the wave is traveling, and the frequency of the signal.

Subsurface features that commonly cause such reflections are: 1) natural geologic conditions, such as changes in sediment composition, bedding, and cementation horizons and voids; or 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines, and utilities. The digital control unit processes the signal from the receiver and produces a continuous cross-section of the subsurface interface reflection events.

GPR data profiles were collected along transects covering the entire rights of ways. Depth of investigation of the GPR signal is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays, brackish groundwater, or groundwater with a high dissolved solid content from natural or manmade sources. Signal attenuation is lowest in relatively low conductivity materials such as dry sand or rock. Depth of investigation is also dependent on the antenna's transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased. The average depth of penetration at this site was approximately 2-5 feet below the surface.

The GPR antenna used at this site is internally shielded from aboveground interference sources. Accordingly, the GPR response is not affected by overhead power lines, metallic buildings, or nearby objects.

Time Domain Electromagnetic Methodology

TDEM methods measure the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time or frequency-varying magnetic field and measuring (with a receiver) the

amplitude and phase shift of an induced secondary magnetic field. The secondary magnetic field is created by subsurface conductive materials behaving as an inductor as the primary magnetic field is passed through them.

The Geonics EM-61 system used in this investigation operates within these principles. However, the EM-61 TDEM system can discriminate between moderately conductive earth materials and very conductive metallic targets. The EM-61 consists of a portable coincident loop time domain transmitter and receiver with a 1.0-meter by 0.5-meter coil system. The EM-61 generates 150 pulses per second and measures the response from the ground after transmission or between pulses. The secondary EM responses from metallic targets are of longer duration than those created by conductive earth materials. By recording the later time EM arrivals, only the response from metallic targets is measured, rather than the field generated by the earth material.

3.0 Field Procedures and Results

The geophysical field investigation was successfully performed on October 15 through October 25, 2018 at the 11 DOT parcels located in the immediate vicinity of Highway 150 in Mooresville, NC. Interpretation of the GPR data was conducted in the field and any potential anomalies were marked in the field. GPR data processing typically included band pass filtering, background removal, horizontal smoothing, and gain adjustments. TDEM was also used to scan the project site. Any electromagnetic anomalies detected during field activities that were indicative of buried metallic objects were also marked in the field.

There were no subsurface geophysical anomalies detected within the limits of Parcel #037 during this investigation that indicated the presence of USTs. The anomalies represented in the data shown on Figure 1 are indicative of known metallic surface features and/or cultural interference.

The locations of underground utilities were designated using EM and GPR equipment, and their locations were marked with paint on the land surface, and additionally shown in Figure 1. Positioning data was obtained using a Trimble R10 GPS antenna.

4.0 Closing

GEL Solutions appreciates the opportunity to assist Wood with this project. If you have any questions or need further information regarding the project, please do not hesitate to call me at (828) 782-3523.

Yours very truly,

William R. Adgate
Senior Project Manager

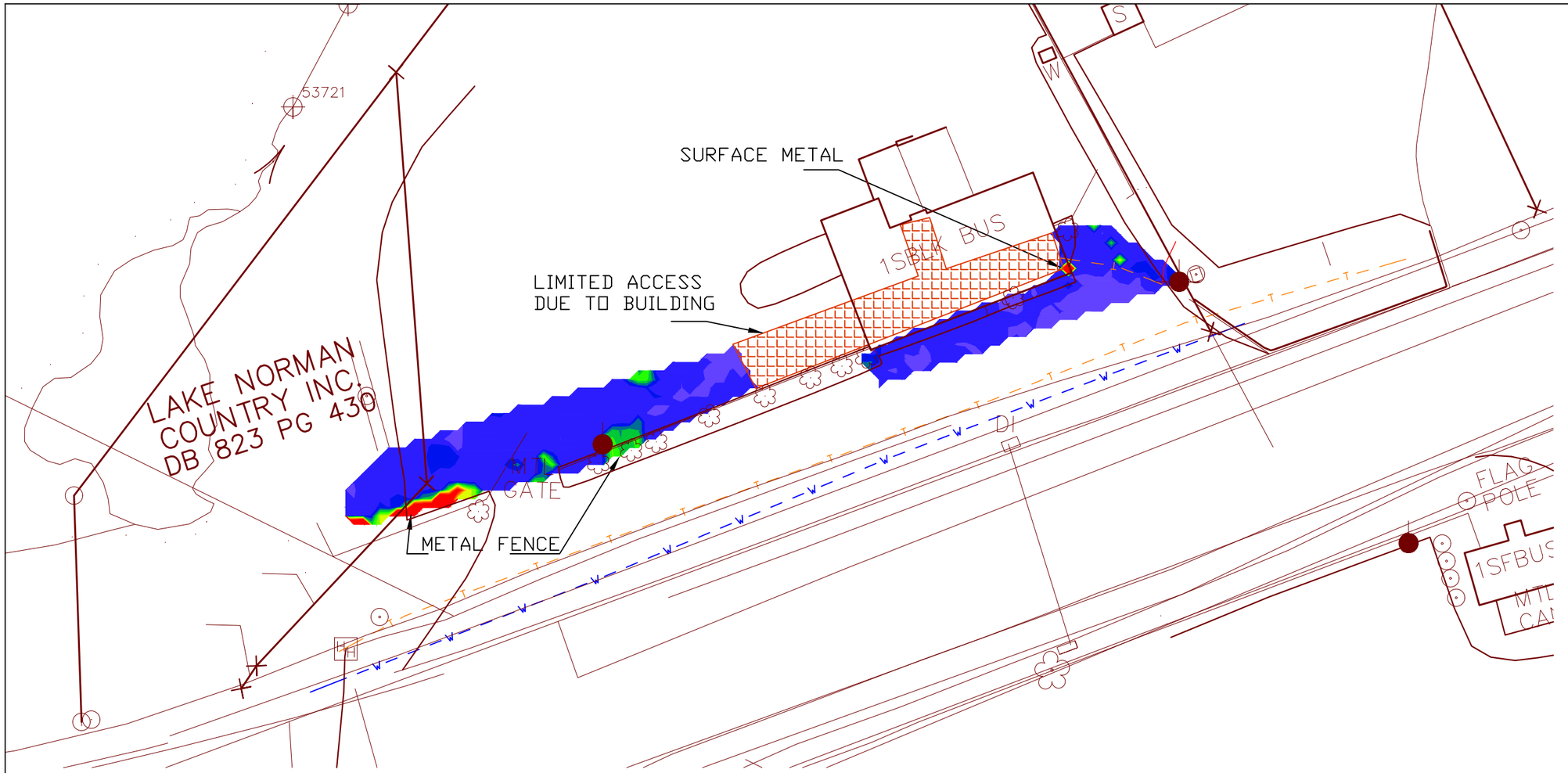
Enclosures
fc: 037.AMEC01118.Report.pdf

Site Photos

Photo 1: Looking east showing surface metal and obstructions

Photo 2: Looking east within fenced area

Photo 3: Looking northwest from southeast corner



LEGEND

- UK — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND UNKNOWN UTILITY LINE
- W — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND WATER LINE
- E — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND ELECTRICAL POWER LINE
- G — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND GAS LINE
- T — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND COMMUNICATIONS LINE
- LIMITED ACCESSIBILITY

GRAPHIC SCALE

0' 15' 30' 60' 120'

(IN FEET)
1 inch = 30 ft.

NOTES

1) UNDERGROUND FEATURES WERE LOCATED USING VISUAL EVIDENCE, GROUND PENETRATING RADAR (GPR), AND TIME DOMAIN ELECTROMAGNETIC (TDEM) METHODS. OTHER BURIED UTILITIES AND STRUCTURES MAY EXIST BUT WERE NOT DETECTED DUE TO LIMITATIONS OF THE GEOPHYSICAL METHODS, SITE ACCESS, AUTHORIZED SCOPE-OF-WORK, AND/OR HIGH TARGET CONGESTION. THEREFORE, DUE CAUTION SHOULD BE USED WHEN PERFORMING SUBSURFACE EXCAVATION ACTIVITIES WHERE POTENTIAL CONFLICTS EXIST. GEL SOLUTIONS IS NOT RESPONSIBLE FOR DAMAGES THAT MAY OCCUR. IDENTIFYING THE LOCATION OF SOME UTILITIES AND STRUCTURES MAY ONLY BE POSSIBLE WITH VACUUM OR OTHER EXCAVATION METHODS.
2) FIELD SURVEY CONDUCTED ON 10.15.2018 - 10.24.2018.
3) GEOPHYISICAL DATA GENERATED USING MALA GEOSCIENCE GPR SYSTEM CONFIGURED WITH A 45OMHZ ANTENNA AND A GEONICS EM-61 TDEM SYSTEM. APPROXIMATE POSITIONING WAS PROVIDED USING TRIMBLE RTK/GPS.
4) GEL SOLUTIONS IS NOT LIABLE FOR ACCURACY OF BASE MAP PROVIDED BY WOOD.

GEL SOLUTIONS
55 SHILOH ROAD, SUITE 6
ASHEVILLE, NC 28803
(828) 782-3523
WWW.GEL-SOLUTIONS.COM

PROJECT: AMEC01118

GEOPHYSICAL INVESTIGATION FOR USTs
PARCEL #037
1258 NC 150 (RIVER HIGHWAY)
MOORESVILLE, NORTH CAROLINA

RESULTS OF GEOPHYSICAL INVESTIGATION

FIGURE 1

DATE: 10/30/18

DRAWN BY: JAT APPRV. BY: WRA

APPENDIX D
RESULTS FROM ONSITE UVF SOIL ANALYSES

QED

AQROS

Hydrocarbon Analysis Results

Client: Wood
Address: 2802 Yorkmont Rd
Charlotte, NC 28208

Samples taken Tuesday, November 13, 2018
Samples extracted Tuesday, November 13, 2018
Samples analysed Tuesday, November 13, 2018

Contact: Helen Corley

Operator Ian Ros

Project: NCDOT Mooresville - Parcel 37 & 44

U00904

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	% Ratios			HC Fingerprint Match
										C5 - C10	C10 - C18	C18	
s	P44B1-2-4	11.8	<0.29	<0.29	<0.29	<0.29	<0.06	<0.09	<0.012	0	0	0	,(FCM),(BO),(P)
s	P44B2-0-2	11.4	<0.28	<0.28	<0.28	0.15	0.15	<0.09	<0.011	0	74.1	25.9	Residual HC,(BO),(P)
s	P44B3-0-2	13.7	<0.34	<0.34	<0.34	<0.34	<0.07	<0.11	<0.014	0	100	0	Residual HC,(BO),(P)
s	P44B4-0-2	11.8	<0.29	0.81	0.95	1.76	0.69	<0.09	<0.012	64.4	32.1	3.5	Deg.Fuel 82.8%,(FCM),(BO)
s	P44B5-0-2	9.5	<0.24	1	0.56	1.56	0.45	<0.08	<0.01	91	7	2	No Match found
s	P37B1-2-4	9.3	<0.23	<0.23	<0.23	<0.23	<0.05	<0.07	<0.009	0	55.8	44.2	Residual HC,(BO),(P)
s	P37B1-2-4	11.2	<0.28	<0.28	<0.28	<0.28	<0.06	<0.09	<0.011	0	0	0	No Match found
s	P37B3-2-4	9.1	<0.23	<0.23	0.74	0.74	0.74	<0.07	<0.009	0	61.4	38.6	V.Deg.PHC 70.8%,(FCM),(BO),(P)
s	P37B4-2-4	9.1	<0.23	<0.23	<0.23	<0.23	<0.05	<0.07	<0.009	0	100	0	No Match found
s	P37B5-2-4	8.4	<0.21	<0.21	<0.21	<0.21	<0.04	<0.07	<0.008	0	0	0	,(FCM)

Initial Calibrator QC check OK Final FCM QC Check OK 88.9 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

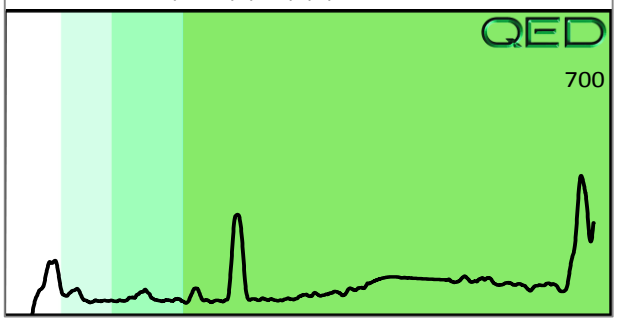
B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

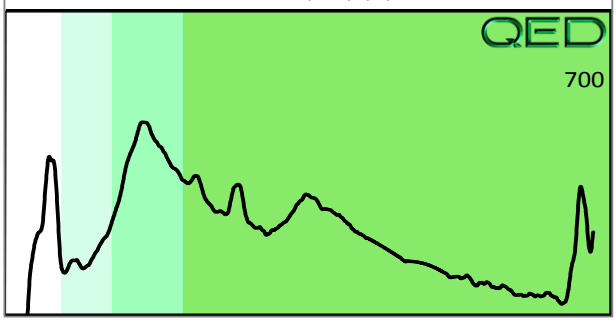
QED Hydrocarbon Fingerprints

Project: NCDOT Mooresville - Parcel 37 & 44 ##################

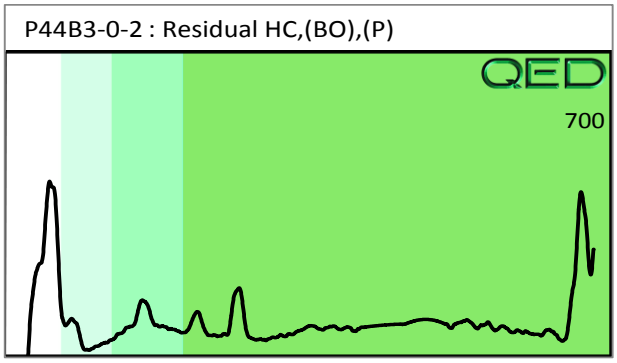
P44B1-2-4 : ,(FCM),(BO),(P)



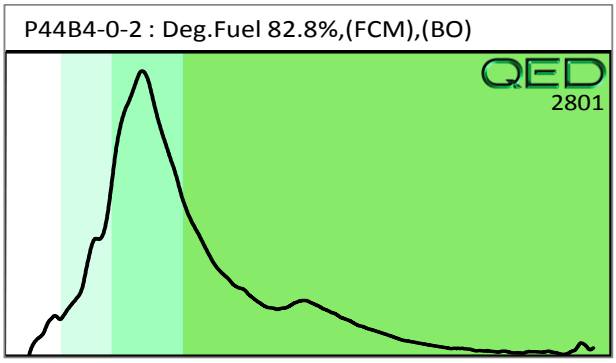
P44B2-0-2 : Residual HC,(BO),(P)



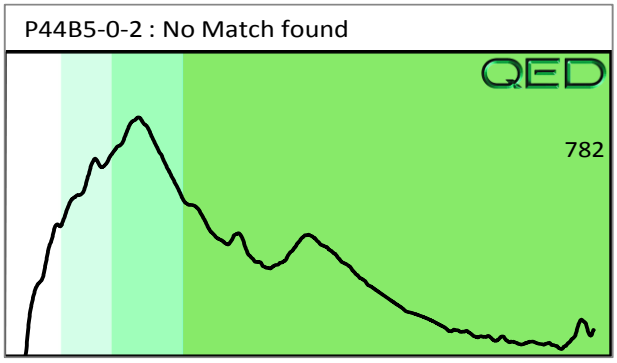
P44B3-0-2 : Residual HC,(BO),(P)



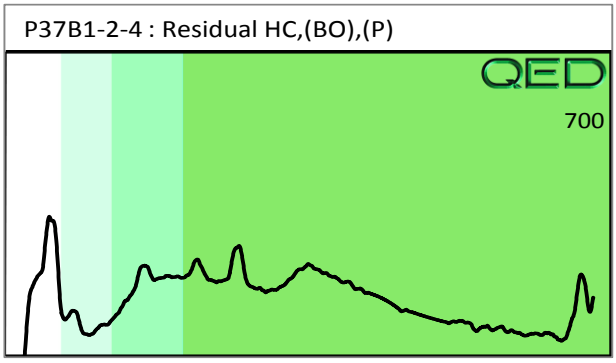
P44B4-0-2 : Deg.Fuel 82.8%,(FCM),(BO)



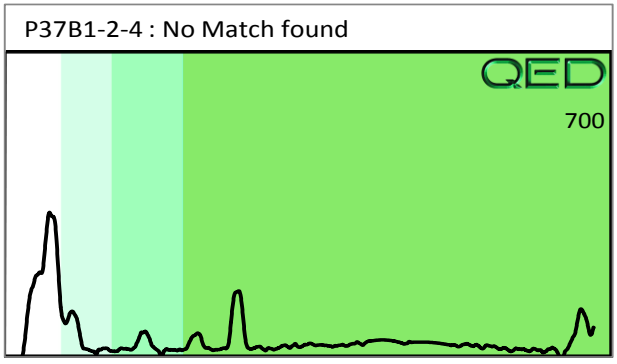
P44B5-0-2 : No Match found



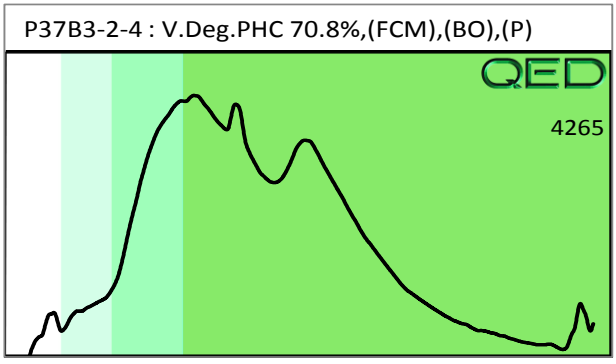
P37B1-2-4 : Residual HC,(BO),(P)



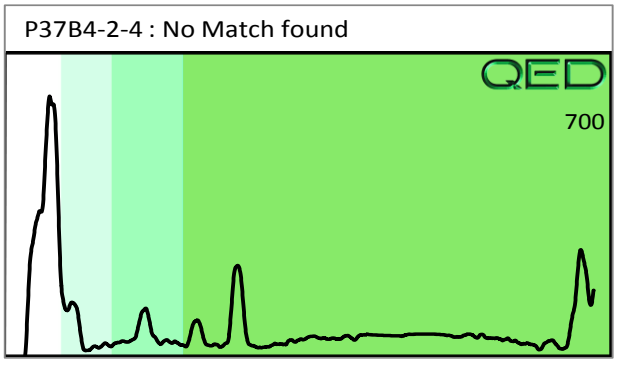
P37B1-2-4 : No Match found



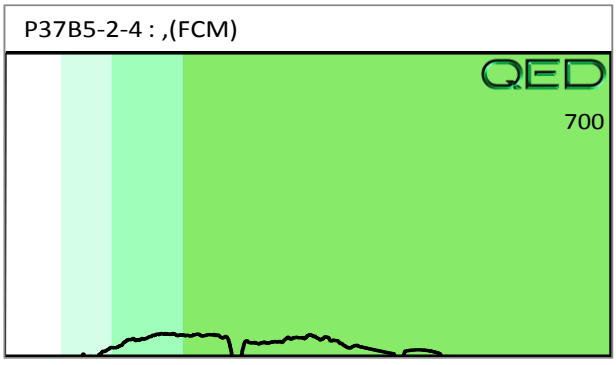
P37B3-2-4 : V.Deg.PHC 70.8%,(FCM),(BO),(P)



P37B4-2-4 : No Match found



P37B5-2-4 : ,(FCM)



QED

AQROS

Hydrocarbon Analysis Results

Client: Wood
Address: 2802 Yorkmont Rd
Charlotte, NC 28208

Samples taken Tuesday, November 13, 2018
Samples extracted Tuesday, November 13, 2018
Samples analysed Tuesday, November 13, 2018

Contact: Helen Corley

Operator Ian Ros

Project: NCDOT Mooresville - Parcel 37 & 44

U00904

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	% Ratios			HC Fingerprint Match
										C5 - C10	C10 - C18	C18	
s	P37B6-2-4	12.1	<0.3	<0.3	<0.3	0.16	0.16	<0.1	<0.012	0	75.1	24.9	V.Deg.PHC,(FCM),(BO),(P)
s	P37B7-2-4	8.3	<0.21	<0.21	<0.21	<0.21	<0.04	<0.07	<0.008	0	0	0	PHC not detected
s	P37B8-2-4	8.7	<0.22	<0.22	<0.22	<0.22	<0.04	<0.07	<0.009	0	0	0	No Match found
s	P44B6-2-4	8.8	<0.22	0.71	1.3	2	1	<0.07	<0.009	71.4	25.7	2.9	Deg.Fuel 79.2%,(FCM)
s	P44B7-2-4	12.0	<0.3	2.2	3.8	6	3	0.13	<0.012	79.3	18.5	2.2	Deg.Fuel 79.1%,(FCM),(BO)
s	P44B8-2-4	9.3	<0.23	1.4	3.3	4.7	1.8	<0.07	<0.009	80.3	17.9	1.8	Deg.Fuel 62.8%,(FCM),(BO)
s	P44B9-2-4	10.4	<0.26	<0.26	<0.26	<0.26	<0.05	<0.08	<0.01	0	0	0	Residual HC
s	P44B10-2-4	9.5	<0.24	<0.24	<0.24	<0.24	<0.05	<0.08	<0.009	75	19	6	Deg.PHC 77.3%,(FCM)
s	P44B11-2-4	10.8	<0.54	<0.27	<0.27	<0.27	<0.05	<0.09	<0.011	0	0	0	V.Deg.PHC,(FCM),(P)
s	P44B12-0-2	12.6	<0.32	<0.32	<0.32	<0.32	<0.06	<0.1	<0.013	0	100	0	No Match found

Initial Calibrator QC check OK Final FCM QC Check OK 110.9 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

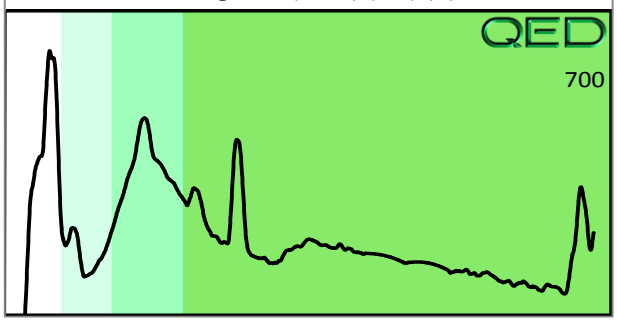
B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

QED Hydrocarbon Fingerprints

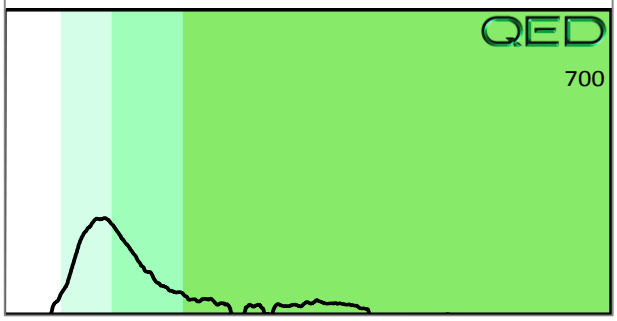
Project: NCDOT Mooresville - Parcel 37 & 44 ##################

P37B6-2-4 : V.Deg.PHC,(FCM),(BO),(P)

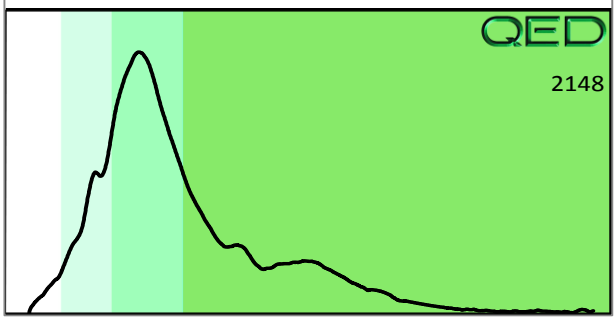


P37B7-2-4 : PHC not detected

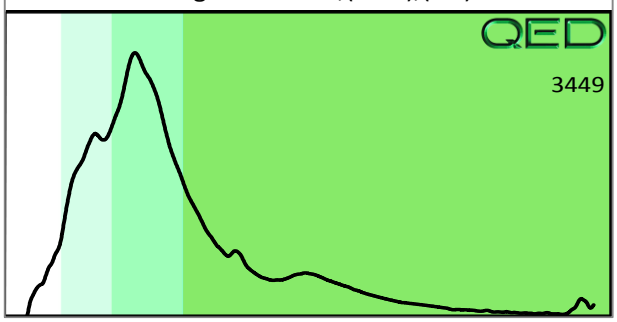
P37B8-2-4 : No Match found



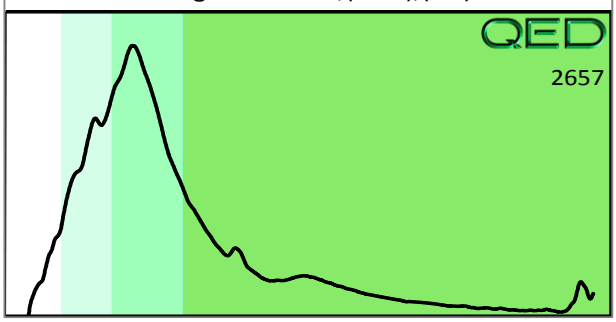
P44B6-2-4 : Deg.Fuel 79.2%,(FCM)



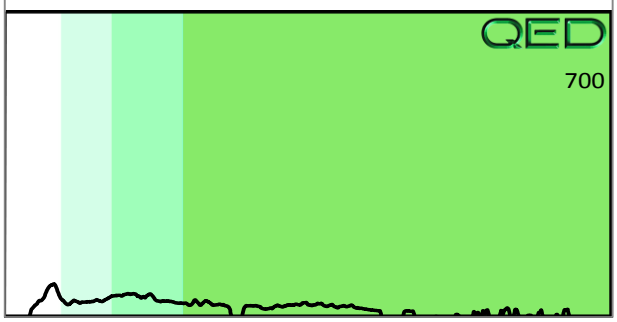
P44B7-2-4 : Deg.Fuel 79.1%,(FCM),(BO)



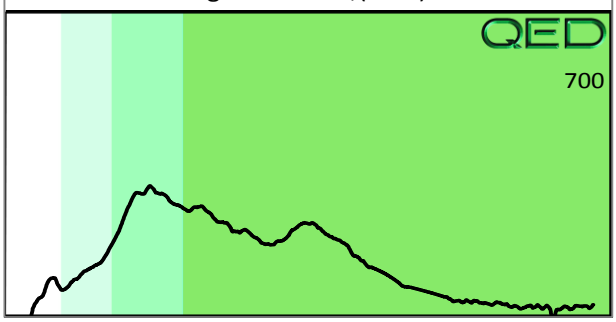
P44B8-2-4 : Deg.Fuel 62.8%,(FCM),(BO)



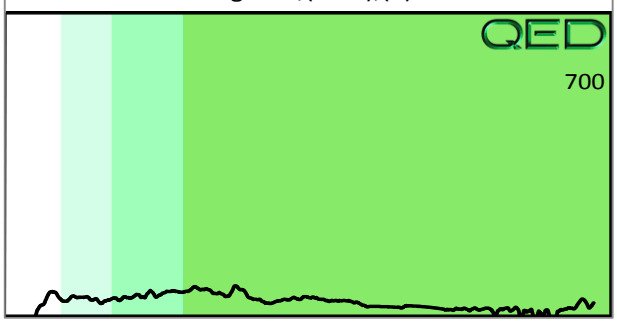
P44B9-2-4 : Residual HC



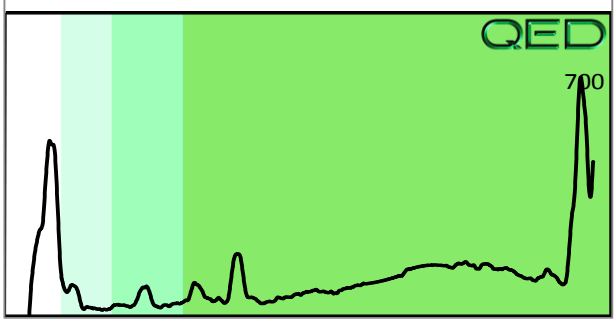
P44B10-2-4 : Deg.PHC 77.3%,(FCM)



P44B11-2-4 : V.Deg.PHC,(FCM),(P)



P44B12-0-2 : No Match found



wood.

North Carolina Department of Transportation

Preliminary Site Assessment
State Project: R-2307B
WBS Element: 37944.1.FR5
Parcel 044
Iredell County

Homerun Market Property
1228 NC 150 (River Highway)
Mooresville, North Carolina
January 7, 2019

Wood Environment and Infrastructure Solutions, Inc.
Project: 188322307

John Maas, LG
Senior Geologist

Helen Corley, LG, PG
Senior Assoc. Hydrogeologist

NORTH CAROLINA LICENSED SEAL 1486 GEOLOGIST HELEN PATRICIA CORLEY

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Site History 1
1.2 Site Description 2

2.0 GEOLOGY 2

2.1 Regional Geology 2
2.2 Site Geology 2

3.0 FIELD ACTIVITIES 3

3.1 Preliminary Activities 3
3.2 Site Reconnaissance 3
3.3 Geophysics Survey and Utility Locating Results 3
3.4 Soil Sampling 4

4.0 SOIL SAMPLING RESULTS 4

5.0 CONCLUSIONS 5

6.0 RECOMMENDATIONS 6

TABLES

Table 1 Summary of PID Screening Results
Table 2 Summary of Onsite UVF Petroleum Soil Results

FIGURES

Figure 1 Vicinity Map
Figure 2 Site Map with Soil Boring Locations
Figure 3 UVF Petroleum Soil Results 11/13/18

APPENDICES

Appendix A Photographic Log
Appendix B Boring Logs
Appendix C Geophysical Report
Appendix D Onsite UVF Hydrocarbon Analytical Results

1.0 INTRODUCTION

In response to the North Carolina Department of Transportation (NCDOT) Request for Proposal, dated September 17, 2018, Wood Environment and Infrastructure Solutions, Inc. (Wood) has performed a Preliminary Site Assessment (PSA) for Parcel 044. The investigation was conducted in accordance with Wood's Technical and Cost proposal dated September 27, 2018. NCDOT contracted Wood to perform a PSA at Parcel 044 within the area to be affected by future road construction activities to identify potential impacts from the former use of the property.

The property is located on the north side of River Highway west of Boaters Dr. intersection and approximately 3.1 miles west of I-77, as shown in the Vicinity Map, **Figure 1**. The parcel, which is located at 1228 NC 150 (River Highway), is currently comprised of one operating Shell gas station and convenience store. It is identified as Parcel 044 (the Site), Homerun Market Property within the NCDOT R-2307B design file. The Site is in Mooresville of Iredell County, North Carolina. The area of investigation is the southern portion of the parcel where the right-of-way and/or easement has been expanded as shown on **Figure 2**.

The following report summarizes a geophysical survey and describes our subsurface field investigation at the Site. The report also presents onsite soil analyses to evaluate potential soil contamination within Parcel 044, the Homerun Market Property.

1.1 Site History

The Site is occupied by an active Shell gas station with associated convenience store and a restaurant, which were constructed in 1987. Wood interviewed the gas station manager, Ms. Lisa Thompson, in person on September 21, 2018. Ms. Thompson stated that the property is on a private water supply well and septic system. The water supply well was not located but was assumed to be north of the gas station and beyond the area of investigation. The septic tank was found approximately 10 feet north of the building. This parcel appears on the UST Section Registry as Site ID: Facility #00-0-0000021566. There are no known groundwater incidents associated with this location. No files associated with the Site were available for review on the NCDEQ Laserfiche website.

1.2 Site Description

The Site is located in a mixed-use commercial and residential area of Mooresville in Iredell County and covers approximately 1.43 acres. At the time of the PSA field implementation, the parcel contained a one-story, multi-unit building and was occupied by a shell gas station with an associated convenience store and a restaurant. Most of the Site ground cover is concrete and asphalt with some grassed areas. The parcel is generally sloping southwest. A UST bed is located beyond the area of investigation. The fueling area is partially within the area of investigation with four dispenser islands in the area of investigation. Photos of the Site are presented in **Appendix A**.

2.0 GEOLOGY

2.1 Regional Geology

The Site is located within the Charlotte Terrane of the Piedmont Physiographic Province of North Carolina. According to the 1985 State Geologic Map of North Carolina, the area is underlain by strongly foliated fine-grained biotite gneiss of Cambrian/Late Proterozoic, with layers of amphibolite and muscovite schist.

2.2 Site Geology

Site geology was observed through the drilling of 12 shallow direct push probe soil borings (P44B1 to P44B12). Figure 2 presents the boring locations and Site layout. Borings did not exceed a total depth of 10 feet bgs. Soils encountered in the borings consisted mostly of red-orange and brown silty clay underlain by orange tan fine-grained sandy silt. Staining was not observed in the borings. Slight petroleum odor was indicated at 0-1 feet at P44B4, 0-2 feet at P44B5, and 0-2 feet at P44B6. These borings are located near the dispenser islands. Groundwater was not encountered in the borings. Based on observations of topography of the Site vicinity, the groundwater flow direction is inferred to be generally to the west or southwest. Boring logs are presented in **Appendix B**.

3.0 FIELD ACTIVITIES

3.1 Preliminary Activities

Prior to commencing field sampling activities at the Site, several tasks were accomplished in preparation for the subsurface investigation. A Health and Safety Plan (HASP) was created including the site-specific health and safety information necessary for the field activities. North Carolina One Call was contacted on November 5, 2018 to report the proposed drilling activities and subsequently notify all affected utilities for the parcel. GEL Solutions (GEL) was procured by Wood to perform utility locating and perform a geophysical survey at the Site. Innovation Environmental Technologies, Inc. (IET) of Concord, North Carolina was retained by Wood to perform the direct push sampling for soil borings.

Wood understands that acquisition of the expanded right-of-way is necessary for widening of NC 150. Boring locations were strategically placed within the parcel to maximize the opportunity to encounter potential contaminated soil. Boring depths were extended to approximately 10 feet bgs.

3.2 Site Reconnaissance

Wood personnel performed a site reconnaissance on September 21, 2018. During the site reconnaissance, the area was visually examined for the presence of any areas/obstructions that could potentially affect the subsurface investigation. The active UST basin was observed east of the metal canopy, outside of the area of investigation. One pair of dispenser islands is located in the area of investigation. No obstructions were noted during the reconnaissance.

3.3 Geophysics Survey Results and Utility Locating

The geophysical survey of the Site occurred from October 15 to 25, 2018. GEL performed an electromagnetic (EM) survey of the Site with a ground penetrating radar (GPR) survey conducted across select EM anomalies. Time domain electromagnetic methodology (TDEM) was also utilized to measure electrical conductivity of subsurface materials. Their complete geophysical report is presented as **Appendix C**. GEL reported no subsurface geophysical anomalies detected within the limits of investigation that indicated the

presence of USTs. The anomalies represented in the data are indicative of known metallic surface features and/or cultural interference.

In advance of drilling activities, GEL identified underground power going through the concrete area to the fuel dispenser islands. A water line, gas line, telecommunications, and more power lines were identified from NC 150 on the western side of the Site north toward the gas station. Overhead distribution powerlines were located along the southern portion of the Site along River Highway.

3.4 Soil Sampling

Wood conducted drilling activities at the Site on November 13, 2018. Wood's drilling subcontractor, IET, advanced 12 direct push soil borings across the area of investigation to an approximate depth of 10 feet bgs. Figure 2 presents the Site Map with boring locations and identifications. Boring locations targeted subsurface design features and potential environmental sources in the area of investigation dependent on utility clearance.

The purpose of soil sampling was to assess if a petroleum release had impacted the Site and if so, to estimate the volume of impacted soil that might require special handling during construction activities. Soil sampling was performed utilizing direct push methods accompanied by field screening. Wood conducted field screening of the soil borings with a PID that was used to screen recovered soil at approximate two-foot intervals. The interval of the soil boring exhibiting the greatest PID reading was selected for analysis of total petroleum hydrocarbons (TPH), diesel range organics (DRO), gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylene (BTEX), total aromatics, and polycyclic aromatic hydrocarbons (PAH) in soil via onsite ultraviolet fluorescence (UVF). Twelve total samples were collected from the Site from the borings for UVF onsite analysis.

4.0 SOIL SAMPLING RESULTS

Based on PID field screening and UVF hydrocarbon analysis, evidence of petroleum hydrocarbon impacts was not identified within the area of investigation.

There was one elevated PID reading, above ten parts per million (ppm), detected at soil boring P44B5 at 0-2 feet bgs. The PID field screening results are summarized in **Table 1** and provided on the boring logs in Appendix B.

Results from the onsite UVF petroleum soil analyses are presented in **Table 2**, with instrument generated tables in **Appendix D**. Several categories of analyses were measured including DRO, GRO, TPH, PAHs, and total aromatics. **Figure 3** presents the GRO and DRO results at each boring.

Elevated TPH values above the NCDEQ Action Limits of 50 milligrams per kilogram (mg/kg) for GRO and 100 mg/kg for DRO were not detected in samples from the 12 borings advanced at the Site. The hydrocarbon analysis results from the QED QROS Hydrocarbon Analyzer are provided in Appendix D.

5.0 CONCLUSIONS

Based on Site observations and UVF onsite analysis, petroleum-impacted soil contamination was not identified above the NCDEQ Action level of 100 mg/kg for DRO and 50 mg/kg for GRO and the NCDEQ DWM MSCCs during the field activities.

The following bulleted summary is based upon Wood's evaluation of field observations, and onsite quantitative analyses of samples collected from the Site on November 13, 2018.

- This parcel in the area of proposed highway widening activities is a property occupied by a shell gas station, convenience store, and restaurant. Most of the Site consists of concrete and asphalt with grassed areas.

- Results of the geophysical survey did not report probable USTs or subsurface magnetic anomalies at the Site.

- No former USTs were identified during a review of the NCDEQ storage tank databases.

- The current active UST basin was located east of the metal canopy, outside of the investigation area.

- The metal canopy, fuel dispensers, and associated fuel piping were found to be partially located within the investigation area. The southernmost pair of fuel dispensers are within the area of investigation.

- Twelve soil borings were advanced to an approximate depth of 10 feet bgs. Groundwater was not encountered in the borings. Samples from each boring were screened at two-foot intervals in the field by a PID. One sample from each boring was selected for onsite UVF Hydrocarbon analysis.

- Elevated TPH values above the NCDEQ Action Limit of 50 mg/kg for GRO were not detected in the samples from 12 borings advanced at the Site.

- Elevated TPH values above the NCDEQ Action Limit of 100 mg/kg for DRO were not detected in the samples from 12 borings advanced at the Site.

6.0 RECOMMENDATIONS

Based on these PSA results, Wood does not recommend further assessment or soil sampling in the area of investigation. However, the proposed design at Parcel 044 includes cut areas and new subsurface storm drain features with catch basins that will likely require the removal of the southern fuel dispenser pair and associated piping. These UST system features will need to be closed by abandonment or relocated according to NCDEQ's UST Guidance.

TABLES

Table 1
PID Field Screening Results
R-2307B, Parcel 44, Home Run Market Property-Iredell County
Mooresville, North Carolina

SAMPLE ID	Sample Date	Sample Depth (feet bgs)	PID Screening (ppm)
P44B1-2-4	11/13/2018	2-4	1.3
P44B2-0-2	11/13/2018	0-2	0
P44B3-0-2	11/13/2018	0-2	0
P44B4-0-2	11/13/2018	0-2	0.3
P44B5-0-2	11/13/2018	0-2	18.2
P44B6-2-4	11/13/2018	2-4	0.3
P44B7-2-4	11/13/2018	2-4	0.2
P44B8-2-4	11/13/2018	2-4	0
P44B9-2-4	11/13/2018	2-4	0
P44B10-2-4	11/13/2018	2-4	0
P44B11-2-4	11/13/2018	2-4	0
P44B12-0-2	11/13/2018	0-2	0

Prepared By/Date DRH 11/28/18
Checked By/Date RPD 12/4/18

Notes: PPM = Parts Per Million
ft bgs = feet below ground surface

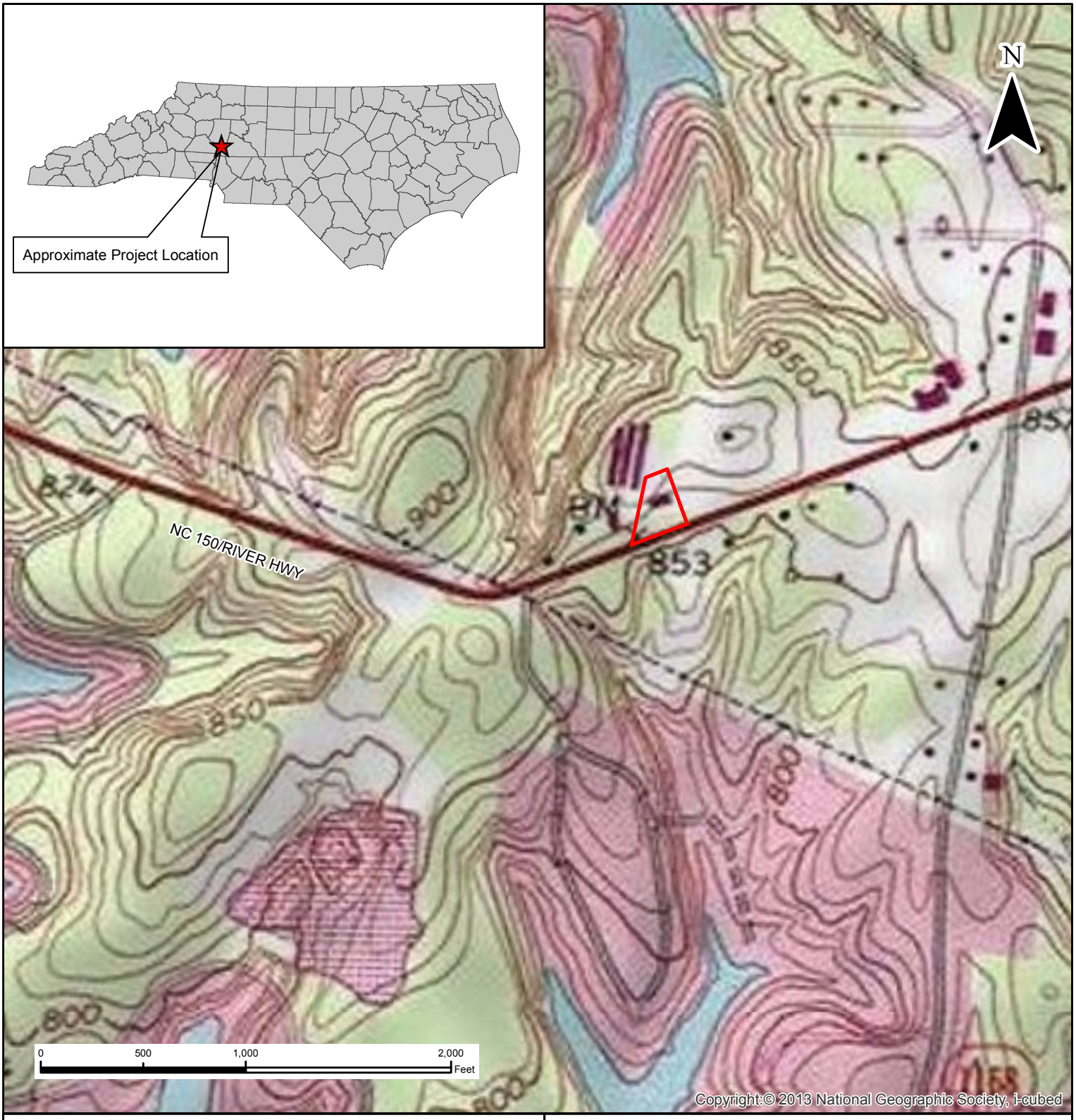
Table 2
UVF Petroleum Soil Results, 11/13/2018
R-2307B, Parcel 44, Home Run Market Property-Iredell County
Mooresville, North Carolina

Sample ID Number	Sample Depth (ft bgs)	PID Screening (ppm)	BTEX (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	PAHs (mg/kg)
NC State Action Level	**NA**	**NA**	**NA**	**50**	**100**	**NA**
P44B1-2-4	2-4	1.3	<0.29	<0.29	<0.29	<0.09
P44B2-0-2	0-2	0	<0.28	<0.28	<0.28	<0.09
P44B3-0-2	0-2	0	<0.34	<0.34	<0.34	<0.11
P44B4-0-2	0-2	0.3	<0.29	0.81	0.95	<0.09
P44B5-0-2	0-2	18.2	<0.24	1.0	0.56	<0.08
P44B6-2-4	2-4	0.3	<0.22	0.71	1.3	<0.07
P44B7-2-4	2-4	0.2	<0.3	2.2	3.8	0.13
P44B8-2-4	2-4	0	<0.23	1.4	3.3	<0.07
P44B9-2-4	2-4	0	<0.26	<0.26	<0.26	<0.08
P44B10-2-4	2-4	0	<0.24	<0.24	<0.24	<0.08
P44B11-2-4	2-4	0	<0.54	<0.27	<0.27	<0.09
P44B12-0-2	0-2	0	<0.32	<0.32	<0.32	<0.1

NOTES:
(mg/kg) = Millograms per kilogram
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
PAHs = Polycyclic Aromatic Hydrocarbon
ft bgs = feet below ground surface
NA= Not applicable

Prepared By/Date DRH 11/26/18
Checked By/Date RPD 12/4/18

FIGURES



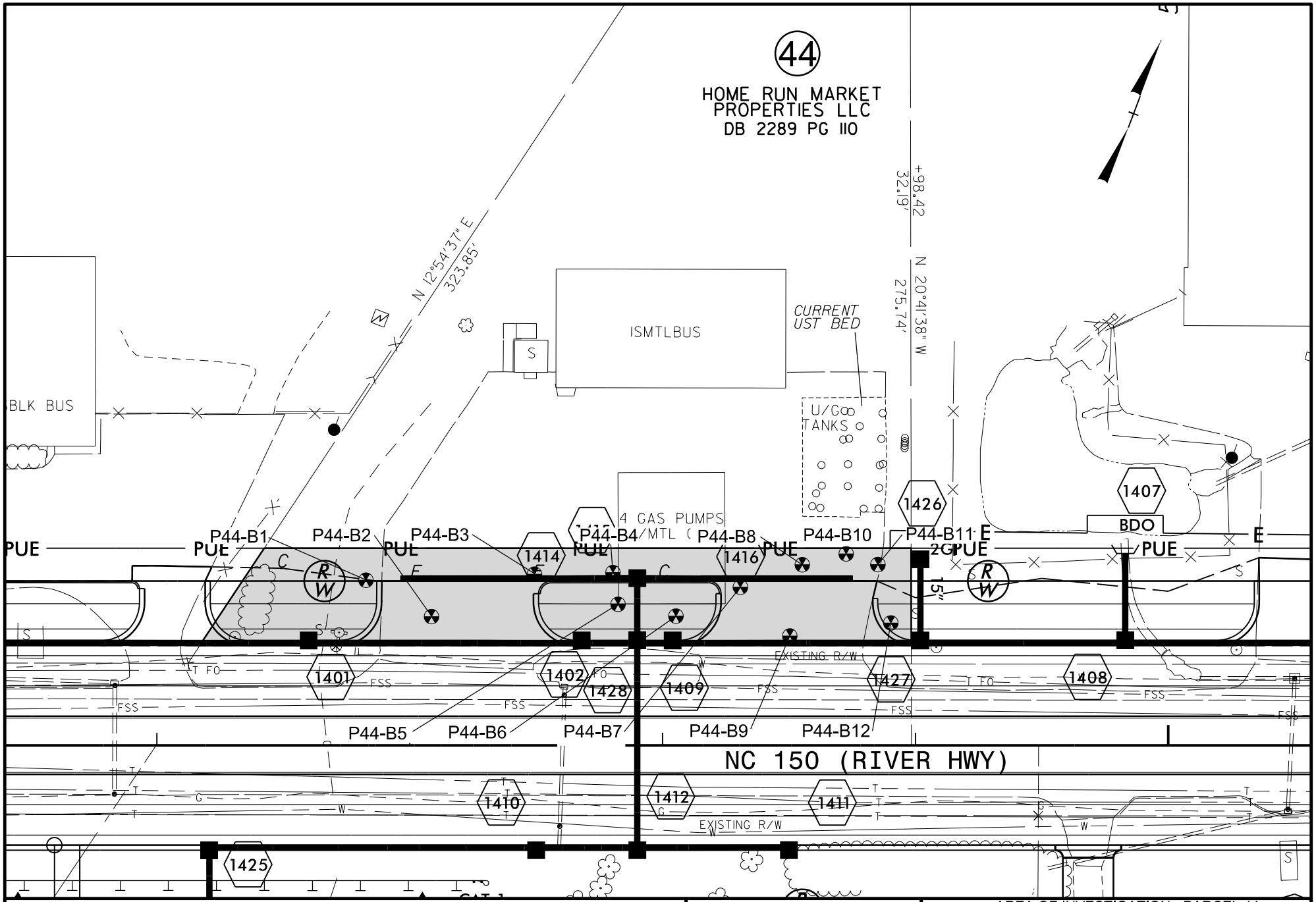
wood.

VICINITY MAP

Parcel 044
Home Run Market Properties, LLC
1228 NC 150 (River Hwy)
Mooresville, North Carolina

Site Boundary

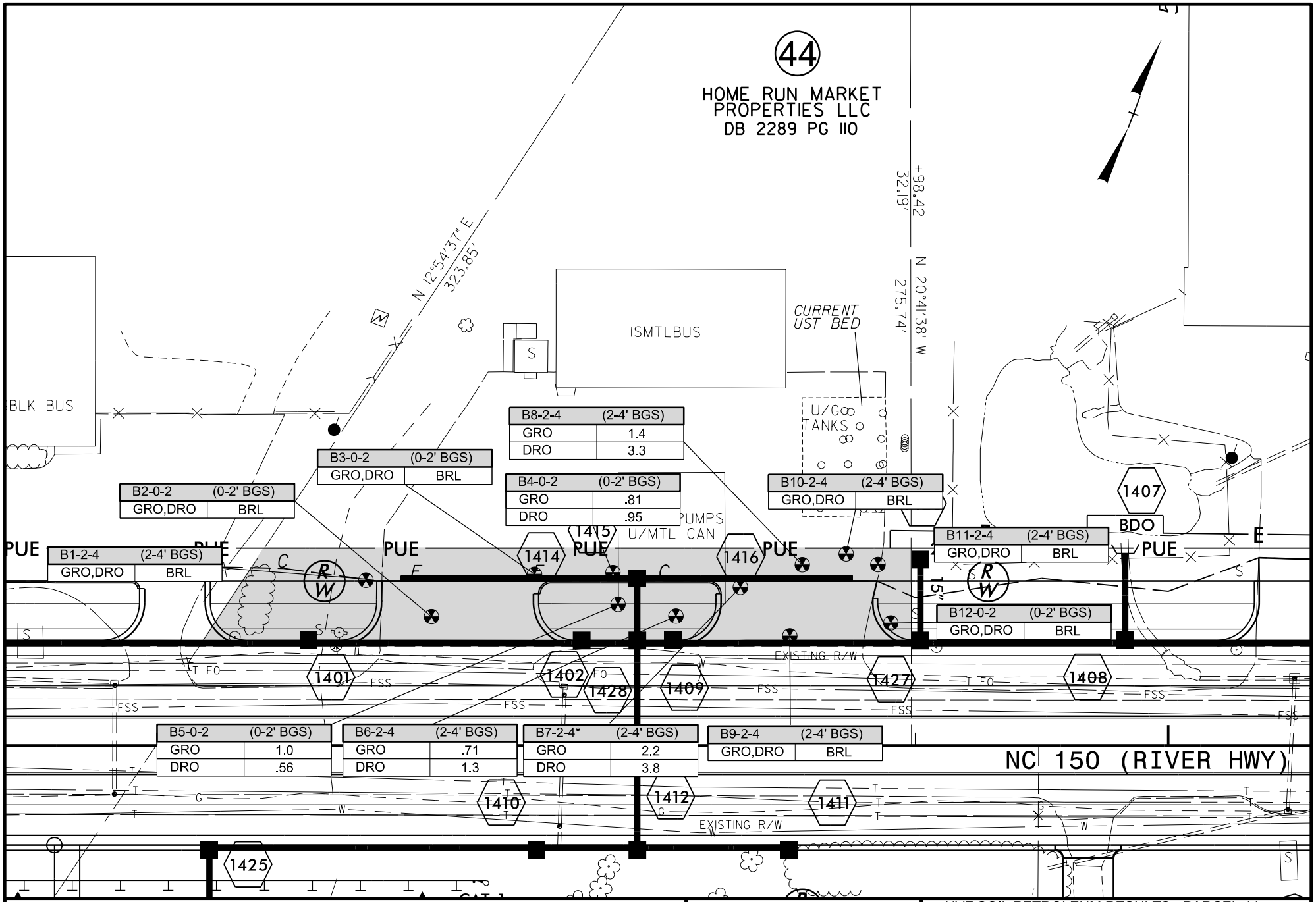
Prepared By: LMM Date: 9/20/2018	Checked By: AJF Date: 9/20/2018	Project No.: 188322307	Figure No.: 1



wood.

AREA OF INVESTIGATION - PARCEL 44
HOME RUN MARKET PROP. R-2307B
1228 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LPL	1/3/19	HPC	1/3/2019	188322307	2


44
HOME RUN MARKET
PROPERTIES LLC
DB 2289 PG 110
+98.42
32.19'
N 20°41'38" W
275.74'
N 12°54'37" E
323.85'
ISMTLBUS
CURRENT
UST BED
U/G
TANKS
PUMPS
U/MTL CAN
BLK BUS
B1-2-4 (2-4' BGS)
GRO,DRO BRL
B2-0-2 (0-2' BGS)
GRO,DRO BRL
B3-0-2 (0-2' BGS)
GRO,DRO BRL
B4-0-2 (0-2' BGS)
GRO .81
DRO .95
B8-2-4 (2-4' BGS)
GRO 1.4
DRO 3.3
B10-2-4 (2-4' BGS)
GRO,DRO BRL
B11-2-4 (2-4' BGS)
GRO,DRO BRL
B12-0-2 (0-2' BGS)
GRO,DRO BRL
B5-0-2 (0-2' BGS)
GRO 1.0
DRO .56
B6-2-4 (2-4' BGS)
GRO .71
DRO 1.3
B7-2-4* (2-4' BGS)
GRO 2.2
DRO 3.8
B9-2-4 (2-4' BGS)
GRO,DRO BRL
1401
1402
1409
1410
1411
1412
1414
1415
1416
1425
1427
1428
1407
1408
PUE
BDO
EXISTING R/W
NC 150 (RIVER HWY)
AREA OF INVESTIGATION
BORING LOCATION
GRO = GASOLINE RANGE ORGANICS
DRO = DIESEL RANGE ORGANICS
BRL = BELOW REPORTABLE LIMITS
* PAH CONCENTRATION DETECTED. SEE TABLE 2 FOR ADDITIONAL INFORMATION
25' 0' 25' 50'
12.5'
(ENGLISH)
wood.
UVF SOIL PETROLEUM RESULTS - PARCEL 44
HOME RUN MARKET PROP. R-2307B
1228 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117
PREPARED BY: LPL
DATE: 1/3/19
CHECKED BY: HPC
DATE: 1/3/2019
JOB NUMBER 188322307
FIGURE 3

APPENDIX A
PHOTOGRAPH LOG

PHOTO 1:

View of the south portion of the property, facing southwest along Highway 150.

Photo taken 9/21/18.

PHOTO 2:

View of the south portion of the property, facing northeast.

Photo taken 10/15/18.

PHOTO 3:

View of the private septic system, behind the building facing west.

Photo taken 9/21/18.

APPENDIX B
BORING LOGS

SOIL BORING FIELD WORKSHEET

BORING #	**B-1**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.2	Red orange brown, silty CLAY, moist	
4	1.3	Orange tan, sandy SILT	Sample taken at 2-4'
6	0.3	White, silty SAND	
8	0.0	Orange tan sandy SILT	
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-2**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-3**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-4**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10' Slight odor at 0-1'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-5**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	18.2	Concrete, gravel	
		Red orange brown, silty CLAY	Sample taken at 0-2'
4	1.6		
6	0.4	Orange tan, sandy SILT, paler with depth	
8	0.2		
10	0.1		
		*Boring terminated at 10' Slight odor at 0-2'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-6**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.2	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.3		Sample taken at 2-4'
6	0.1	Orange tan, sandy SILT, paler with depth	
8	0.1		
10	0.1		
		*Boring terminated at 10' Slight odor at 0-2'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-7**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.1	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.2		Sample taken at 2-4'
6	0.1	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.1		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-8**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-9**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-10**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-11**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-12**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 44.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Concrete, gravel	
		Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, sandy SILT, paler with depth	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

APPENDIX C
GEOPHYSICAL REPORT

GEL Solutions

55 Shiloh Road, Suite 6
Asheville, NC 28803
P 828.782.3523

www.gel-solutions.com

November 2, 2018

Mr. John Maas, PG
Wood, PLC
2801 Yorkmont Road, Suite 100
Charlotte, NC 28208

Re: Report for Geophysical Survey to Identify Underground Storage Tanks
And Underground Utilities
Parcel #044
1228 NC 150 (River Highway)
Mooresville, North Carolina 28117

Dear Mr. Maas,

GEL Solutions appreciates the opportunity to provide Wood with this report of our geophysical investigation for the referenced project. This investigation was designed to determine the potential presence of underground storage tanks (USTs) at the site and underground utilities that would obstruct drilling activities at the site. The geophysical field investigation was successfully performed on October 15, 2018 through October 25, 2018.

1.0 Summary of Results

No subsurface anomalies were identified in the geophysical data that indicated the presence of USTs. The anomalies represented in Figure 1 are consistent with known metallic surface objects, utilities, and/or cultural interference. Although geophysical methods provide a high level of assurance for the location of subsurface objects, the possibility exists that not all features can or will be identified. Therefore, due caution should be used when performing any subsurface excavation, and GEL Solutions, LLC will not be liable for any damages that may occur. Descriptions of the technologies employed during this geophysical investigation are provided below.

2.0 Overview of Geophysical Investigation

The geophysical evaluation included the deployment of radio-frequency electromagnetic (EM), ground penetrating radar (GPR) and time-domain electromagnetic (TDEM) technologies to the site. These technologies were used in concert with one another in order to identify the presence of potential underground utilities and USTs at the site. A brief description of each technology is presented in the following paragraphs.

Radio-Frequency Electromagnetic

Radio-Frequency Electromagnetic (EM) utility locating equipment consists of a transmitter and a dual-function receiver. The receiver can be operated in a “passive” mode or in an “active” mode. The two modes of operation provide various levels of detection capabilities depending on the specific target or application.

The EM system is operated in the “active” mode by either inducting or conducting a signal into the underground utility to be traced. A transmitter is placed over and in line with a suspected buried utility. The transmitter induces a signal, which propagates along the buried utility. As the receiver is moved back and forth across the suspected path of the utility, the trace signal induces a signal into the receiver’s coil sensor. A visual and audio response indicates when the receiver is directly over the buried utility.

Another means of detecting in the "active" mode utilizes a method to "conduct" a signal within the buried utility. To accomplish this, a cable from the transmitter is clamped onto an exposed section of the buried utility and a signal propagates along the buried line. This technique minimizes any interference caused by parasitic emissions from adjacent cables in congested areas. When the system is utilized in the "passive" mode, the receiver is responding to a 60 Hertz cycle current energized by underground utilities.

Interference can and may occur when buried utilities intersect or are adjacent to each other. This effect referred to as "bleed-off" may provide a false response to the identification of the tracked utility. "Bleed-off" is caused by utilities that may be energized in the "active" or "passive" mode.

Ground Penetrating Radar Methodology

A RAMAC digital radar control system configured with a 450-Megahertz (MHz) antenna array was used in this investigation. GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver, a digital control unit which both generates and digitally records the GPR data, and a color video monitor to view data as it is collected in the field.

The transmitter radiates repetitive short-duration electromagnetic waves (at radar frequencies) into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver from the interface of materials with different dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material through which the wave is traveling, and the frequency of the signal.

Subsurface features that commonly cause such reflections are: 1) natural geologic conditions, such as changes in sediment composition, bedding, and cementation horizons and voids; or 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines, and utilities. The digital control unit processes the signal from the receiver and produces a continuous cross-section of the subsurface interface reflection events.

GPR data profiles were collected along transects covering the entire rights of ways. Depth of investigation of the GPR signal is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays, brackish groundwater, or groundwater with a high dissolved solid content from natural or manmade sources. Signal attenuation is lowest in relatively low conductivity materials such as dry sand or rock. Depth of investigation is also dependent on the antenna's transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased. The average depth of penetration at this site was approximately 2-5 feet below the surface.

The GPR antenna used at this site is internally shielded from aboveground interference sources. Accordingly, the GPR response is not affected by overhead power lines, metallic buildings, or nearby objects.

Time Domain Electromagnetic Methodology

TDEM methods measure the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time or frequency-varying magnetic field and measuring (with a receiver) the

amplitude and phase shift of an induced secondary magnetic field. The secondary magnetic field is created by subsurface conductive materials behaving as an inductor as the primary magnetic field is passed through them.

The Geonics EM-61 system used in this investigation operates within these principles. However, the EM-61 TDEM system can discriminate between moderately conductive earth materials and very conductive metallic targets. The EM-61 consists of a portable coincident loop time domain transmitter and receiver with a 1.0-meter by 0.5-meter coil system. The EM-61 generates 150 pulses per second and measures the response from the ground after transmission or between pulses. The secondary EM responses from metallic targets are of longer duration than those created by conductive earth materials. By recording the later time EM arrivals, only the response from metallic targets is measured, rather than the field generated by the earth material.

3.0 Field Procedures and Results

The geophysical field investigation was successfully performed on October 15 through October 25, 2018 at the 11 DOT parcels located in the immediate vicinity of Highway 150 in Mooresville, NC. Interpretation of the GPR data was conducted in the field and any potential anomalies were marked in the field. GPR data processing typically included band pass filtering, background removal, horizontal smoothing, and gain adjustments. TDEM was also used to scan the project site. Any electromagnetic anomalies detected during field activities that were indicative of buried metallic objects were also marked in the field.

There were no subsurface geophysical anomalies detected within the limits of Parcel #044 during this investigation that indicated the presence of USTs. The anomalies represented in the data shown on Figure 1 are indicative of known metallic surface features and/or cultural interference.

The locations of underground utilities were designated using EM and GPR equipment, and their locations were marked with paint on the land surface, and additionally shown in Figure 1. Positioning data was obtained using a Trimble R10 GPS antenna.

4.0 Closing

GEL Solutions appreciates the opportunity to assist Wood with this project. If you have any questions or need further information regarding the project, please do not hesitate to call me at (828) 782-3523.

Yours very truly,

William R. Adgate
Senior Project Manager

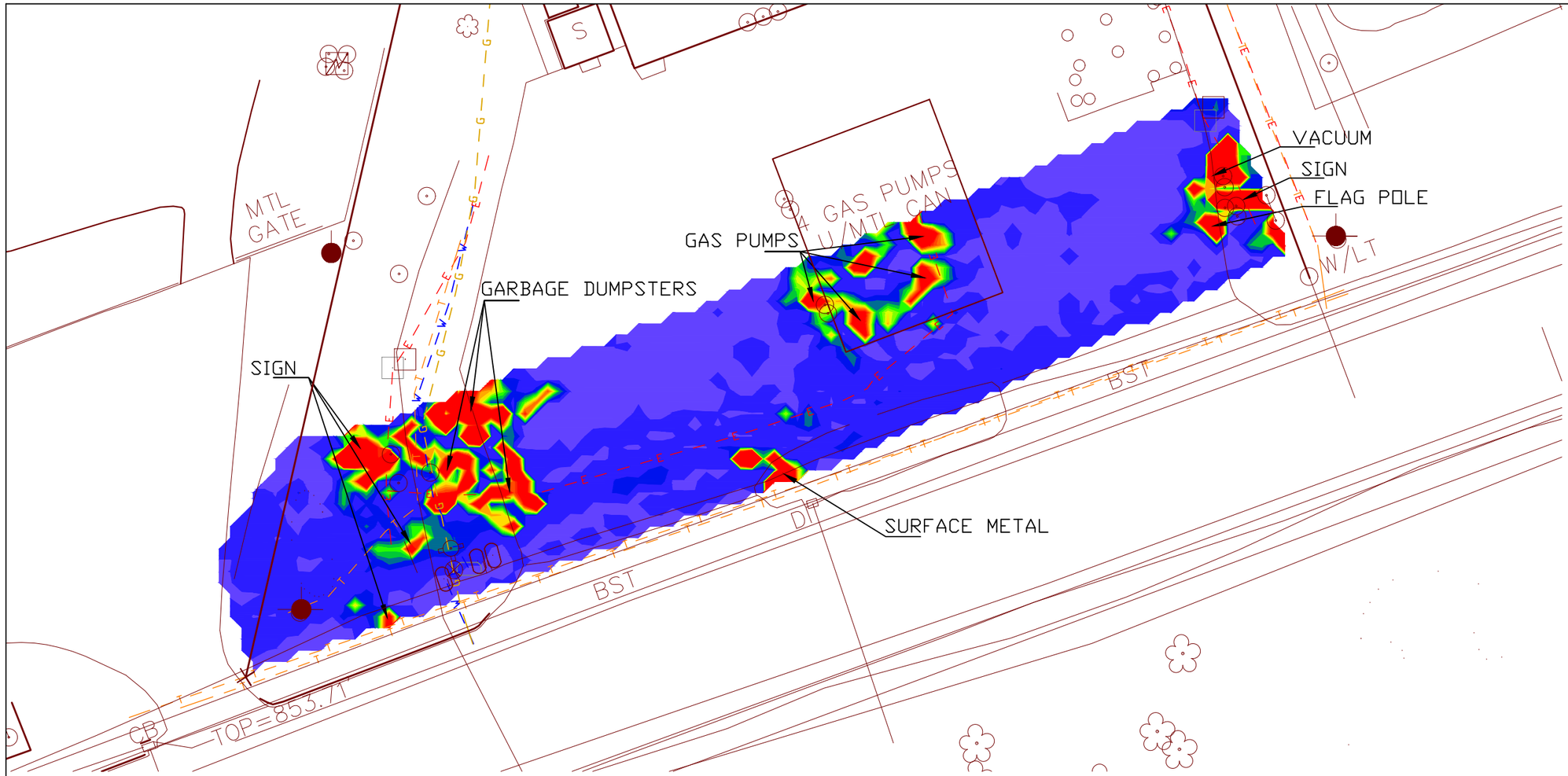
Enclosures
fc: 044.AMEC01118.Report.pdf

Site Photos

Photo 1: Looking northeast showing obstructions and surface metal

Photo 2: Looking east beyond obstructions

Photo 3: Looking west showing obstructions and surface metal



LEGEND

- UK — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND UNKNOWN UTILITY LINE
- W — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND WATER LINE
- E — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND ELECTRICAL POWER LINE
- G — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND GAS LINE
- T — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND COMMUNICATIONS LINE
- LIMITED ACCESSIBILITY

GRAPHIC SCALE

0' 15' 30' 60' 120'

(IN FEET)
1 inch = 30 ft.

NOTES

1) UNDERGROUND FEATURES WERE LOCATED USING VISUAL EVIDENCE, GROUND PENETRATING RADAR (GPR), AND TIME DOMAIN ELECTROMAGNETIC (TDEM) METHODS. OTHER BURIED UTILITIES AND STRUCTURES MAY EXIST BUT WERE NOT DETECTED DUE TO LIMITATIONS OF THE GEOPHYSICAL METHODS, SITE ACCESS, AUTHORIZED SCOPE-OF-WORK, AND/OR HIGH TARGET CONGESTION. THEREFORE, DUE CAUTION SHOULD BE USED WHEN PERFORMING SUBSURFACE EXCAVATION ACTIVITIES WHERE POTENTIAL CONFLICTS EXIST. GEL SOLUTIONS IS NOT RESPONSIBLE FOR DAMAGES THAT MAY OCCUR. IDENTIFYING THE LOCATION OF SOME UTILITIES AND STRUCTURES MAY ONLY BE POSSIBLE WITH VACUUM OR OTHER EXCAVATION METHODS.
2) FIELD SURVEY CONDUCTED ON 10.15.2018 - 10.24.2018.
3) GEOPHYISICAL DATA GENERATED USING MALA GEOSCIENCE GPR SYSTEM CONFIGURED WITH A 450MHZ ANTENNA AND A GEONICS EM-61 TDEM SYSTEM. APPROXIMATE POSITIONING WAS PROVIDED USING TRIMBLE RTK/GPS.
4) GEL SOLUTIONS IS NOT LIABLE FOR ACCURACY OF BASE MAP PROVIDED BY WOOD.

GEL SOLUTIONS
55 SHILOH ROAD, SUITE 6
ASHEVILLE, NC 28803
(828) 782-3523
WWW.GEL-SOLUTIONS.COM

PROJECT: AMEC01118

GEOPHYSICAL INVESTIGATION FOR USTs
PARCEL #044
1228 NC 150 (RIVER HIGHWAY)
MOORESVILLE, NORTH CAROLINA

RESULTS OF GEOPHYSICAL INVESTIGATION

FIGURE 1

DATE: 10/30/18

DRAWN BY: JAT APPRV. BY: WRA

APPENDIX D
RESULTS FROM ONSITE UVF SOIL ANALYSES

QED

AQROS

Hydrocarbon Analysis Results

Client: Wood
Address: 2802 Yorkmont Rd
Charlotte, NC 28208

Samples taken Tuesday, November 13, 2018
Samples extracted Tuesday, November 13, 2018
Samples analysed Tuesday, November 13, 2018

Contact: Helen Corley

Operator Ian Ros

Project: NCDOT Mooresville - Parcel 37 & 44

U00904

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	% Ratios			HC Fingerprint Match
										C5 - C10	C10 - C18	C18	
s	P44B1-2-4	11.8	<0.29	<0.29	<0.29	<0.29	<0.06	<0.09	<0.012	0	0	0	,(FCM),(BO),(P)
s	P44B2-0-2	11.4	<0.28	<0.28	<0.28	0.15	0.15	<0.09	<0.011	0	74.1	25.9	Residual HC,(BO),(P)
s	P44B3-0-2	13.7	<0.34	<0.34	<0.34	<0.34	<0.07	<0.11	<0.014	0	100	0	Residual HC,(BO),(P)
s	P44B4-0-2	11.8	<0.29	0.81	0.95	1.76	0.69	<0.09	<0.012	64.4	32.1	3.5	Deg.Fuel 82.8%,(FCM),(BO)
s	P44B5-0-2	9.5	<0.24	1	0.56	1.56	0.45	<0.08	<0.01	91	7	2	No Match found
s	P37B1-2-4	9.3	<0.23	<0.23	<0.23	<0.23	<0.05	<0.07	<0.009	0	55.8	44.2	Residual HC,(BO),(P)
s	P37B1-2-4	11.2	<0.28	<0.28	<0.28	<0.28	<0.06	<0.09	<0.011	0	0	0	No Match found
s	P37B3-2-4	9.1	<0.23	<0.23	0.74	0.74	0.74	<0.07	<0.009	0	61.4	38.6	V.Deg.PHC 70.8%,(FCM),(BO),(P)
s	P37B4-2-4	9.1	<0.23	<0.23	<0.23	<0.23	<0.05	<0.07	<0.009	0	100	0	No Match found
s	P37B5-2-4	8.4	<0.21	<0.21	<0.21	<0.21	<0.04	<0.07	<0.008	0	0	0	,(FCM)

Initial Calibrator QC check OK Final FCM QC Check OK 88.9 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

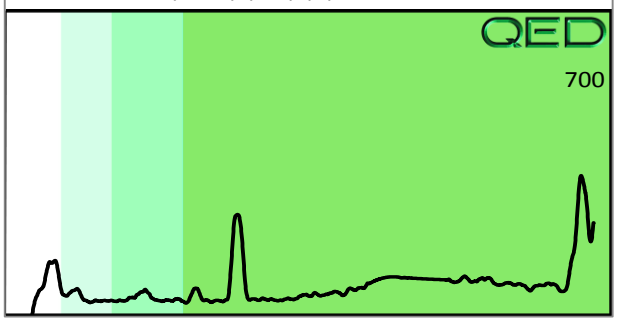
B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

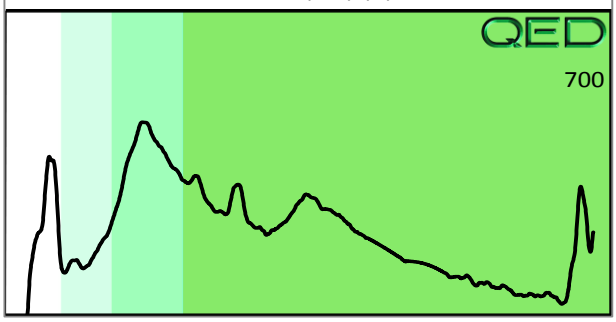
QED Hydrocarbon Fingerprints

Project: NCDOT Mooresville - Parcel 37 & 44 ##################

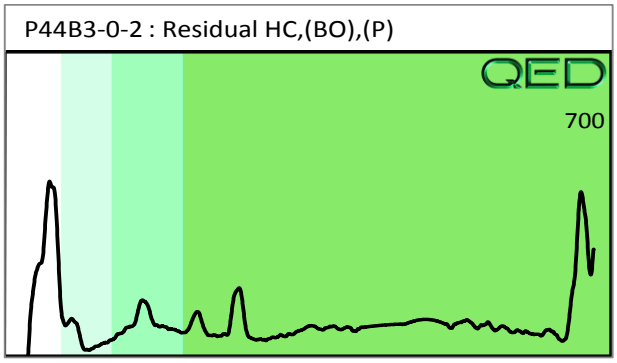
P44B1-2-4 : ,(FCM),(BO),(P)



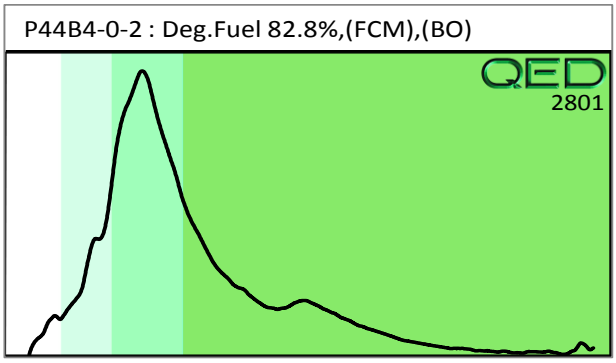
P44B2-0-2 : Residual HC,(BO),(P)



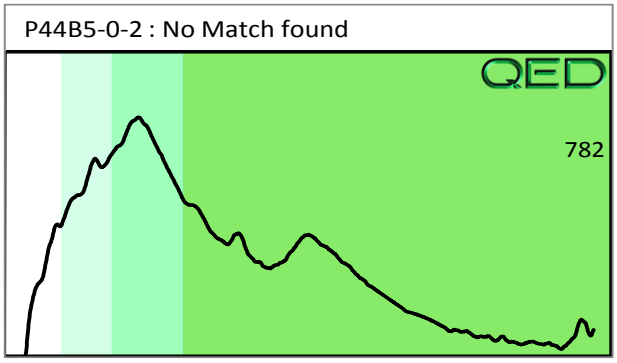
P44B3-0-2 : Residual HC,(BO),(P)



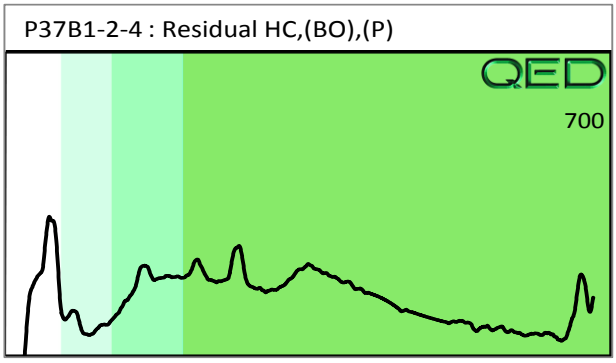
P44B4-0-2 : Deg.Fuel 82.8%,(FCM),(BO)



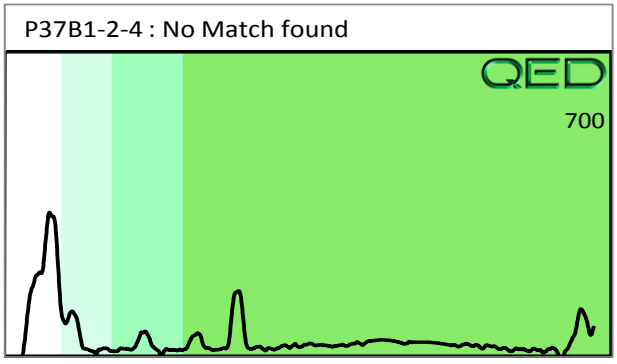
P44B5-0-2 : No Match found



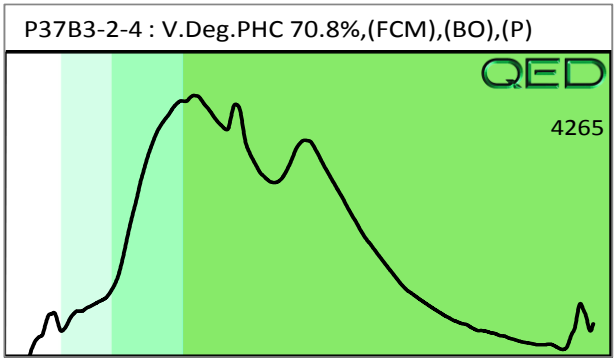
P37B1-2-4 : Residual HC,(BO),(P)



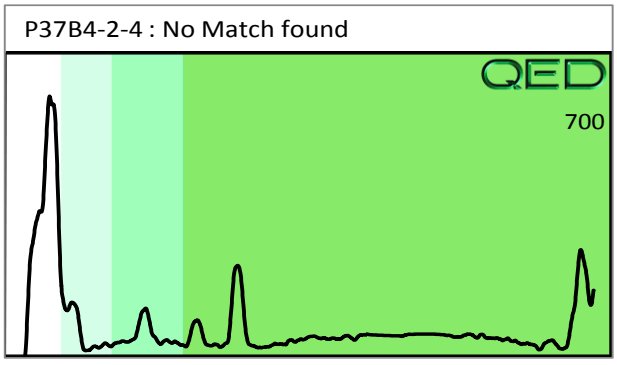
P37B1-2-4 : No Match found



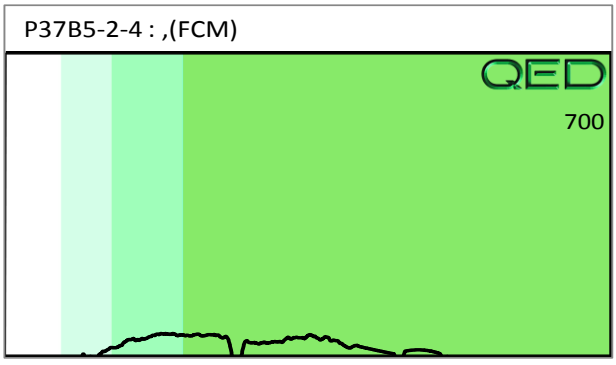
P37B3-2-4 : V.Deg.PHC 70.8%,(FCM),(BO),(P)



P37B4-2-4 : No Match found



P37B5-2-4 : ,(FCM)



QED

AQROS

Hydrocarbon Analysis Results

Client: Wood
Address: 2802 Yorkmont Rd
Charlotte, NC 28208

Samples taken Tuesday, November 13, 2018
Samples extracted Tuesday, November 13, 2018
Samples analysed Tuesday, November 13, 2018

Contact: Helen Corley

Operator Ian Ros

Project: NCDOT Mooresville - Parcel 37 & 44

U00904

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	% Ratios			HC Fingerprint Match
										C5 - C10	C10 - C18	C18	
s	P37B6-2-4	12.1	<0.3	<0.3	<0.3	0.16	0.16	<0.1	<0.012	0	75.1	24.9	V.Deg.PHC,(FCM),(BO),(P)
s	P37B7-2-4	8.3	<0.21	<0.21	<0.21	<0.21	<0.04	<0.07	<0.008	0	0	0	PHC not detected
s	P37B8-2-4	8.7	<0.22	<0.22	<0.22	<0.22	<0.04	<0.07	<0.009	0	0	0	No Match found
s	P44B6-2-4	8.8	<0.22	0.71	1.3	2	1	<0.07	<0.009	71.4	25.7	2.9	Deg.Fuel 79.2%,(FCM)
s	P44B7-2-4	12.0	<0.3	2.2	3.8	6	3	0.13	<0.012	79.3	18.5	2.2	Deg.Fuel 79.1%,(FCM),(BO)
s	P44B8-2-4	9.3	<0.23	1.4	3.3	4.7	1.8	<0.07	<0.009	80.3	17.9	1.8	Deg.Fuel 62.8%,(FCM),(BO)
s	P44B9-2-4	10.4	<0.26	<0.26	<0.26	<0.26	<0.05	<0.08	<0.01	0	0	0	Residual HC
s	P44B10-2-4	9.5	<0.24	<0.24	<0.24	<0.24	<0.05	<0.08	<0.009	75	19	6	Deg.PHC 77.3%,(FCM)
s	P44B11-2-4	10.8	<0.54	<0.27	<0.27	<0.27	<0.05	<0.09	<0.011	0	0	0	V.Deg.PHC,(FCM),(P)
s	P44B12-0-2	12.6	<0.32	<0.32	<0.32	<0.32	<0.06	<0.1	<0.013	0	100	0	No Match found

Initial Calibrator QC check OK Final FCM QC Check OK 110.9 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

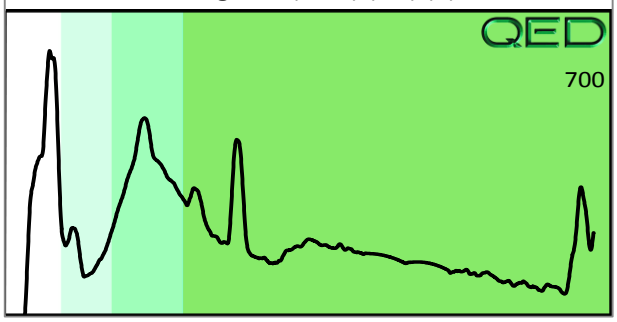
B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

QED Hydrocarbon Fingerprints

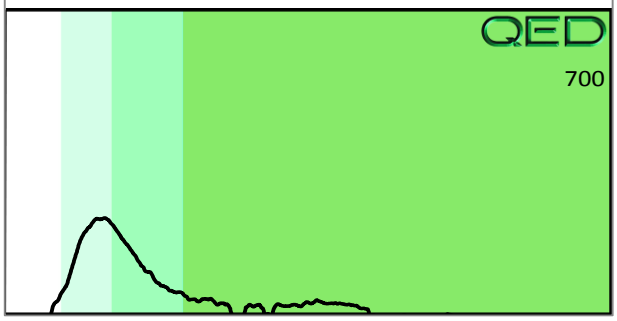
Project: NCDOT Mooresville - Parcel 37 & 44 ##################

P37B6-2-4 : V.Deg.PHC,(FCM),(BO),(P)

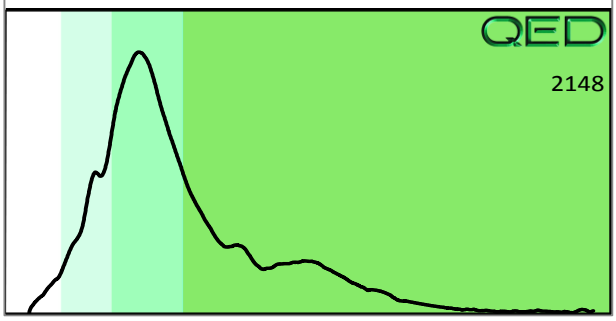


P37B7-2-4 : PHC not detected

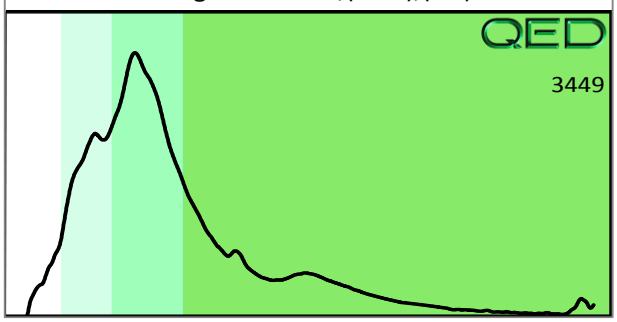
P37B8-2-4 : No Match found



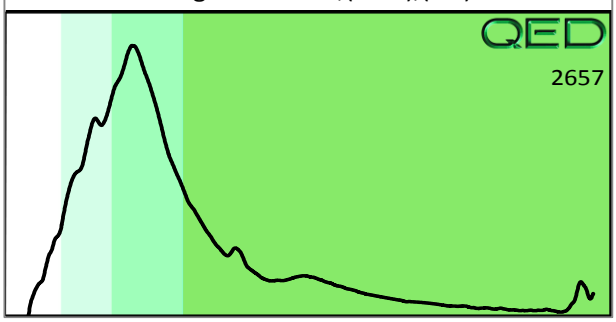
P44B6-2-4 : Deg.Fuel 79.2%,(FCM)



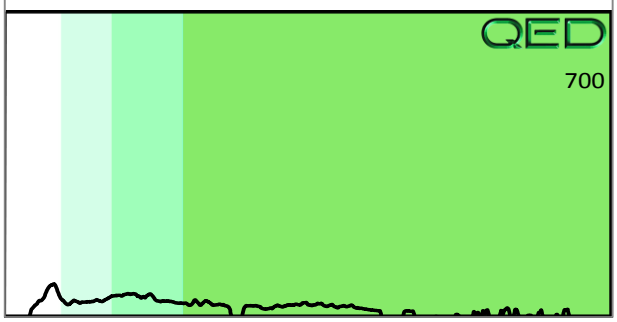
P44B7-2-4 : Deg.Fuel 79.1%,(FCM),(BO)



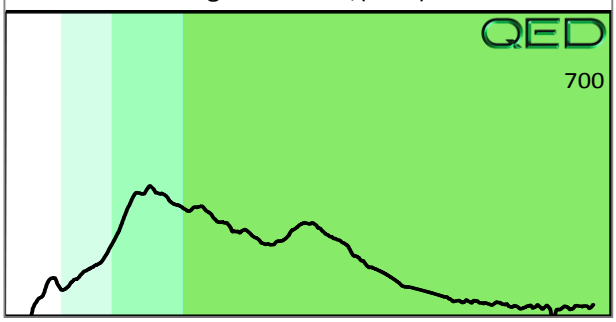
P44B8-2-4 : Deg.Fuel 62.8%,(FCM),(BO)



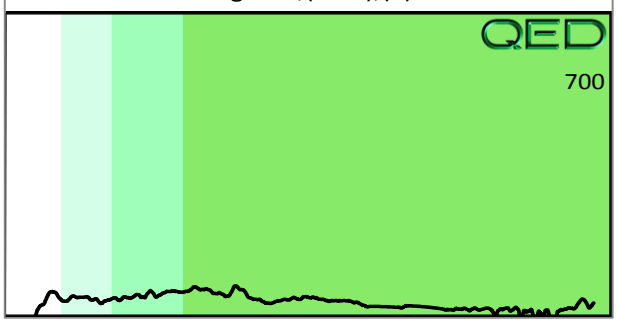
P44B9-2-4 : Residual HC



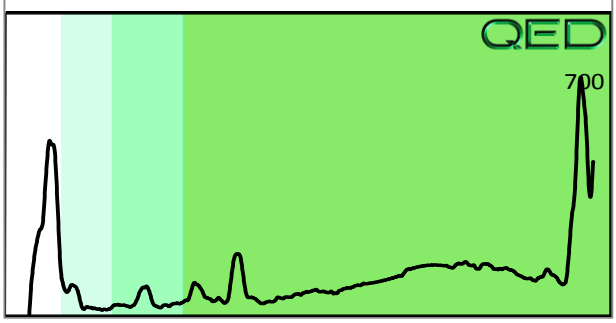
P44B10-2-4 : Deg.PHC 77.3%,(FCM)



P44B11-2-4 : V.Deg.PHC,(FCM),(P)



P44B12-0-2 : No Match found



wood.

North Carolina Department of Transportation
Preliminary Site Assessment
State Project: R-2307B
WBS Element: 37944.1.FR5
Parcel 048
Iredell County

Jai Giriraj, Inc.
1208 NC 150 (River Highway)
Mooresville, North Carolina
January 7, 2019

Wood Environment and Infrastructure Solutions, Inc.
Project: 188322307

John Maas, LG
Senior Geologist

Helen Corley, LG,
Senior Assoc. Hydrogeologist

NORTH CAROLINA LICENSED SEAL 1486 GEOLOGIST HELEN PATRICIA CORLEY

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Site History 1
1.2 Site Description 2

2.0 GEOLOGY 2

2.1 Regional Geology 2
2.2 Site Geology 2

3.0 FIELD ACTIVITIES 3

3.1 Preliminary Activities 3
3.2 Site Reconnaissance 3
3.3 Geophysics Survey Results and Utility Locating 3
3.4 Soil Sampling 4

4.0 SOIL SAMPLING RESULTS 5

5.0 CONCLUSIONS 5

6.0 RECOMMENDATIONS 6

TABLES

Table 1 Summary of PID Screening Results
Table 2 Summary of Onsite UVF Petroleum Soil Results

FIGURES

Figure 1 Vicinity Map
Figure 2 Site Map with Soil Boring Locations
Figure 3 UVF Petroleum Soil Results 11/13/18

APPENDICES

Appendix A Photographic Log
Appendix B Boring Logs
Appendix C Geophysical Report
Appendix D Onsite UVF Hydrocarbon Analytical Results

1.0 INTRODUCTION

In response to the North Carolina Department of Transportation (NCDOT) Request for Proposal, dated September 17, 2018, Wood Environment and Infrastructure Solutions, Inc. (Wood) has performed a Preliminary Site Assessment (PSA) for Parcel 048. The investigation was conducted in accordance with Wood's Technical and Cost proposal dated September 27, 2018. NCDOT contracted Wood to perform the PSA at the parcel, within the area to be affected by future road construction activities, to identify potential impacts from the former use of the property.

The parcel is located on the north side of River Highway and across the road from Boaters Dr., approximately three miles west of I-77, as shown in the Vicinity Map, **Figure 1**. The parcel, which is located at 1208 NC 150 (River Highway), is currently comprised of an active BP gas station and associated convenience store. It is identified as Parcel 048 (the Site), and Jai Giriraj, Inc. property within the NCDOT R-2307B design file. The Site is in Mooresville of Iredell County, North Carolina. The area of investigation within Parcel 048 is shown on **Figure 2**.

The following report summarizes a geophysical survey and describes our subsurface field investigation at the Site. The report also presents onsite soil analyses to evaluate potential soil contamination within Parcel 048, the Jai Giriraj, Inc. property.

1.1 Site History

The Site is occupied by a BP gas station constructed in 1998 along River Highway. Wood interviewed the gas station manager, Ms. Dolly, in person on September 21, 2018. Ms. Dolly stated that the gas station was on public water and sewer. This parcel appears on the UST Section Registry as Site ID: Facility #00-0-0000035931. There are no known groundwater incidents associated with this location. No files associated with the Site were on the NCDEQ Laserfiche website.

1.2 Site Description

The Site is located in a mixed-use commercial and residential area of Mooresville in Iredell County and covers approximately 1.21 acres. At the time of the PSA field implementation, the parcel was occupied by a BP gas station and convenience store. A UST bed and six canopy-covered fuel pumps are located beyond the area of investigation. Most of the Site ground cover is concrete and asphalt with some grassy areas. The parcel is generally sloping southeast. Photos of the Site are presented in **Appendix A**.

2.0 GEOLOGY

2.1 Regional Geology

The Site is located within the Charlotte Terrane of the Piedmont Physiographic Province of North Carolina. According to the 1985 State Geologic Map of North Carolina, the area is underlain by strongly foliated fine-grained biotite gneiss of Cambrian/Late Proterozoic age, with layers of amphibolite and muscovite schist.

2.2 Site Geology

Site geology was observed through the drilling of seven shallow direct push probe soil borings (P48B1 to P48B7). Figure 2 presents the boring locations and Site layout. Borings did not exceed a total depth of 10 feet bgs. Soils encountered in the borings consisted mostly of red orange and brown silty clay underlain by orange tan silt. Staining was not observed in the borings. Groundwater was not encountered in the borings. Based on observations of topography of the Site vicinity, the groundwater flow direction is inferred to be generally to the south or southeast. Boring logs are presented in **Appendix B**.

3.0 FIELD ACTIVITIES

3.1 Preliminary Activities

Prior to commencing field sampling activities at the Site, several tasks were accomplished in preparation for the subsurface investigation. A Health and Safety Plan (HASP) was created including the site-specific health and safety information necessary for the field activities. North Carolina One Call was contacted on November 5, 2018 to report the proposed drilling activities and subsequently notify all affected utilities for the parcel. GEL Solutions (GEL) was procured by Wood to perform utility locating and perform a geophysical survey at the Site. Innovation Environmental Technologies, Inc. (IET) of Concord, North Carolina was retained by Wood to perform the direct push sampling for soil borings.

Wood understands that acquisition of the right-of-way is necessary for the widening of NC 150. Boring locations were strategically placed within the parcel to maximize the opportunity to encounter potential contaminated soil. Boring depths were extended to approximately 10 feet bgs.

3.2 Site Reconnaissance

Wood personnel performed a Site reconnaissance on September 21, 2018. During the Site reconnaissance, the area was visually examined for the presence of any areas/obstructions that could potentially affect the subsurface investigation. The active UST basin was observed east of the metal canopy; both outside the area of investigation. No obstructions were noted during the reconnaissance.

3.3 Geophysics Survey Results and Utility Locating

The geophysical survey of the Site occurred from October 15 to 25, 2018. GEL performed an electromagnetic (EM) survey of the Site with a ground penetrating radar (GPR) survey conducted across select EM anomalies. Time domain electromagnetic methodology (TDEM) was also utilized to measure electrical conductivity of subsurface materials. Their complete geophysical report is presented as **Appendix C**. GEL reported no subsurface geophysical anomalies detected within the limits of investigation that indicated the

presence of USTs. The anomalies represented in the data are indicative of known metallic surface features and/or cultural interference.

In advance of drilling activities, GEL identified underground electric, water lines, and telecommunications on the eastern portion of the parcel. A water line was identified on the western portion of the parcel and an unknown utility was identified from the central grass median to the fuel dispenser islands. Overhead distribution powerlines were located along the southern portion of the Site along River Highway.

3.4 Soil Sampling

Wood conducted drilling activities at the Site on November 13, 2018. Wood's drilling subcontractor, IET, advanced seven direct push soil borings across the area of investigation to an approximate depth of 10 feet bgs. Figure 2 presents the Site Map with boring locations and identifications. Boring locations targeted subsurface design features and potential environmental sources in the area of investigation dependent on utility clearance.

The purpose of soil sampling was to determine if a petroleum release had impacted the Site and if so, to estimate the volume of impacted soil that might require special handling during construction activities. Soil sampling was performed utilizing direct push methods accompanied by field screening. Wood conducted field screening of the soil borings with a PID that was used to screen recovered soil at approximate two-foot intervals. The interval of the soil boring exhibiting the greatest PID reading was selected for analysis of total petroleum hydrocarbons (TPH), diesel range organics (DRO), gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylene (BTEX), total aromatics, and polycyclic aromatic hydrocarbons (PAH) soil via on-site ultraviolet fluorescence (UVF). Eight total samples were collected from the Site from the borings for UVF on-site analysis.

4.0 SOIL SAMPLING RESULTS

Based on PID field screening and UVF hydrocarbon analysis, evidence of petroleum hydrocarbon impacts was not identified within the area of investigation.

There were no elevated PID readings, above ten parts per million (ppm), detected at any of the soil borings. The PID field screening results are summarized in **Table 1** and provided on the boring logs in Appendix B.

Results from the onsite UVF petroleum soil analyses are presented in **Table 2**, with instrument generated tables in **Appendix D**. Several categories of analyses were measured including DRO, GRO, TPH, PAHs, and total aromatics. **Figure 3** presents the GRO and DRO results at each boring.

Elevated TPH values above the NCDEQ Action Limits of 50 milligrams per kilogram (mg/kg) for GRO and 100 mg/kg for DRO were not detected in samples from the seven borings advanced at the Site. The hydrocarbon analysis results from the QED QROS Hydrocarbon Analyzer are provided in Appendix D.

5.0 CONCLUSIONS

Based on Site observations and UVF onsite analysis, petroleum-impacted soil contamination was not identified above the NCDEQ Action level of 100 mg/kg for DRO and 50 mg/kg for GRO and the NCDEQ DWM MSCCs during the field activities.

The following bulleted summary is based upon Wood's evaluation of field observations, and onsite and offsite quantitative analyses of samples collected from the Site on November 13, 2018.

- This parcel in the area of proposed highway widening activities is a property occupied by a BP station and convenience store. Most of the Site consists of concrete and asphalt with grass on the perimeter of the parcel.

- Results of the geophysical survey did not identify any probable USTs or subsurface magnetic anomalies at the Site.

- The current active UST basin is west of the metal canopy with fueling dispensers and neither are within the area of investigation.

- No former USTs were identified during a review of the NCDEQ storage tank databases.

- Seven soil borings were advanced to an approximate depth of 10 feet bgs. Groundwater was not encountered in the borings. Samples from each boring were screened at two-foot intervals in the field by a PID.

- Elevated TPH values above the NCDEQ Action Limit of 50 mg/kg for GRO were not detected in the samples from seven borings advanced at the Site.

- Elevated TPH values above the NCDEQ Action Limit of 100 mg/kg for DRO were not detected in the samples from seven borings advanced at the Site.

6.0 RECOMMENDATIONS

Based on these PSA results, Wood does not recommend further assessment or soil sampling in the area of investigation.

TABLES

Table 1
PID Field Screening Results
R-2307B, Parcel 48, Jai Giriraj, Inc.-Iredell County
Mooresville, North Carolina

SAMPLE ID	Sample Date	Sample Depth (feet bgs)	PID Screening (ppm)
P48B1-2-4	11/13/2018	2-4	0.5
P48B2-0-2	11/13/2018	0-2	0
P48B3-0-2	11/13/2018	0-2	0
P48B4-2-4	11/13/2018	2-4	0
P48B5-0-2	11/13/2018	0-2	0
P48B6-2-4	11/13/2018	2-4	0
P48B7-0-2	11/13/2018	0-2	0
P48B7-8-10	11/13/2018	8-10	0
		Prepared By/Date	DRH 11/28/18
		Checked By/Date	RPD 12/5/18

Notes: PPM = Parts Per Million
ft bgs = feet below ground surface

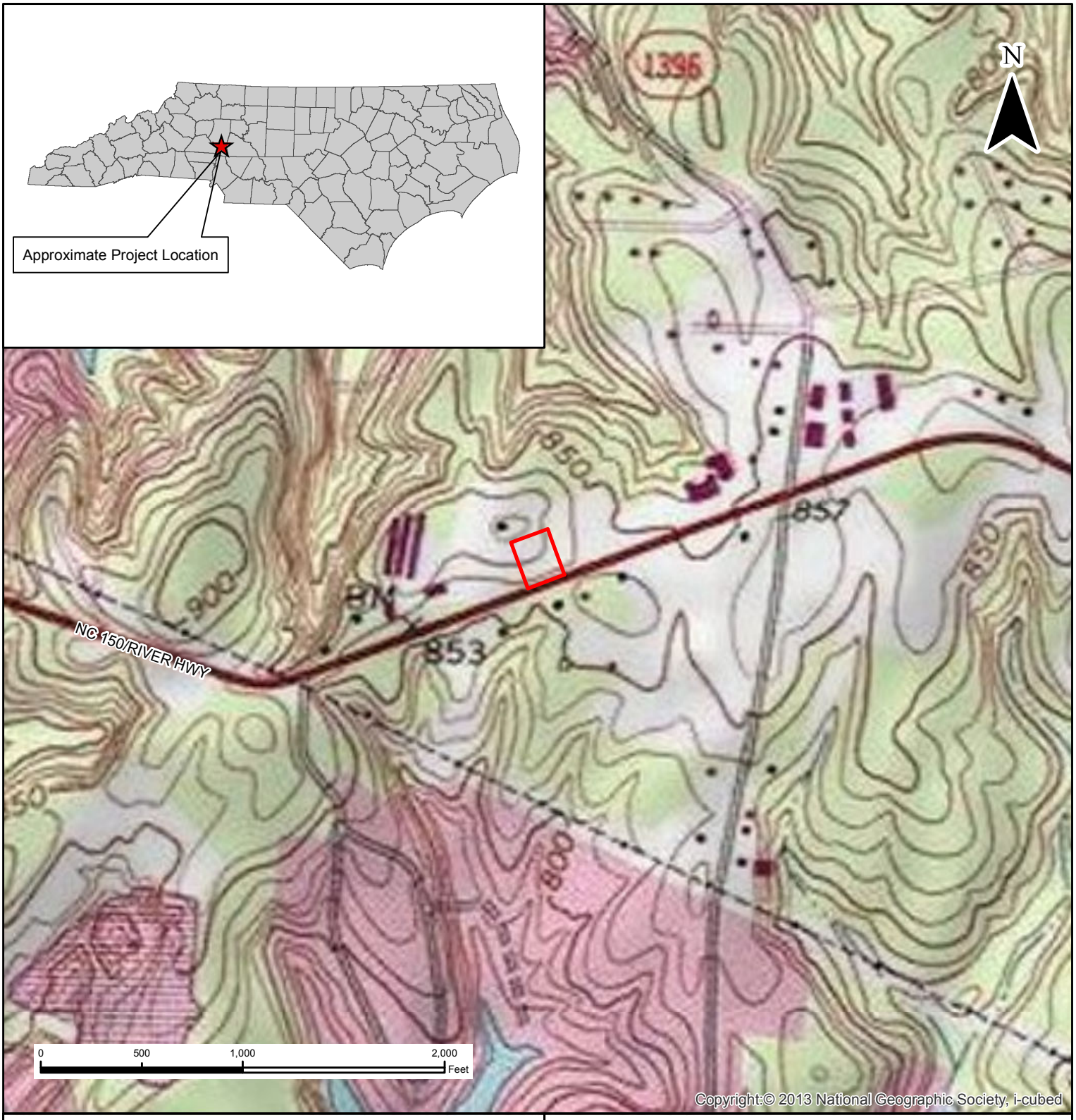
Table 2
UVF Petroleum Soil Results, 11/13/2018
R-2307B, Parcel 48, Jai Giriraj, Inc.- Iredell County
Mooresville, North Carolina

Sample ID Number	Sample Depth (ft bgs)	BTEX (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	PAHs (mg/kg)
NC State Action Level	**NA**	**NA**	**50**	**100**	**NA**
P48B1-2-4	2-4	<0.22	<0.22	0.22	<0.07
P48B2-0-2	0-2	<0.27	<0.27	0.27	<0.09
P48B3-0-2	0-2	<0.29	<0.29	<0.29	<0.09
P48B4-2-4	2-4	<0.26	<0.26	<0.26	<0.08
P48B5-0-2	0-2	<0.29	<0.29	0.29	<0.09
P48B6-2-4	2-4	<0.26	<0.26	0.26	<0.08
P48B7-0-2	0-2	<0.27	<0.27	<0.27	<0.09
P48B7-8-10	8-10	<0.24	<0.24	3.1	0.14

NOTES:
(mg/kg) = Millograms per kilogram
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
PAHs = Polycyclic Aromatic Hydrocarbon
ft bgs = feet below ground surface
NA= Not applicable

Prepared By/Date DRH 11/26/18
Checked By/Date RPD 12/5/18

FIGURES



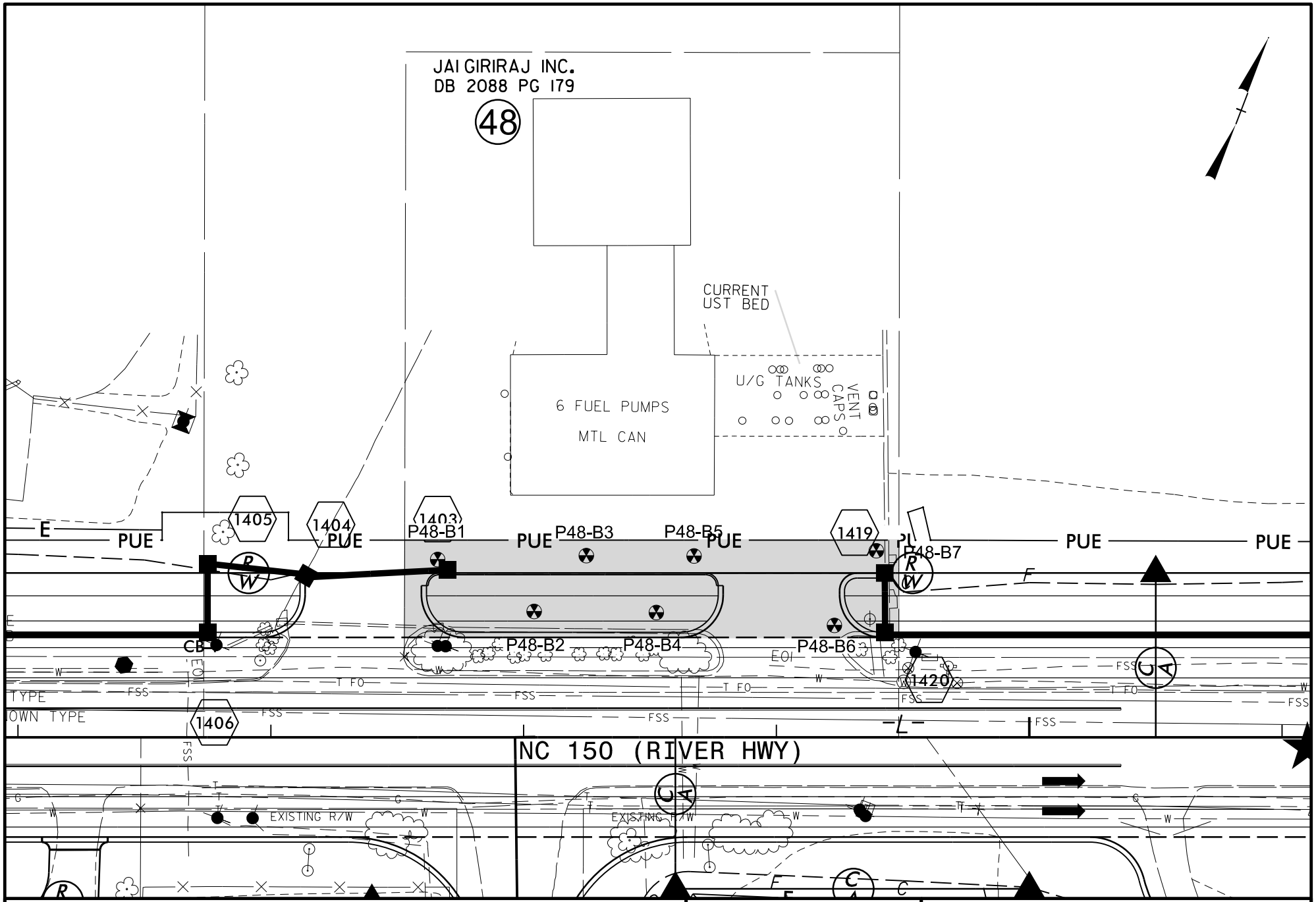
wood.

VICINITY MAP

Parcel 048
Jai Giriraj, Inc.
1208 NC 150 (River Hwy) Mooresville, North Carolina

Site Boundary

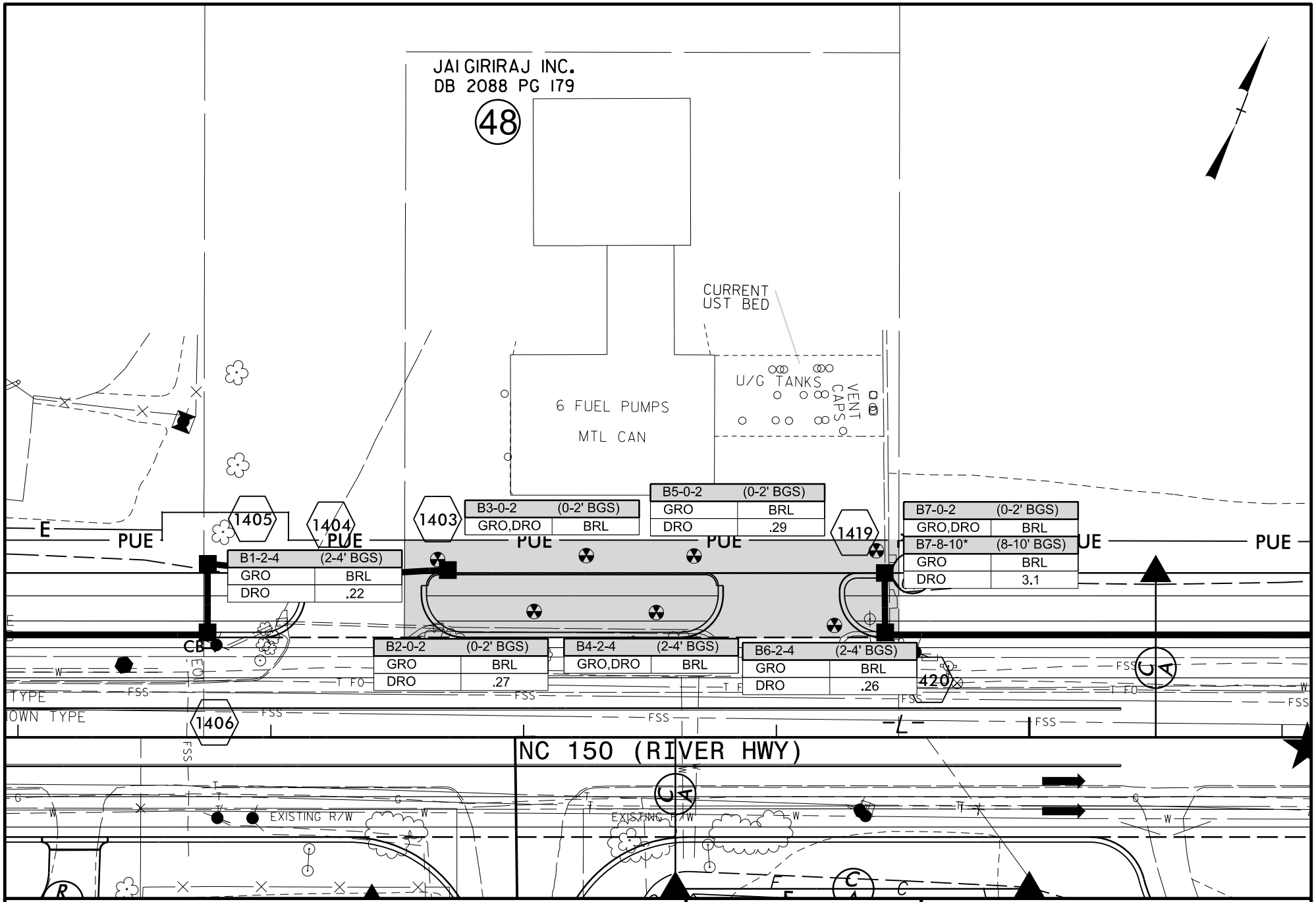
Prepared By: LMM Date: 9/20/2018	Checked By: AJF Date: 9/20/2018	Project No.: 188322307	Figure No.: 1



wood.

AREA OF INVESTIGATION - PARCEL 048
JAI GIRIRAJ, INC. R-2307B
1208 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LPL	1/3/19	HPC	1/3/2019	188322307	2



AREA OF INVESTIGATION
BORING LOCATION
GRO = GASOLINE RANGE ORGANICS
DRO = DIESEL RANGE ORGANICS
BRL = BELOW REPORTABLE LIMITS
* PAH EXCEEDS LIMITS. SEE TABLE 2 FOR ADDITIONAL INFORMATION

25' 0' 25' 50'
12.5
(ENGLISH)

wood.

UVF PETROLEUM RESULTS - PARCEL 48
JAI GIRIRAJ, INC. R-2307B
1208 NC 150 (RIVER HWY)
MOORESVILLE, NC 28117

PREPARED BY:	DATE:	CHECKED BY:	DATE:	JOB NUMBER	FIGURE
LPL	1/3/19	HPC	1/3/2019	188322307	3

APPENDIX A
PHOTOGRAPH LOG

PHOTO 1:

View of the south portion of the property, facing southwest. Overhead power running along River Highway.

Photo taken 9/21/18.

PHOTO 2:

BP gas station pump islands, facing west.

Photo taken 9/21/18.

PHOTO 3:

Current active UST basin.

Photo taken 9/21/18.

APPENDIX B
BORING LOGS

SOIL BORING FIELD WORKSHEET

BORING #	**B-1**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-2**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-3**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

SOIL BORING FIELD WORKSHEET

BORING #	**B-4**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-5**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-6**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	
4	0.0		Sample taken at 2-4'
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

SOIL BORING FIELD WORKSHEET

BORING #	**B-7**	BORING DEPTH (ft)	**10**	NUMBER OF PAGES	**1**
PROJECT #	**188322307**			PROJECT NAME	**NCDOT Mooresville-Parcel 48.**
DATE DRILLED	**11/13/2018**			WEATHER CONDITIONS	**Cloudy, 40˚F**
DRILLING SUB-CONTRACTOR	**IET**			DRILL RIG	**AMS PowerProbe**

DEPTH (ft bgs)	PID (ppm)	SOIL DESCRIPTION	SAMPLE INFO
2	0.0	Red orange brown, silty CLAY	Sample taken at 0-2'
4	0.0		
6	0.0	Orange tan, SILT, some sandy spots	
8	0.0		
10	0.0		Sample taken at 8-10'
		*Boring terminated at 10'	

Log Completed By: **DRH**

Page: **1**

APPENDIX C
GEOPHYSICAL REPORT

GEL Solutions

55 Shiloh Road, Suite 6
Asheville, NC 28803
P 828.782.3523

www.gel-solutions.com

November 2, 2018

Mr. John Maas, PG
Wood, PLC
2801 Yorkmont Road, Suite 100
Charlotte, NC 28208

Re: Report for Geophysical Survey to Identify Underground Storage Tanks
And Underground Utilities
Parcel #048
1208 NC 150 (River Highway)
Mooresville, North Carolina 28117

Dear Mr. Maas,

GEL Solutions appreciates the opportunity to provide Wood with this report of our geophysical investigation for the referenced project. This investigation was designed to determine the potential presence of underground storage tanks (USTs) at the site and underground utilities that would obstruct drilling activities at the site. The geophysical field investigation was successfully performed on October 15, 2018 through October 25, 2018.

1.0 Summary of Results

No subsurface anomalies were identified in the geophysical data that indicated the presence of USTs. The anomalies represented in Figure 1 are consistent with known metallic surface objects, utilities, and/or cultural interference. Although geophysical methods provide a high level of assurance for the location of subsurface objects, the possibility exists that not all features can or will be identified. Therefore, due caution should be used when performing any subsurface excavation, and GEL Solutions, LLC will not be liable for any damages that may occur. Descriptions of the technologies employed during this geophysical investigation are provided below.

2.0 Overview of Geophysical Investigation

The geophysical evaluation included the deployment of radio-frequency electromagnetic (EM), ground penetrating radar (GPR) and time-domain electromagnetic (TDEM) technologies to the site. These technologies were used in concert with one another in order to identify the presence of potential underground utilities and USTs at the site. A brief description of each technology is presented in the following paragraphs.

Radio-Frequency Electromagnetic

Radio-Frequency Electromagnetic (EM) utility locating equipment consists of a transmitter and a dual-function receiver. The receiver can be operated in a “passive” mode or in an “active” mode. The two modes of operation provide various levels of detection capabilities depending on the specific target or application.

The EM system is operated in the “active” mode by either inducting or conducting a signal into the underground utility to be traced. A transmitter is placed over and in line with a suspected buried utility. The transmitter induces a signal, which propagates along the buried utility. As the receiver is moved back and forth across the suspected path of the utility, the trace signal induces a signal into the receiver’s coil sensor. A visual and audio response indicates when the receiver is directly over the buried utility.

Another means of detecting in the "active" mode utilizes a method to "conduct" a signal within the buried utility. To accomplish this, a cable from the transmitter is clamped onto an exposed section of the buried utility and a signal propagates along the buried line. This technique minimizes any interference caused by parasitic emissions from adjacent cables in congested areas. When the system is utilized in the "passive" mode, the receiver is responding to a 60 Hertz cycle current energized by underground utilities.

Interference can and may occur when buried utilities intersect or are adjacent to each other. This effect referred to as "bleed-off" may provide a false response to the identification of the tracked utility. "Bleed-off" is caused by utilities that may be energized in the "active" or "passive" mode.

Ground Penetrating Radar Methodology

A RAMAC digital radar control system configured with a 450-Megahertz (MHz) antenna array was used in this investigation. GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver, a digital control unit which both generates and digitally records the GPR data, and a color video monitor to view data as it is collected in the field.

The transmitter radiates repetitive short-duration electromagnetic waves (at radar frequencies) into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver from the interface of materials with different dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material through which the wave is traveling, and the frequency of the signal.

Subsurface features that commonly cause such reflections are: 1) natural geologic conditions, such as changes in sediment composition, bedding, and cementation horizons and voids; or 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines, and utilities. The digital control unit processes the signal from the receiver and produces a continuous cross-section of the subsurface interface reflection events.

GPR data profiles were collected along transects covering the entire rights of ways. Depth of investigation of the GPR signal is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays, brackish groundwater, or groundwater with a high dissolved solid content from natural or manmade sources. Signal attenuation is lowest in relatively low conductivity materials such as dry sand or rock. Depth of investigation is also dependent on the antenna's transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased. The average depth of penetration at this site was approximately 2-5 feet below the surface.

The GPR antenna used at this site is internally shielded from aboveground interference sources. Accordingly, the GPR response is not affected by overhead power lines, metallic buildings, or nearby objects.

Time Domain Electromagnetic Methodology

TDEM methods measure the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time or frequency-varying magnetic field and measuring (with a receiver) the

amplitude and phase shift of an induced secondary magnetic field. The secondary magnetic field is created by subsurface conductive materials behaving as an inductor as the primary magnetic field is passed through them.

The Geonics EM-61 system used in this investigation operates within these principles. However, the EM-61 TDEM system can discriminate between moderately conductive earth materials and very conductive metallic targets. The EM-61 consists of a portable coincident loop time domain transmitter and receiver with a 1.0-meter by 0.5-meter coil system. The EM-61 generates 150 pulses per second and measures the response from the ground after transmission or between pulses. The secondary EM responses from metallic targets are of longer duration than those created by conductive earth materials. By recording the later time EM arrivals, only the response from metallic targets is measured, rather than the field generated by the earth material.

3.0 Field Procedures and Results

The geophysical field investigation was successfully performed on October 15 through October 25, 2018 at the 11 DOT parcels located in the immediate vicinity of Highway 150 in Mooresville, NC. Interpretation of the GPR data was conducted in the field and any potential anomalies were marked in the field. GPR data processing typically included band pass filtering, background removal, horizontal smoothing, and gain adjustments. TDEM was also used to scan the project site. Any electromagnetic anomalies detected during field activities that were indicative of buried metallic objects were also marked in the field.

There were no subsurface geophysical anomalies detected within the limits of Parcel #048 during this investigation that indicated the presence of USTs. The anomalies represented in the data shown on Figure 1 are indicative of known metallic surface features and/or cultural interference.

The locations of underground utilities were designated using EM and GPR equipment, and their locations were marked with paint on the land surface, and additionally shown in Figure 1. Positioning data was obtained using a Trimble R10 GPS antenna.

4.0 Closing

GEL Solutions appreciates the opportunity to assist Wood with this project. If you have any questions or need further information regarding the project, please do not hesitate to call me at (828) 782-3523.

Yours very truly,

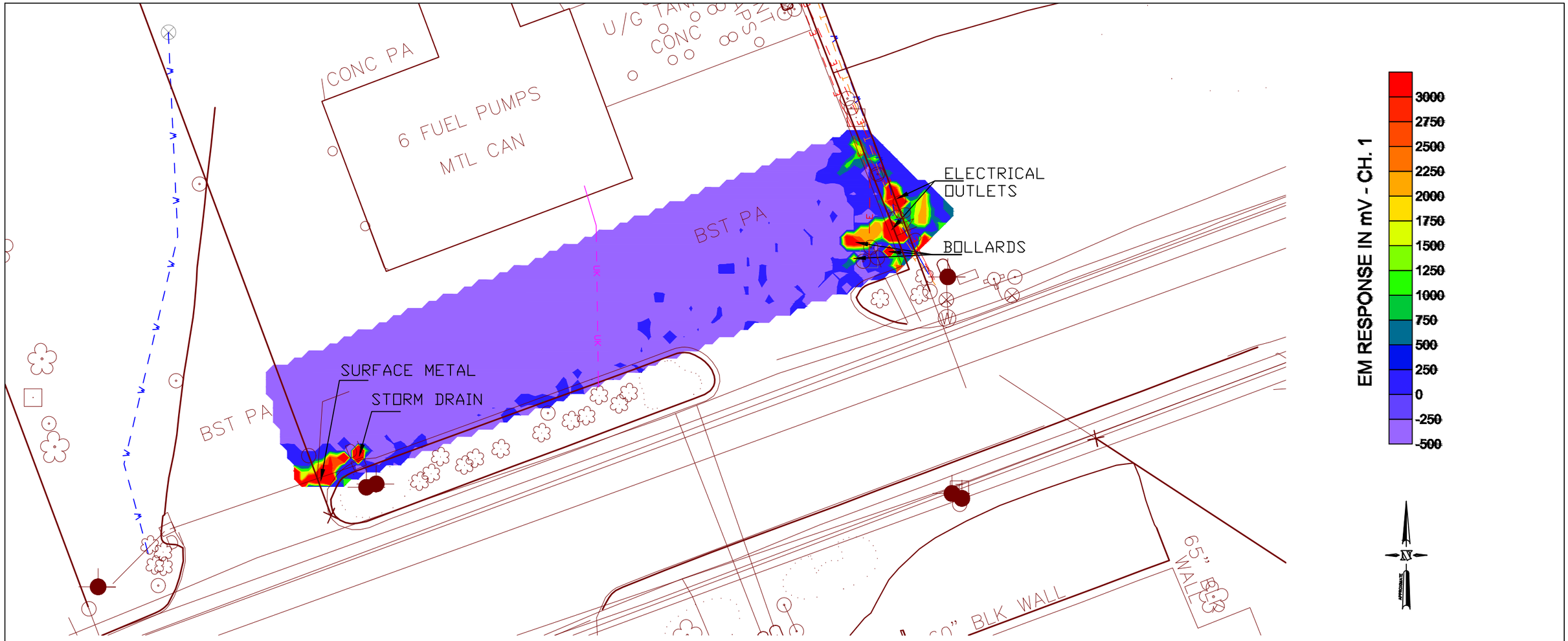
William R. Adgate
Senior Project Manager

Enclosures
fc: 048.AMEC01118.Report.pdf

Site Photos

Photo 1: Looking east from west edge

Photo 2: Looking east showing obstructions and surface metal at east end of grid



LEGEND

- UK — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND UNKNOWN UTILITY LINE
- W — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND WATER LINE
- E — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND ELECTRICAL POWER LINE
- G — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND GAS LINE
- T — APPROXIMATE LOCATION OF SUSPECTED UNDERGROUND COMMUNICATIONS LINE
- LIMITED ACCESSIBILITY

GRAPHIC SCALE

0' 15' 30' 60' 120'

(IN FEET)
1 inch = 30 ft.

NOTES

1) UNDERGROUND FEATURES WERE LOCATED USING VISUAL EVIDENCE, GROUND PENETRATING RADAR (GPR), AND TIME DOMAIN ELECTROMAGNETIC (TDEM) METHODS. OTHER BURIED UTILITIES AND STRUCTURES MAY EXIST BUT WERE NOT DETECTED DUE TO LIMITATIONS OF THE GEOPHYSICAL METHODS, SITE ACCESS, AUTHORIZED SCOPE-OF-WORK, AND/OR HIGH TARGET CONGESTION. THEREFORE, DUE CAUTION SHOULD BE USED WHEN PERFORMING SUBSURFACE EXCAVATION ACTIVITIES WHERE POTENTIAL CONFLICTS EXIST. GEL SOLUTIONS IS NOT RESPONSIBLE FOR DAMAGES THAT MAY OCCUR. IDENTIFYING THE LOCATION OF SOME UTILITIES AND STRUCTURES MAY ONLY BE POSSIBLE WITH VACUUM OR OTHER EXCAVATION METHODS.
2) FIELD SURVEY CONDUCTED ON 10.15.2018 - 10.24.2018.
3) GEOPHYISICAL DATA GENERATED USING MALA GEOSCIENCE GPR SYSTEM CONFIGURED WITH A 45OMHZ ANTENNA AND A GEONICS EM-61 TDEM SYSTEM. APPROXIMATE POSITIONING WAS PROVIDED USING TRIMBLE RTK/GPS.
4) GEL SOLUTIONS IS NOT LIABLE FOR ACCURACY OF BASE MAP PROVIDED BY WOOD.

GEL SOLUTIONS
55 SHILOH ROAD, SUITE 6
ASHEVILLE, NC 28803
(828) 782-3523
WWW.GEL-SOLUTIONS.COM

PROJECT: AMEC01118

GEOPHYSICAL INVESTIGATION FOR USTs
PARCEL #048
1208 NC 150 (RIVER HIGHWAY)
MOORESVILLE, NORTH CAROLINA

RESULTS OF GEOPHYSICAL INVESTIGATION

FIGURE
1

DATE: 10/30/18

DRAWN BY: JAT APPRV. BY: WRA

APPENDIX D
RESULTS FROM ONSITE UVF SOIL ANALYSES

QED

QROS

Hydrocarbon Analysis Results

Client: Wood
Address: 2801 Yorkmount Rd
Charlotte, NC 28208

Samples taken Tuesday, November 13, 2018
Samples extracted Tuesday, November 13, 2018
Samples analysed Tuesday, November 13, 2018

Contact: Helen Corley

Operator Ian Ros

Project: NCDOT Mooresville - Parcel 48

U00904

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	% Ratios			HC Fingerprint Match
										C5 - C10	C10 - C18	C18	
s	P48B1-2-4	8.6	<0.22	<0.22	0.22	0.22	0.15	<0.07	<0.009	0	88.9	11.1	Deg Fuel 76.8%,(FCM)
s	P48B2-0-2	10.9	<0.27	<0.27	0.27	0.27	<0.05	<0.09	<0.011	0	78.9	21.1	Deg Fuel 61.6%,(FCM),(BO),(P)
s	P48B3-0-2	11.6	<0.29	<0.29	<0.29	<0.29	<0.06	<0.09	<0.012	0	100	0	,(FCM),(BO),(P)
s	P48B4-2-4	10.5	<0.26	<0.26	<0.26	<0.26	<0.05	<0.08	<0.011	0	100	0	Residual HC,(BO)
s	P48B5-0-2	11.7	<0.29	<0.29	0.29	0.29	<0.06	<0.09	<0.012	0	94.5	5.5	Deg Fuel 76.3%,(FCM),(BO)
s	P48B6-2-4	10.5	<0.26	<0.26	0.26	0.26	<0.05	<0.08	<0.011	0	94.2	5.8	Deg Fuel 91.1%,(FCM),(BO)
s	P48B7-0-2	10.9	<0.27	<0.27	<0.27	<0.27	<0.05	<0.09	<0.011	0	100	0	Residual HC,(BO),(P)
s	P48B7-8-10	9.7	<0.24	<0.24	3.1	3.1	2.6	0.14	<0.01	0	90.8	9.2	Deg Fuel 79.7%,(FCM)

Initial Calibrator QC check OK

Final FCM QC Check OK 102.9 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

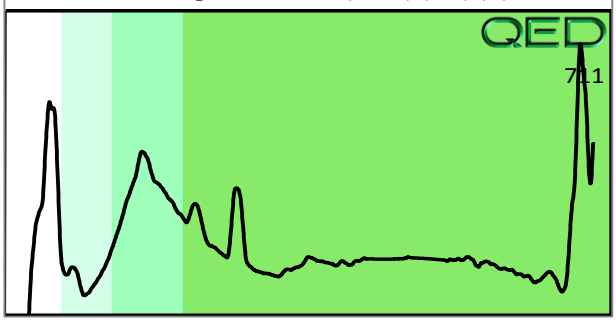
% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

QED Hydrocarbon Fingerprints

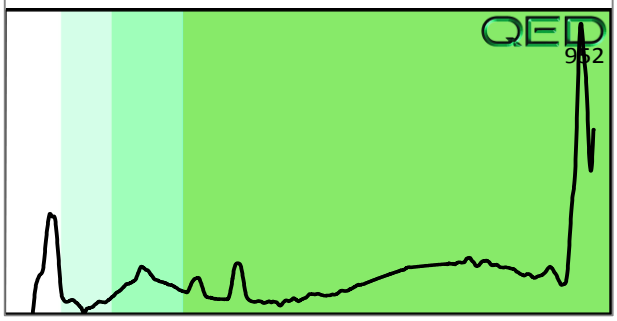
Project: NCDOT Mooresville - Parcel 48 ##################

P48B1-2-4 : Deg Fuel 76.8%,(FCM)

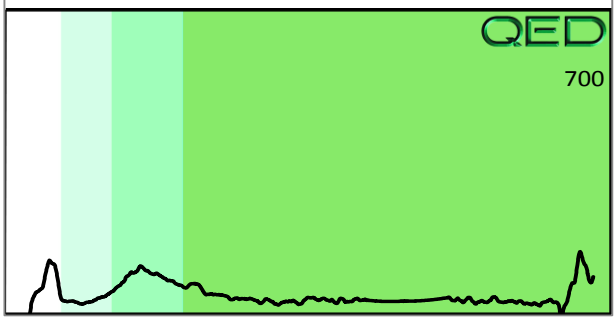
P48B2-0-2 : Deg Fuel 61.6%,(FCM),(BO),(P)



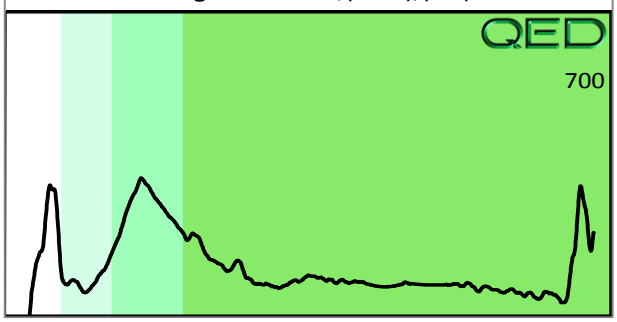
P48B3-0-2 : ,(FCM),(BO),(P)



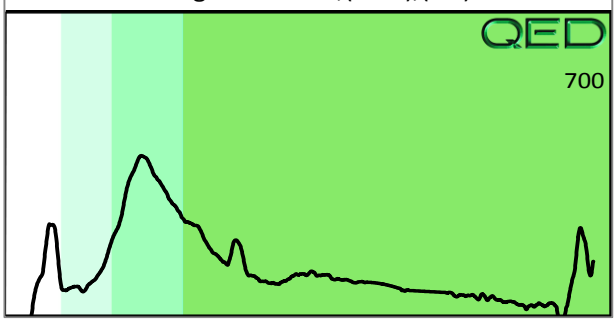
P48B4-2-4 : Residual HC,(BO)



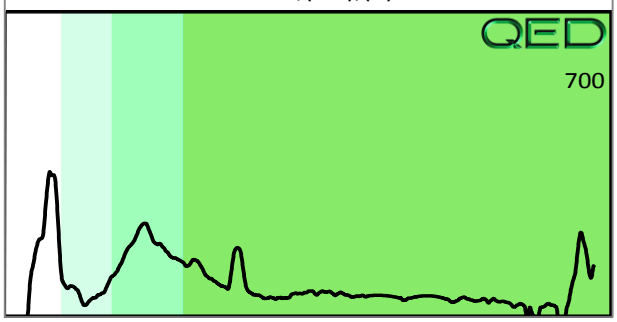
P48B5-0-2 : Deg Fuel 76.3%,(FCM),(BO)



P48B6-2-4 : Deg Fuel 91.1%,(FCM),(BO)



P48B7-0-2 : Residual HC,(BO),(P)



P48B7-8-10 : Deg Fuel 79.7%,(FCM)