



## **PRELIMINARY SITE ASSESSMENT**

**MORRIS COMMUNICATIONS CORP. (PARCEL #10)  
508 Capital Boulevard  
Raleigh, North Carolina  
State Project: B-5121 & B-5317  
WBS Element: 42263.1.1  
F&R Project #66T-0097**

**August 21, 2015**

**Prepared for:**

**North Carolina Department of Transportation  
Geotechnical Engineering Unit  
1020 Birch Ridge Drive  
Raleigh, NC 27610**



**FROEHLING & ROBERTSON, INC.**

*Engineering Stability Since 1881*

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August 21, 2015

**North Carolina Department of Transportation  
Geotechnical Engineering Unit**  
1020 Birch Ridge Drive  
Raleigh, North Carolina 27610

Attn.: Mr. Terry Fox, L.G.  
GeoEnvironmental Project Manager

**Re:** State Project: B-5121 & B-5317  
WBS Element: 42263.1.1  
BR 277 on US 70/US 401/NC 50 (Capital Blvd.) over Peace Street and  
BR 213 on US 70/NC 50 (Wade Ave.) over US 401 (Capital Blvd.)

**Subject: Preliminary Site Assessment**  
**Parcel #10 – Morris Communications Corp. (Fairway Outdoor Advertising)**  
508 Capital Blvd  
Raleigh, North Carolina  
F&R Project #66T-0097

Dear Mr. Fox:

Froehling and Robertson, Inc. (F&R) has completed the authorized Preliminary Site Assessment at the Morris Communications Corp. property in Raleigh, North Carolina. The work was performed in general accordance with F&R's Proposal No. 1666-00058, dated May 19, 2015. Notice to Proceed was issued to F&R on June 25, 2015. This report documents our field activities, presents the results of laboratory analysis and provides estimated quantities of petroleum impacted soils.

Please do not hesitate to contact us if you should have any questions regarding this report.

Sincerely,

**FROEHLING & ROBERTSON, INC.**

DocuSigned by:  
*Benjamin A. Whitley*  
E425D6E8C23545B...  
Benjamin A. Whitley, P.E.  
Project Engineer



DocuSigned by:  
*Michael Sabodish*  
B4FED45203C345C...

Michael S. Sabodish, Jr., Ph.D, P.E.  
Engineering and Remediation Services Manager



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**Preliminary Site Assessment Report  
Morris Communications Corp. Property (Parcel #10)  
Raleigh, Wake County, North Carolina  
F&R Project No. 66T-0097**

**1.0 Introduction**

Froehling and Robertson, Inc. (F&R) has prepared this Preliminary Site Assessment (PSA) Report to document soil assessment activities performed at the Morris Communications Corp. Property addressed as 508 Capital Boulevard in Raleigh, Wake County, North Carolina. The site is located at the southeast quadrant of the Capital Boulevard and West Peace Street intersection, as shown in Appendix I, Figures 1 and 2. As indicated in the Request for Technical and Cost Proposal (RFTCP), the existing business located at the site operates as Fairway Outdoor Advertising. According to the NCDENR UST Section Registry, two (2) USTs were removed in February 1994. Ground Water Incident-UST # RA-12312 was assigned to this facility. A Comprehensive Site Assessment (CSA) with revisions was conducted from 1994 to 1996, and the Corrective Action Plan (CAP) was implemented from 1996 to 2001. CSA and CAP documents were not provided to F&R.

The PSA was performed in general accordance with F&R's Proposal No. 1666-00058, dated May 19, 2015 with Notice to Proceed issued to F&R by the NCDOT on June 25, 2015. The purpose of this report is to document field activities, present the results of laboratory analysis, and provide estimated quantities of petroleum impacted soils.

As outlined by the NCDOT in their RFTCP, acquisition of right-of-way is necessary for the Peace Street Bridge, Wade Avenue Bridge and Capital Boulevard improvements in Raleigh (See Figure No. 3). As such, the NCDOT requested a PSA be performed to assess the possibility of encountering petroleum impacted soil from known or unknown USTs which may exist/existed at the project site.

The existing on-site structure is one-story in height with a partial basement on the northern end of the building. The building is constructed of brick with steel framing. During site reconnaissance activities, F&R was informed by Mr. Jason Watson, the Operations Manager for Fairway, that a UST and pump island were located in the parking lot southeast of the building. Mr. Watson also informed F&R of several monitoring well locations on the property. The remainder of the site consists of an asphalt paved parking lot and manicured landscaping. Access to the site is gained from Capital Boulevard to the west. The property is enclosed on



the northern and eastern sides by a metal fence. The site is bordered to the north by Peace Street; to the east and south by Fairway warehouse properties; and to the west by Capital Boulevard. Photos detailing existing site features are attached as Appendix IV of this report.

## **2.0 Geophysical Survey**

Prior to F&R's soil assessment activities, Pyramid Environmental & Engineering, P.C. (Pyramid) conducted a geophysical survey to locate suspect metal underground storage tanks (USTs). The geophysical work was conducted from June 26 to July 1, 2015, and was performed within the proposed right-of-way.

The geophysical investigation consisted of electromagnetic (EM) induction surveys using a Geonics EM61 instrument. Ground-penetrating radar (GPR) investigations of selected EM61 anomalies were investigated using a Geophysical Survey Systems UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. The EM61 data was collected along parallel survey lines spaced approximately five feet apart. The data was reviewed in the field to evaluate the possible presence of USTs and later transferred to a desktop computer for further review. Data was collected over most of the planned survey site with the exception of the building footprint and areas immediately adjacent to metallic objects and other obstacles (such as vehicles). Isolated EM anomalies were identified on the site, including signs, utilities, monitoring well caps, buildings and suspected reinforced concrete.

Based on the EM data collected at the site, Pyramid did not observe anomalies that were interpreted to be the results of metallic USTs within about 6 feet of the ground surface. The complete geophysical report is attached as Appendix II.

## **3.0 Site Assessment Activities**

F&R visited the site on July 22, 2015 to perform the Preliminary Site Assessment. The assessment consisted of advancing 10 borings into the soils at the project site using direct-push technology (Geoprobe). The borings (B-1 through B-10) were generally located throughout the parking lot and driveway areas on the site (Appendix I, Figure 3). Boring locations were determined by F&R staff based on the results of the geophysical survey, site features and proposed construction activities. The borings were generally advanced to the proposed depth of 10 feet bgs. However, Boring B-1 was terminated at 8 feet bgs, where Geoprobe refusal was encountered.



Soil sample cores from the borings were collected in disposable, 4-foot long acetate sleeves. The soil samples were visually/manually classified and screened in the field using a photo-ionization detector (PID) for evidence of petroleum hydrocarbons. Evaluation of VOC concentrations were performed using a MiniRae 2000 PID which produces results in parts per million (ppm). A representative soil sample was collected from one foot sections of each sleeve and placed in a re-sealable plastic bag. The vapors were then allowed to equilibrate in the headspace of the bag for approximately ten minutes prior to measurement with the PID. The measurements were collected by placing the probe tip into the headspace of the bag. PID measurements can be found in the Geoprobe Logs in Appendix III, as well as in Table 1 in Section 5.0 below.

The soil sample which exhibited the highest PID concentration or the sample at boring termination was submitted for laboratory analysis for diesel range organics (DRO), gasoline range organics (GRO), Total BTEX (benzene, toluene, ethylbenzene and xylenes), 16 PAHs (polycyclic aromatic hydrocarbons) and BaP (Benzo(a)pyrene) by Ultraviolet Fluorescence (UVF) technology (QROS QED Hydrocarbon Analyzer).

The samples were collected in laboratory-supplied sample containers, placed in a cooler with ice, and shipped via UPS to QROS in Wilmington, North Carolina following standard chain-of-custody procedures.

#### **4.0 Subsurface Conditions**

As indicated in the attached Geoprobe Logs (Appendix III), subsurface conditions from existing ground surface to boring termination primarily included various layers of moist, tan to gray fine to coarse sand (USCS – SW/SP), red-brown to red-tan fine sandy micaceous silt (USCS – ML), and orange-tan to red-tan sandy clay (USCS – CL). The borings were terminated at the proposed depth of 10 feet bgs; however, Boring B-1 was terminated at approximately 8 feet bgs in an apparent layer of partially weathered rock (sampled as dry, tan, medium to coarse sand). Groundwater was not observed during field screening or sample collection activities.

Petroleum odors were observed in Boring B-4 from 6 to 10 feet bgs, and in Boring B-6 from 5 to 10 feet bgs. In addition, a glue-like odor was noted in Boring B-5 from existing ground surface to 10 feet bgs.

Of the samples screened, PID readings generally did not exceed 1.8 ppm; however, elevated PID readings were recorded in Borings B-4 (from 6 to 10 feet bgs), B-5 (from ground surface to 10 feet bgs), B-6 (from 5 to 10 feet bgs), and B-8 (from 8 to 10 feet bgs).



## 5.0 Analytical Results

As shown in the following table, petroleum hydrocarbons identified as DRO were encountered in the soil samples collected at the ten boring locations advanced at the site (B-1 through B-10), at depths from 1 foot bgs (B-5) to 10 feet bgs (B-4). The laboratory results indicate that the DRO concentrations ranged from 2.1 mg/kg (B-3) to 173.4 mg/kg (B-1). DRO concentrations above the NCDENR Action Level of 10 mg/kg were detected in eight of the samples submitted.

In addition, GRO was detected in the sample obtained from Boring B-4 at a concentration of 30.8 mg/kg, which is above the NCDENR Action Level of 10 mg/kg.

The laboratory analytical results indicate concentrations of the Sum of 16 PAHs above the method detection limit, but below the NCDENR Action Level of 7,041.14 mg/kg in the ten samples submitted. In addition, Benzo (a) pyrene (BaP) was detected in sample B-1 at a concentration above the NCDENR Soil-to-Water MSCC (0.096 mg/kg).

The soil analytical results are summarized in Table 1 below. The laboratory analytical results can also be found in the attached Appendix V of this report.

**Table 1**  
**Soil Sampling Analytical Results**

Sample ID	Sample Date	Sample Depth (ft bgs)	PID Reading (ppm)	GRO (mg/kg)	DRO (mg/kg)	TPH (mg/kg)	Total BTEX (mg/kg)	Total Aromatics (mg/kg)	16 EPA PAHs (mg/kg)	BaP (mg/kg)
B-1	7/22/15	4-6	0.7	< 7.5	<b>173.4</b>	<b>173.4</b>	< 15.1	152.1	22.7	<b>0.46</b>
B-2		6-7	1.1	< 0.56	<b>24</b>	<b>24</b>	< 1.1	22.7	4	0.078
B-3		5-6	0.9	< 0.57	2.1	2.1	< 1.1	2.1	0.25	0.014
B-4		8-10	208	<b>30.8</b>	<b>95.9</b>	<b>126.7</b>	< 1.1	65.2	2.5	0.021
B-5		1-2	9.1	< 0.55	<b>30.7</b>	<b>30.7</b>	< 1.1	25.3	3.6	0.03
B-6		8-9	25.5	< 0.59	<b>12.9</b>	<b>12.9</b>	< 1.2	7.7	0.31	0.012
B-7		7-8	1.4	< 8.5	<b>53.8</b>	<b>53.8</b>	< 16.9	24.7	0.93	< 0.17
B-8		9-10	3.7	< 0.54	7.8	7.8	< 1.1	7.1	0.33	0.004
B-9		4-5	0.8	< 5.9	<b>43.9</b>	<b>43.9</b>	< 11.8	34.5	5.6	0.038
B-10		6-7	1.2	< 0.74	<b>30.2</b>	<b>30.2</b>	< 1.5	25.1	1.2	0.015
<b>NC DENR Action Level</b>				<b>10</b>	<b>10</b>	<b>10</b>	<b>13.8</b>	<b>NSE</b>	<b>7,041.41</b>	<b>0.096</b>

Samples shown in bold exceed the NCDENR Action Level as outlined in the NCDENR, DWM, UST Section Guidelines  
 ppm = parts per million  
 GRO = Gasoline Range Organics  
 DRO = Diesel Range Organics  
 TPH = Total Petroleum Hydrocarbons  
 BTEX = Benzene, Toluene, Ethylbenzene and Xylenes  
 NSE = No Standard Exists



## 6.0 Conclusions and Recommendations

F&R conducted a PSA at the Morris Communications Corp. Property located at 508 Capital Boulevard in Raleigh, Wake County, North Carolina. A geophysical investigation was performed by Pyramid Environmental & Engineering to investigate the existence of unknown/known USTs in the proposed right-of-way. Based on the results of the geophysical survey, it was determined that USTs were not present within the surveyed area.

Ten Geoprobe borings were advanced during the assessment within the proposed right-of-way, where grading activities are proposed in association with the Peace Street Bridge, Wade Avenue Bridge and Capital Boulevard improvements. Based on the results of laboratory testing and observed PID readings, petroleum impacted soils were found at concentrations above the NCDENR Action Level of 10 mg/kg within the areas evaluated. Therefore, it is estimated that petroleum impacted soils, at concentrations above the NCDENR Action Level, are present from existing ground surface to a depth of at least ten feet below existing ground surface in the vicinity of Borings B-1, B-2, B-4 through B-7, B-9 and B-10.

No below grade utilities appear on the proposed improvement plans. However, a proposed exit ramp from Capital Boulevard onto Peace Street is depicted, which will likely require re-grading of the existing ground surface during the construction. For the purpose of this assessment, we have estimated an average petroleum-impacted area of 9,564.55 square feet, extending to a depth of ten feet bgs. This area accounts for impacted soils that may be generated during re-grading activities and for unknown below grade utilities that may be installed during construction. The area was determined by averaging distances between the proposed right-of-way and the proposed edge of pavement on the construction drawings (Appendix I, Figure 4).

**Table 2**  
**Approximate Volume of Petroleum Impacted Soil**

Excavation Location (As Shown on Figure 4)	L x W x D (feet)	Soil Volume (cubic feet)	Soil Volume (tons)
Vicinity of B-1, B-2, B-4 through B-7, B-9 and B-10	L x W varies (9,564.55 SF) X 10' depth	95,645.5	5,738.7
<b>Soil Volume (assuming a soil density of 120 pcf)</b>		<b>Total</b>	<b>5,738.7</b>





It should be noted that a delineation of the soil contamination was not performed, as this was not included in the proposed scope of work. The above estimates are based on interpretations of soil analytical results, PID readings and our experience with petroleum UST releases. In order to generate estimated quantities of petroleum impacted soils, we have inferred that the contamination has occurred between the existing ground surface and the sample collection depth. The amount of impacted soil can only be determined after excavation or by advancing additional borings and performing additional laboratory analysis to possibly delineate the extents (horizontal and vertical) of contamination.

## **7.0 Limitations**

These services have been performed, under authorization of the North Carolina Department of Transportation for specific application on this project. These services have been performed in accordance with generally accepted environmental and hydrogeological practices. No other warranty, expressed or implied is made. As with any subsurface investigation, actual conditions exist only at the precise locations from which samples were taken. Certain inferences are based on the results of sampling and related testing to form a professional opinion of conditions in areas beyond those from which samples were taken. Our conclusions and recommendations are based upon information provided to us by others, our sampling and testing results and our site observations. We have not verified the completeness or accuracy of the information provided by others, unless otherwise noted. Our observations are based upon conditions readily visible at the site at the time of our site visits.

Froehling & Robertson, Inc. 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 any conditions at the site that may present a potential danger to public health, safety or the environment. In areas that require notification of local, state, or federal public agencies as required by law, it is the Client's responsibility to so notify.



## **APPENDIX I**

**Figure No. 1 – SITE VICINITY MAP**

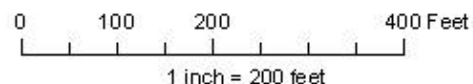
**Figure No. 2 – TOPOGRAPHIC MAP**

**Figure No. 3 – LABORATORY RESULTS & BORING LOCATION PLAN**

**Figure No. 4 – ESTIMATED EXTENTS OF SOIL CONTAMINATION**



Image Courtesy of Wake County iMaps



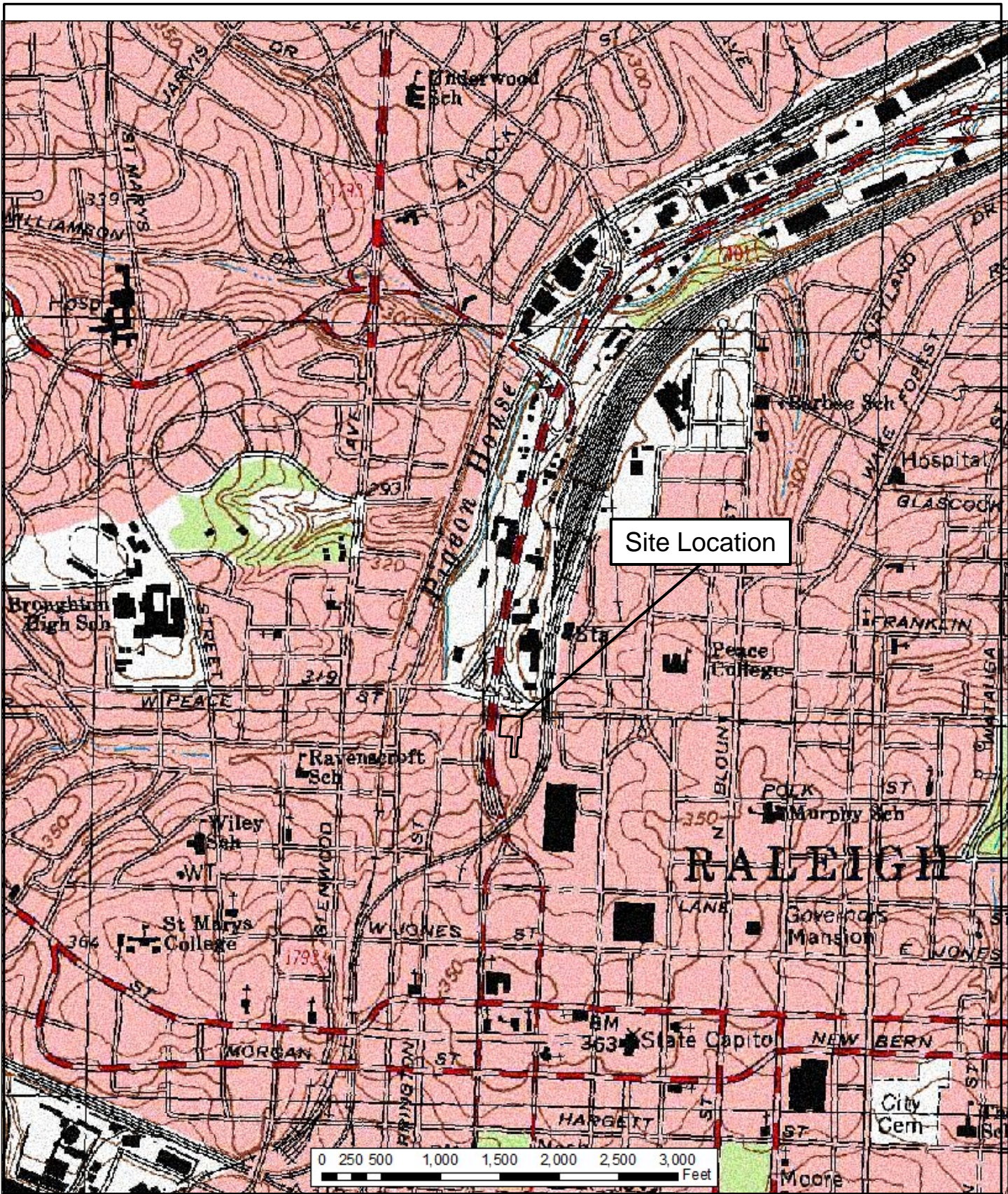
**SITE VICINITY MAP**

**North** ▲



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<b>CLIENT:</b> NCDOT	
<b>PROJECT:</b> B-5121 & B-5317, Morris Communications Corp., NCDOT Parcel #10	
<b>LOCATION:</b> Raleigh, Wake County, North Carolina	
<b>F&amp;R PROJECT No.:</b> 66T-0097	
<b>DRAWN BY:</b> B. Whitley	<b>FIGURE No.:</b> <b>1</b>
<b>DATE:</b> August 2015	
<b>SCALE:</b> 1" = 200'	



**TOPOGRAPHIC MAP – RALEIGH WEST, NC**

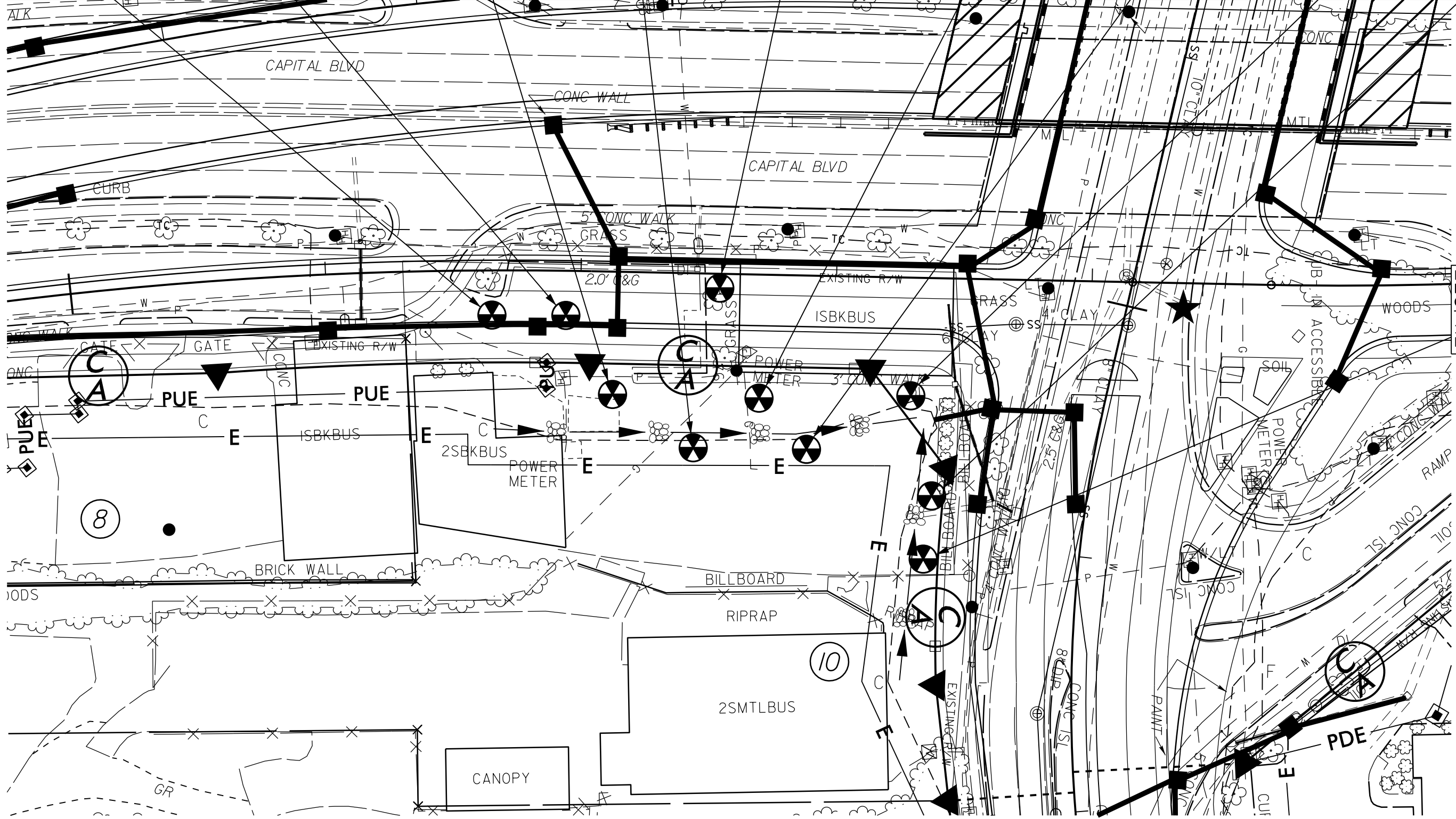
North



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CLIENT: NCDOT		FIGURE No.: <b>2</b>
PROJECT: B-5121/B-5317, Morris Communications Corp., NCDOT Parcel #10		
LOCATION: Raleigh, Wake County, North Carolina		
F&R PROJECT No.: 66T-0097		
DRAWN BY: B. Whitley		
DATE: August 2015	SCALE: As Shown	

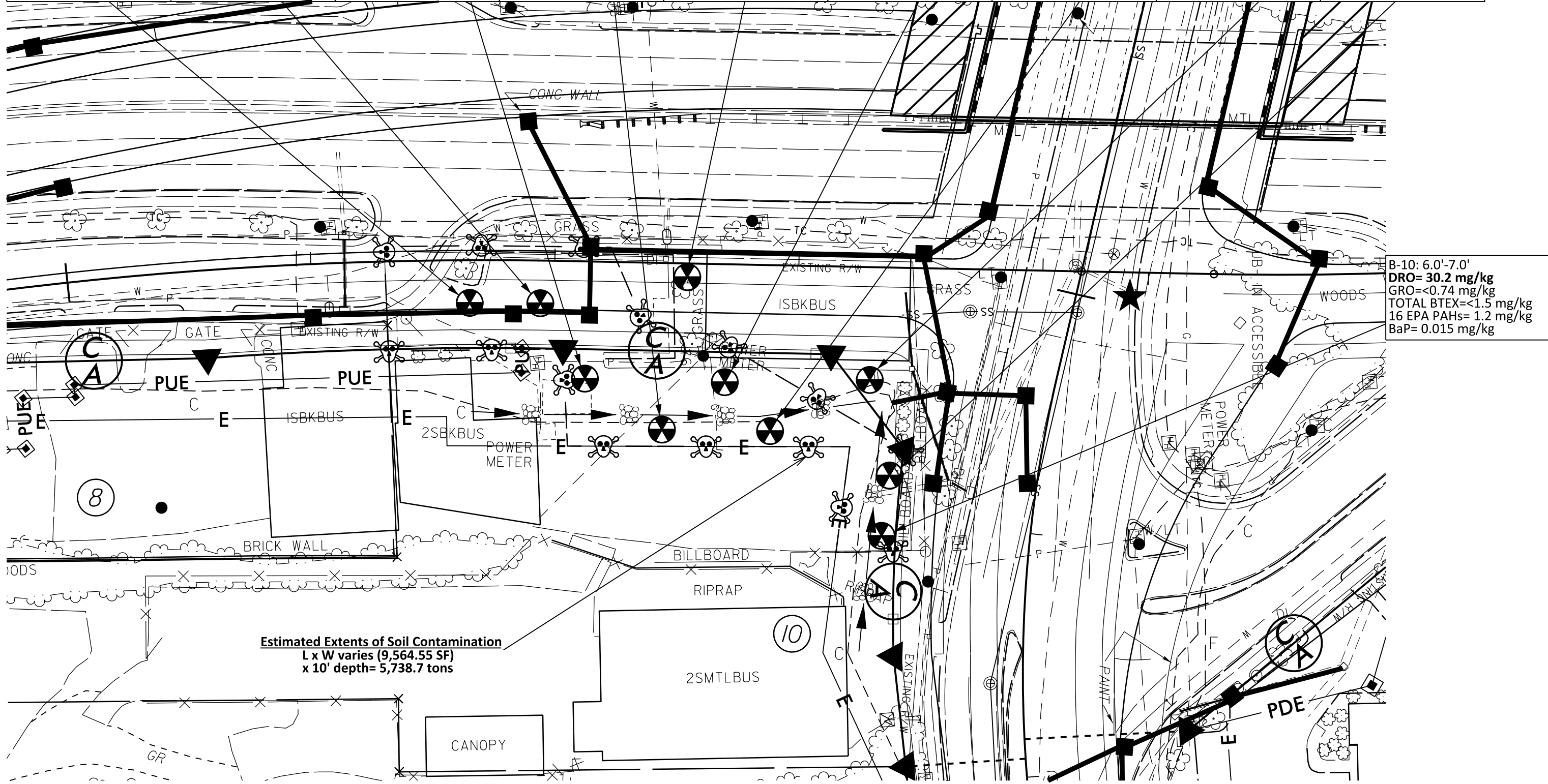
B-1: 4.0'-6.0' DRO= 173.4 mg/kg GRO=<7.5 mg/kg TOTAL BTEX=<15.1 mg/kg 16 EPA PAHs= 22.7 mg/kg BaP= 0.46 mg/kg	B-2: 6.0'-7.0' DRO= 24 mg/kg GRO=<0.56 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 4 mg/kg BaP=0.078 mg/kg	B-4: 8.0'-10.0' DRO= 95.9 mg/kg GRO= 30.8 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 2.5 mg/kg BaP= 0.021 mg/kg	B-5: 1.0'-2.0' DRO= 30.7 mg/kg GRO=<0.55 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 3.6 mg/kg BaP= 0.03 mg/kg	B-3: 5.0'-6.0' DRO= 2.1 mg/kg GRO=<0.57 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs=0.25 mg/kg BaP=0.014 mg/kg	B-6: 8.0'-9.0' DRO= 12.9 mg/kg GRO=<0.59 mg/kg TOTAL BTEX=<1.2 mg/kg 16 EPA PAHs= 0.31 mg/kg BaP= 0.012 mg/kg	B-7: 7.0'-8.0' DRO= 53.8 mg/kg GRO=<8.5 mg/kg TOTAL BTEX=<16.9 mg/kg 16 EPA PAHs= 0.93 mg/kg BaP=<0.17 mg/kg	B-8: 9.0'-10.0' DRO= 7.8 mg/kg GRO=<0.54 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 0.33 mg/kg BaP= 0.004 mg/kg	B-9: 4.0'-5.0' DRO= 43.9 mg/kg GRO=<5.9 mg/kg TOTAL BTEX=<11.8 mg/kg 16 EPA PAHs= 5.6 mg/kg BaP= 0.038 mg/kg
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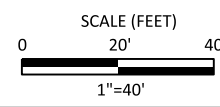
B-10: 6.0'-7.0' DRO= 30.2 mg/kg GRO=<0.74 mg/kg TOTAL BTEX=<1.5 mg/kg 16 EPA PAHs= 1.2 mg/kg BaP= 0.015 mg/kg
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	<p><b>F&amp;R</b> 1881</p>	<p><b>FRUEHLING &amp; ROBERTSON, INC.</b> Engineering Stability Since 1881 310 Hubert Street Raleigh, North Carolina 27603-2302   USA T 919.828.3441   F 919.828.5751 www.fandr.com</p>	<p><b>LEGEND</b></p> <p> Approximate Geoprobe Boring Location</p> <p><b>Samples Shown in Bold Exceed the NCDENR Action Level as Outlined in the NCDENR, DWM, UST Section Guideline</b></p>	<p><b>LABORATORY RESULTS &amp; BORING LOCATION PLAN</b></p>	
				<p>CLIENT: NCDOT PROJECT: B-5121/B-5317 Morris Communications Corp. Property (Parcel #10) LOCATION: Raleigh, Wake County, North Carolina F&amp;R PROJECT No.: 66T-0097</p>	<p>FIGURE No.: <b>3</b></p>
<p>SCALE (FEET) 0 20' 40' 1"=40'</p>	<p>SCALE: 1"=40'</p>	<p>DRAWN BY: T. T. Walker DATE: August 2015</p>	<p>CHECKED BY: M. Sabodish, P.E.</p>	<p>DATE: August 2015</p>	<p>SCALE: 1"=40'</p>

<b>B-1: 4.0'-6.0'</b> <b>DRO= 173.4 mg/kg</b> GRO=<7.5 mg/kg TOTAL BTEX=<15.1 mg/kg 16 EPA PAHs= 22.7 mg/kg <b>BaP= 0.46 mg/kg</b>	<b>B-2: 6.0'-7.0'</b> <b>DRO= 24 mg/kg</b> GRO=<0.56 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 4 mg/kg <b>BaP=0.078 mg/kg</b>	<b>B-4: 8.0'-10.0'</b> <b>DRO= 95.9 mg/kg</b> <b>GRO= 30.8 mg/kg</b> TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 2.5 mg/kg <b>BaP= 0.021 mg/kg</b>	<b>B-5: 1.0'-2.0'</b> <b>DRO= 30.7 mg/kg</b> GRO=<0.55 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 3.6 mg/kg <b>BaP= 0.03 mg/kg</b>	<b>B-3: 5.0'-6.0'</b> DRO= 2.1 mg/kg GRO=<0.57 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs=0.25 mg/kg <b>BaP=0.014 mg/kg</b>	<b>B-6: 8.0'-9.0'</b> <b>DRO= 12.9 mg/kg</b> GRO=<0.59 mg/kg TOTAL BTEX=<1.2 mg/kg 16 EPA PAHs= 0.31 mg/kg <b>BaP= 0.012 mg/kg</b>	<b>B-7: 7.0'-8.0'</b> <b>DRO= 53.8 mg/kg</b> GRO=<8.5 mg/kg TOTAL BTEX=<16.9 mg/kg 16 EPA PAHs= 0.93 mg/kg <b>BaP=&lt;0.17 mg/kg</b>	<b>B-8: 9.0'-10.0'</b> DRO= 7.8 mg/kg GRO=<0.54 mg/kg TOTAL BTEX=<1.1 mg/kg 16 EPA PAHs= 0.33 mg/kg <b>BaP= 0.004 mg/kg</b>	<b>B-9: 4.0'-5.0'</b> <b>DRO= 43.9 mg/kg</b> GRO=<5.9 mg/kg TOTAL BTEX=<11.8 mg/kg 16 EPA PAHs= 5.6 mg/kg <b>BaP= 0.038 mg/kg</b>
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<b>B-10: 6.0'-7.0'</b> <b>DRO= 30.2 mg/kg</b> GRO=<0.74 mg/kg TOTAL BTEX=<1.5 mg/kg 16 EPA PAHs= 1.2 mg/kg <b>BaP= 0.015 mg/kg</b>
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NAD 83/NSRS 2007

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**LEGEND**

Approximate Geoprobe Boring Location

**Samples Shown in Bold Exceed the NCDENR Action Level as Outlined in the NCDENR, DWM, UST Section Guideline**

ESTIMATED EXTENTS OF SOIL CONTAMINATION	
CLIENT: NCDOT	
PROJECT: B-5121/B-5317 Morris Communications Corp. Property (Parcel #10)	
LOCATION: Raleigh, Wake County, North Carolina	
F&R PROJECT No.: 66T-0097	
DRAWN BY: T. T. Walker	CHECKED BY: M. Sabodish, P.E.
DATE: August 2015	SCALE: 1"=40'
FIGURE No.: <b>4</b>	



**APPENDIX II**

**GEOPHYSICAL REPORT PREPARED BY PYRAMID**



PYRAMID ENVIRONMENTAL & ENGINEERING  
(PROJECT 2015-176)

# GEOPHYSICAL SURVEY


---


METALLIC UST INVESTIGATION:  
PARCEL 10 – MORRIS COMMUNICATIONS  
CORP.  
NCDOT PROJECT B-5121/B5317  
(WBS 42263.1.1)

508 CAPITAL BLVD., RALEIGH, WAKE COUNTY, NC

JULY 17, 2015

Report prepared for: Michael Sabodish Jr., Ph.D., P.E.  
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C257: GEOLOGY C1251: ENGINEERING



**GEOPHYSICAL INVESTIGATION REPORT**  
**Parcel 10 – Morris Communications Corporation**  
**Raleigh, Wake County, North Carolina**

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## LIST OF ACRONYMS

CADD .....	Computer Assisted Drafting and Design
DF .....	Dual Frequency
EM.....	Electromagnetic
GPR.....	Ground Penetrating Radar
GPS .....	Global Positioning System
NCDOT.....	North Carolina Department of Transportation
ROW .....	Right-of-Way
SVE.....	Soil Vapor Extraction
UST .....	Underground Storage Tank

## EXECUTIVE SUMMARY

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**Project Description:** Pyramid Environmental conducted a geophysical investigation for Froehling & Robertson (F&R) at Parcel 10, located at 508 Capital Blvd., Raleigh, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project B-5121/B-5317). F&R directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to extend from the existing edge of pavement into the proposed ROW line and/or proposed easements, whichever distance was greater. Conducted from June 26 to July 1, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

**Geophysical Results:** The majority of the EM anomalies recorded by the survey were the result of visible cultural features such as fences, signs, utilities, buildings, and suspected reinforced concrete. One large unknown EM feature was observed in the center of the survey area. GPR scans across the unknown EM feature, as well as other specific EM anomalies that were further investigated, did not record any evidence of significant subsurface structures such as USTs. The metallic anomalies investigated by the GPR were concluded to be caused by a variety of factors such as utilities, reinforced concrete, and buried debris. Collectively, the geophysical data did not record any evidence of unknown metallic USTs at the property.

## INTRODUCTION

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Pyramid Environmental conducted a geophysical investigation for Froehling & Robertson (F&R) at Parcel 10, located at 508 Capital Blvd., Raleigh, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project B-5121/B-5317). F&R directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to extend from the existing edge of pavement into the proposed ROW line and/or proposed easements, whichever distance was greater. Conducted from June 26 to July 1, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included four buildings surrounded by fencing, sections of concrete and asphalt parking space, and grass medians. Portions of the survey area were inaccessible by the geophysical equipment due to parked vehicles. Aerial photographs showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

## FIELD METHODOLOGY

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The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61 metal detector integrated with a Trimble AG-114 GPS antenna. The integrated GPS system allows the location of the instrument to be recorded in real-time during data collection, resulting in an EM data set that geo-referenced and can be overlain on aerial photographs and CADD drawings. A boundary grid was established around the perimeter of the site with marks every 10 feet to maintain orientation of the instrument throughout the survey and assure complete coverage of the area.

According to the instrument specifications, the EM61 can detect a metal drum down to a maximum depth of approximately 8 feet. Smaller objects (1-foot or less in size) can be

detected to a maximum depth of 4 to 5 feet. The EM61 data were digitally collected at approximately 0.8 foot intervals along north-south trending or east-west trending, generally parallel survey lines spaced five feet apart. The data were downloaded to a computer and reviewed in the field and office using the Geonics NAV61 and Surfer for Windows Version 11.0 software programs.

GPR data were acquired across select EM anomalies on June 30, 2015, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in reconnaissance fashion as well as along formal transect lines across EM features and across areas containing reinforced concrete. The GPR data were viewed in real time using a vertical scan of 512 samples, at a rate of 48 scans per second. GPR data were viewed down to a maximum depth of approximately 10 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects were saved to the hard drive of the DF unit for post-processing and figure generation.

Pyramid’s classifications of USTs for the purposes of this report are based directly on the geophysical UST ratings provided to us by the NCDOT. These ratings are as follows:

Geophysical Surveys for Underground Storage Tanks on NCDOT Projects			
High Confidence	Intermediate Confidence	Low Confidence	No Confidence
<b>Known UST</b> Active tank - spatial location, orientation, and approximate depth determined by geophysics.	<b>Probable UST</b> Sufficient geophysical data from both magnetic and radar surveys that is characteristic of a tank. Interpretation may be supported by physical evidence such as fill/vent pipe, metal cover plate, asphalt/concrete patch, etc.	<b>Possible UST</b> Sufficient geophysical data from either magnetic or radar surveys that is characteristic of a tank. Additional data is not sufficient enough to confirm or deny the presence of a UST.	Anomaly noted but not characteristic of a UST. Should be noted in the text and may be called out in the figures at the geophysicist’s discretion.

## DISCUSSION OF RESULTS

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### *Discussion of EM Results*

A contour plot of the EM61 results obtained across the survey area at the property is presented in **Figure 2**. Each EM anomaly is numbered for reference to the figure. The following table presents the list of EM anomalies and the cause of the metallic response, if known:

#### **LIST OF METALLIC ANOMALIES IDENTIFIED BY EM SURVEY**

<b>Metallic Anomaly #</b>	<b>Cause of Anomaly</b>	<b>Investigated with GPR</b>
1	Building	
2	Monitoring Well	
3	Storm Drain	
4	Metal Fence	
5	Metal Fence	
6	Utilities	
7	Monitoring Well	
8	Metal Gate	
9	Reinforced Concrete	☑
10	Metal Door	☑
11	Unknown Metal	☑
12	Vehicles	
13	Monitoring Well/Fence	☑
14	Billboard	
15	Knee Wall	
16	Vehicles	

The parcel contained a variety of metal cultural features that resulted in EM anomalies, including vehicles, signs, fences, utilities, monitoring well caps, buildings, and suspected reinforced concrete. These features are listed above and depicted on **Figure 2**.

In addition to visible cultural features, multiple EM anomalies were observed that were at least partially associated with unknown buried metal. Specifically, an EM feature was recorded in the center of the survey area in the asphalt parking lot (Anomaly #11) that was not directly associated with any objects at the ground surface. Additionally, Anomaly #10 and #13 were adjacent to cultural features such as doors, monitor wells and a fence; however, it was deemed necessary to further investigate these areas due to the extensive nature of the metallic features. The EM response along the south side of the northeast building (Anomaly #1) also exhibited an area of increased amplitude that was investigated by the GPR. Lastly, the negative amplitude EM features (green) in the south-central portion of the survey area (Anomaly #9) were suspected to be the result of reinforced concrete. This area was also investigated further with the GPR.

#### *Discussion of GPR Results*

**Figure 3** presents the locations of the formal GPR transects performed at the property, as well as select transect images. A total of 25 formal GPR transects were performed at the property. GPR transects 1-3 were performed across the suspected reinforced concrete in the south-central portion of the parking lot (Anomaly #9), and verified the presence of metal reinforcement in this area. Transects 4-7 were performed across an area of the parking lot that was blocked by vehicles during the EM survey, and recorded further evidence that the reinforced concrete extended to the north of Anomaly #9.

GPR transect 8 was performed on the north side of the southeast building, and did not record any evidence of significant subsurface structures, indicating the metallic anomaly was likely the result of an adjacent metal door. GPR transect 9-15 were performed across the large EM feature in the center of the survey area. No significant structures that would be indicative of USTs were observed. Isolated reflectors suggested possible utilities crossing through the parcel at this location.

GPR transects 16-17 were performed on the south side of the northwest building across the high amplitude EM feature there. No evidence of any significant structures was observed. The remaining GPR transects (18-25) were performed across a variety of small

metallic features in the northeast portion of the survey area, and did not record any evidence of structures such as tanks. Intermittent possible utilities, buried debris, and the previously mentioned monitor wells were concluded to be the cause of these metal features.

Collectively, the geophysical data did not record any evidence of unknown metallic USTs at the property.

## **SUMMARY & CONCLUSIONS**

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Our evaluation of the EM61 and GPR data collected at Parcel 10 in Raleigh, Wake County, North Carolina, provides the following summary and conclusions:

- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- The majority of the EM anomalies recorded by the survey were the result of visible cultural features such as fences, signs, utilities, buildings, and suspected reinforced concrete.
- One large unknown EM feature was observed in the center of the survey area.
- GPR scans across the unknown EM feature, as well as other specific EM anomalies that were further investigated, did not record any evidence of significant subsurface structures such as USTs.
- The metallic anomalies investigated by the GPR were concluded to be caused by a variety of factors such as utilities, reinforced concrete, and buried debris.
- Collectively, the geophysical data did not record any evidence of unknown metallic USTs at the property.

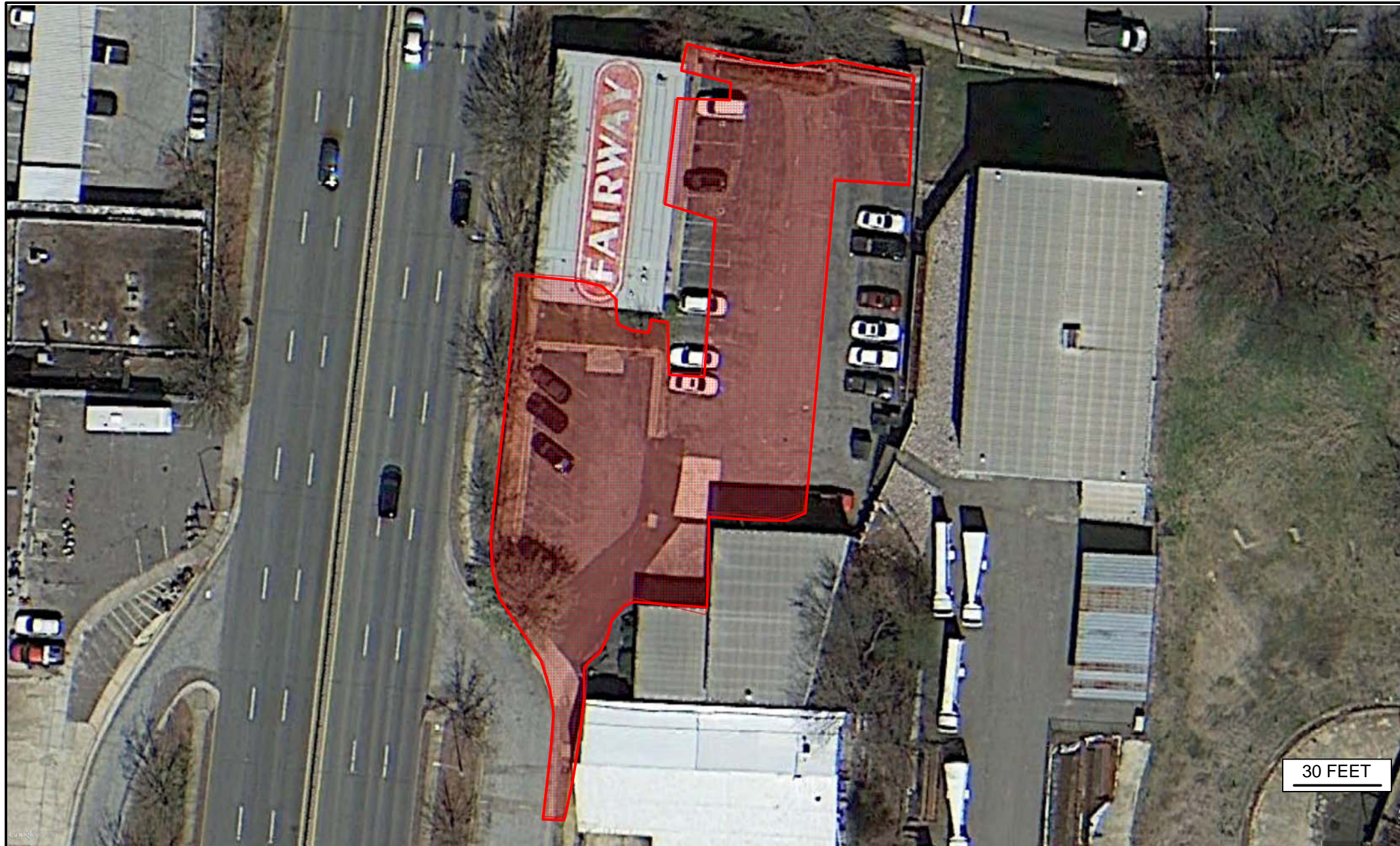


## LIMITATIONS

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Geophysical surveys have been performed and this report prepared for F&R in accordance with generally accepted guidelines for EM61 and GPR surveys. It is generally recognized that the results of the EM61 and GPR surveys are non-unique and may not represent actual subsurface conditions. The EM61 and GPR results obtained for this project have not conclusively determined the definitive presence or absence of metallic USTs, but that the evidence collected is sufficient to result in the conclusions made in this report. Additionally, it should be understood that areas containing extensive vegetation, reinforced concrete, or other restrictions to the accessibility of the geophysical instruments could not be fully investigated.

N ↑




APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREA



View of South Survey Area  
(Facing Approximately North)

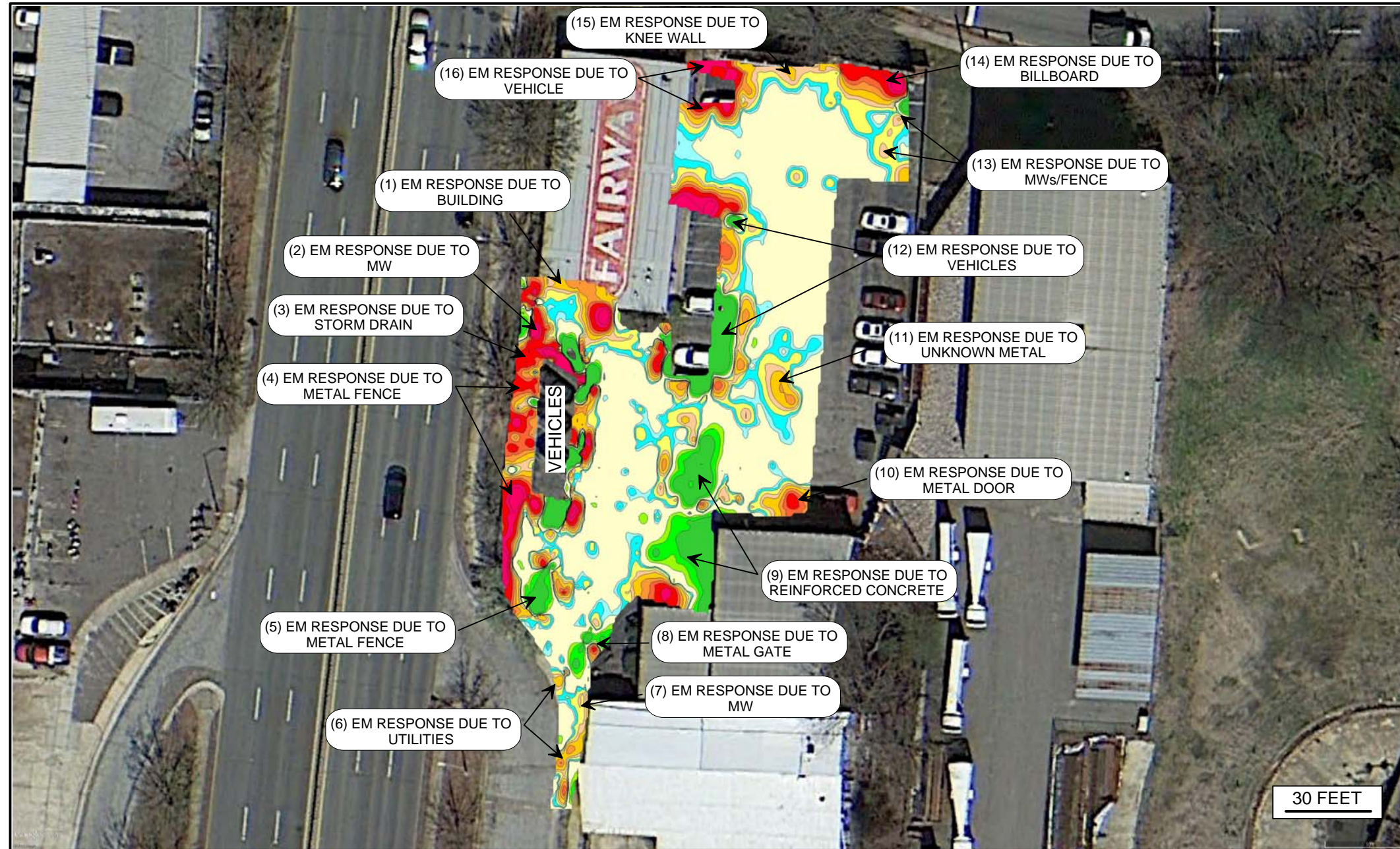


View of North Survey Area  
(Facing Approximately North)

TITLE	PARCEL 10 - 508 CAPITAL BLVD. GEOPHYSICAL SURVEY BOUNDARIES AND SITE PHOTOGRAPHS	
PROJECT	METALLIC UST INVESTIGATION NCDOT B-5121/B-5317, RALEIGH, NC	
		503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	<b>FIGURE 1</b>



## Parcel 10 - EM61 Differential Results

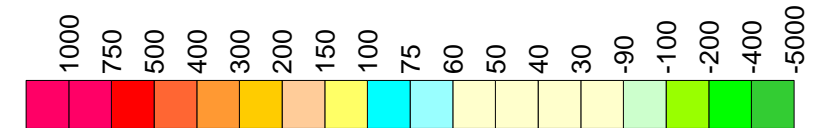



Locations of metallic anomalies detected by the EM61 survey. Numbers correspond to descriptive Table in report.

## NO EVIDENCE OF METALLIC USTs OBSERVED

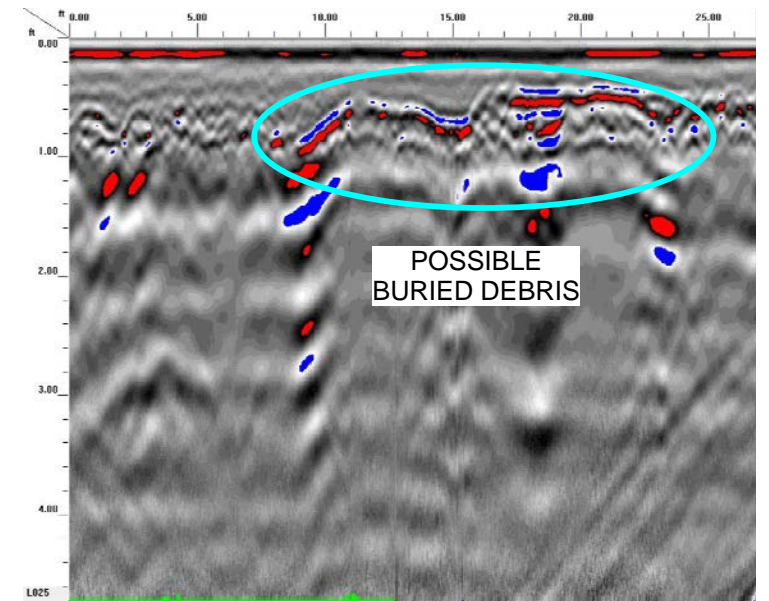
The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The EM61 data were collected on June 26, 2015, using a Geonics EM61 instrument. Ground penetrating radar (GPR) data were collected on June 30, 2015, using a GSSI UtilityScan DF unit with a dual frequency 300/800 MHz antenna.

### EM61 Metal Detection Response (millivolts)

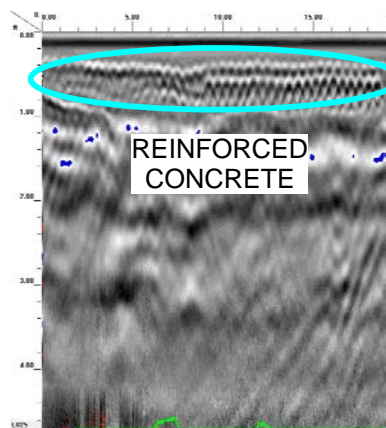


TITLE	PARCEL 10 - 508 CAPITAL BLVD. EM 61 RESULTS CONTOUR MAP	
PROJECT	METALLIC UST INVESTIGATION NCDOT PROJECT B-5121/B-5317 (42263.1.1)	
	 503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	<b>FIGURE 2</b>

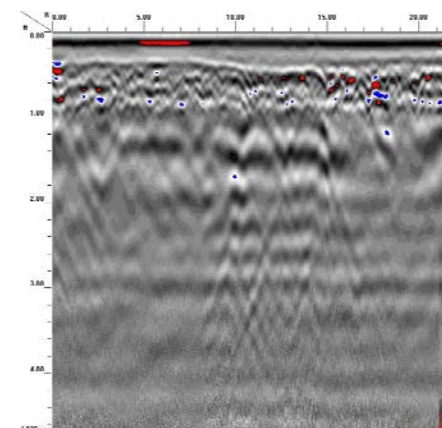
# Parcel 10 - GPR Transect Locations



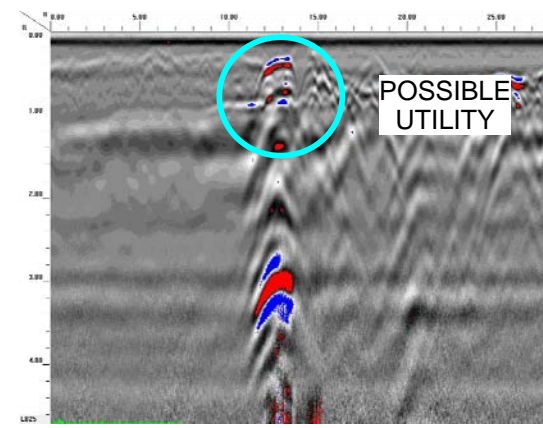
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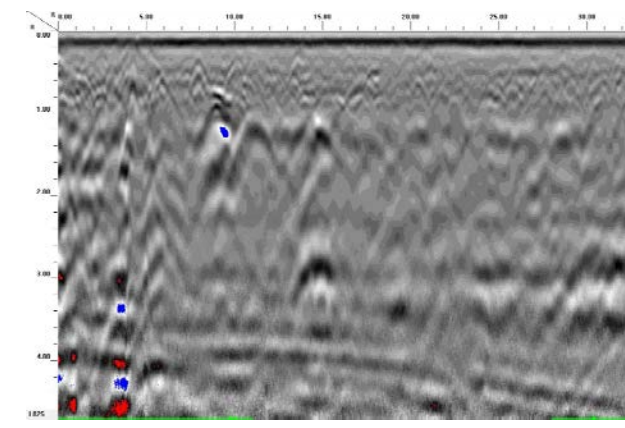
GPR TRANSECT 2 (T2)



GPR TRANSECT 7 (T7)



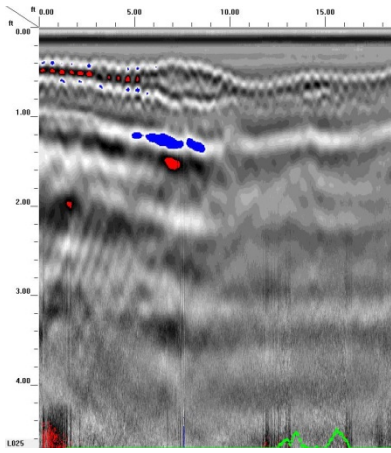
GPR TRANSECT 10 (T10)



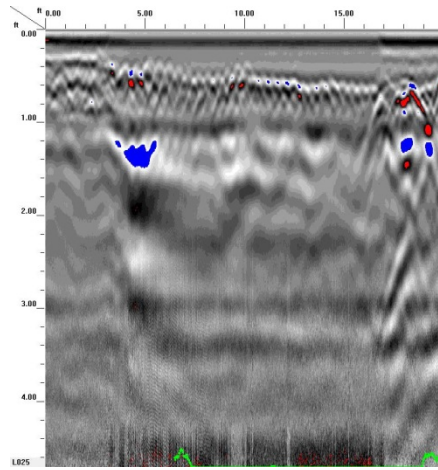
GPR TRANSECT 16 (T16)

TITLE		PARCEL 10 - 508 CAPITAL BLVD. GPR TRANSECT LOCATIONS AND SELECT IMAGES	
PROJECT		METALLIC UST INVESTIGATION NCDOT PROJECT B-5121/B-5317 (42263.1.1)	
		503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON	
PYRAMID PROJECT #:	2015-176	<b>FIGURE 3</b>	

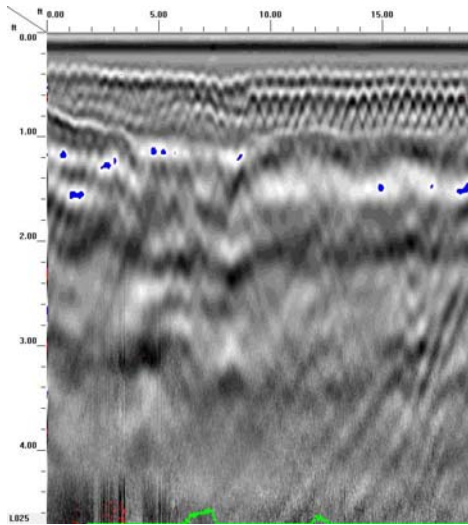
## **Appendix A – GPR Transects**



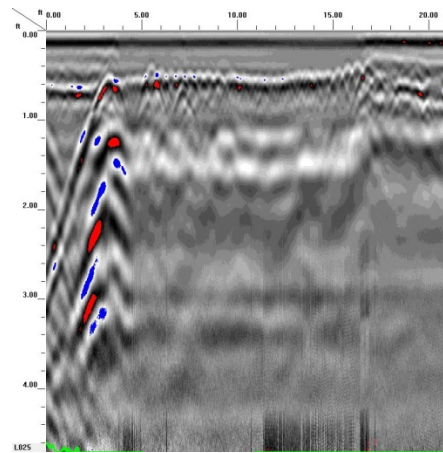
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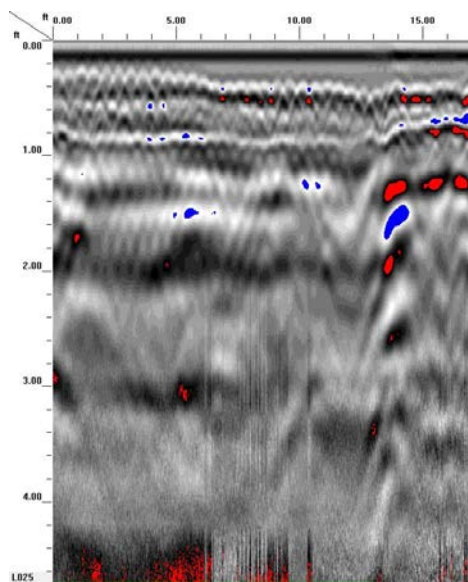
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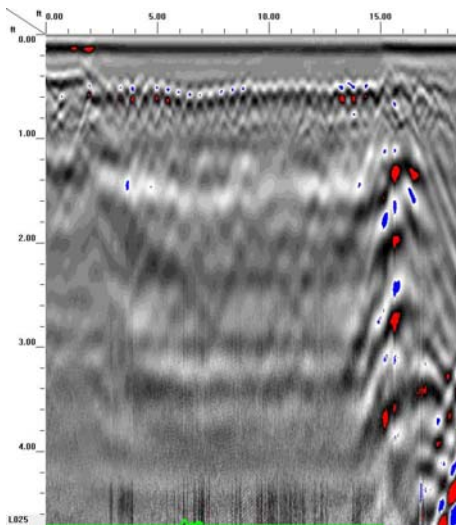
GPR TRANSECT 2



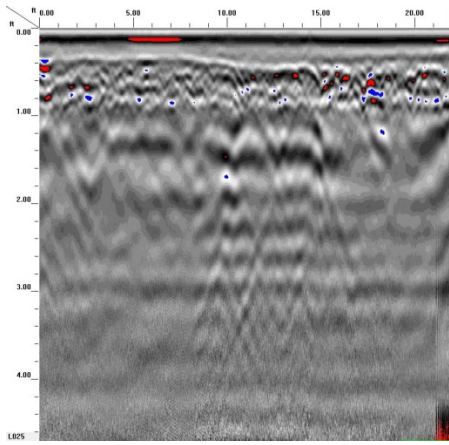
GPR TRANSECT 5



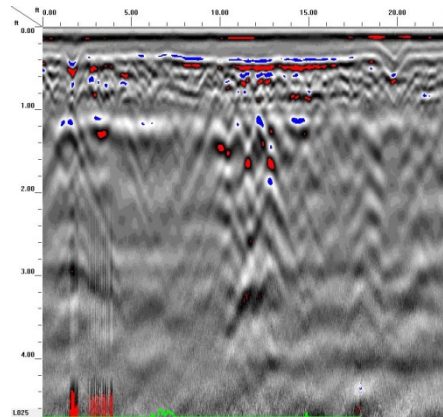
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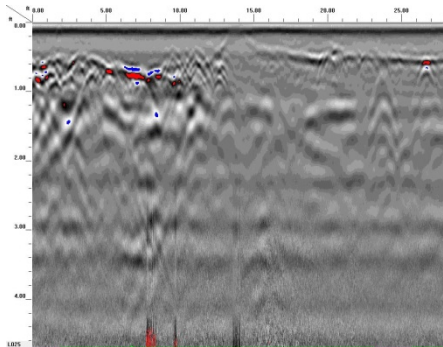
GPR TRANSECT 6



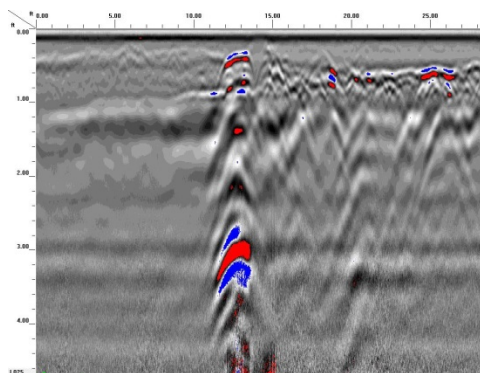
GPR TRANSECT 7



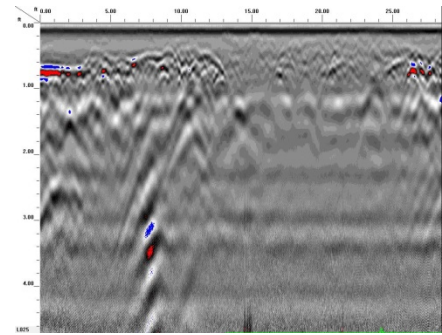
GPR TRANSECT 8



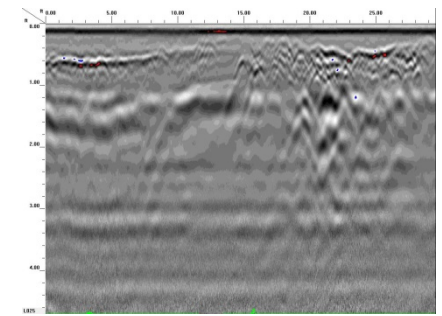
GPR TRANSECT 9



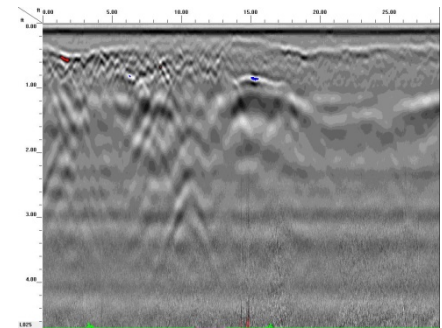
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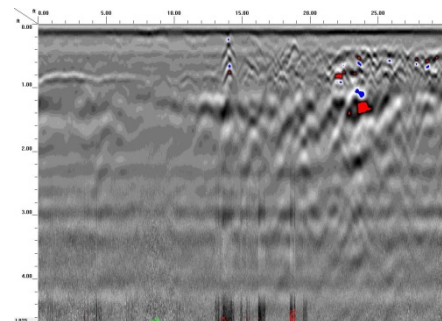
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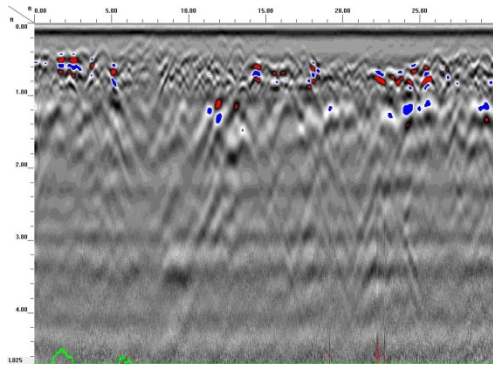
GPR TRANSECT 12



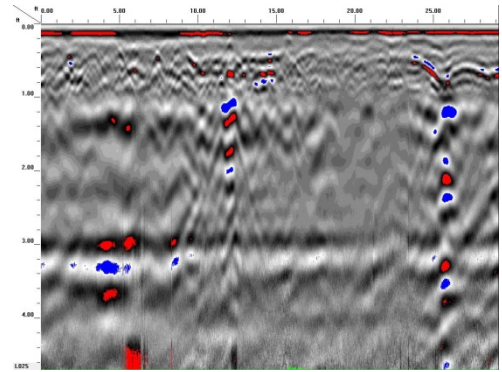
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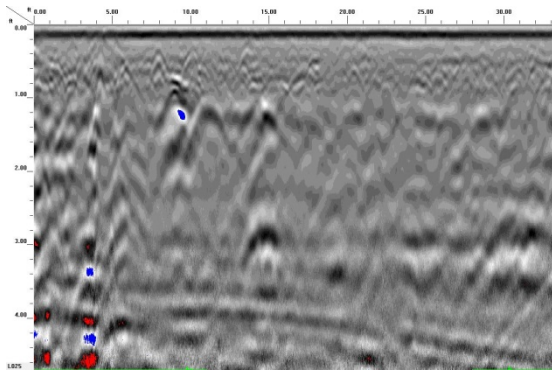
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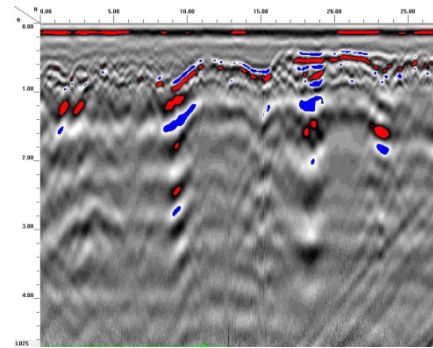
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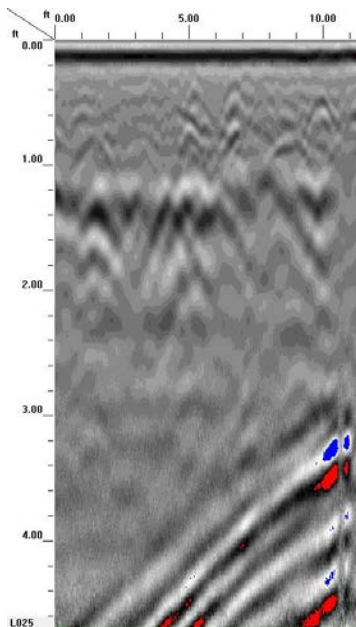
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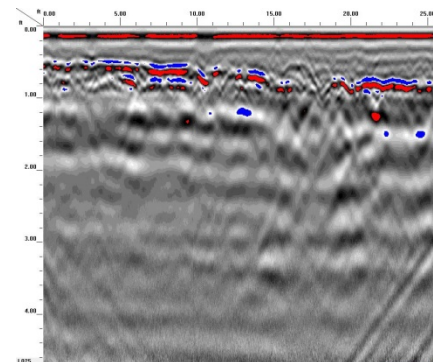
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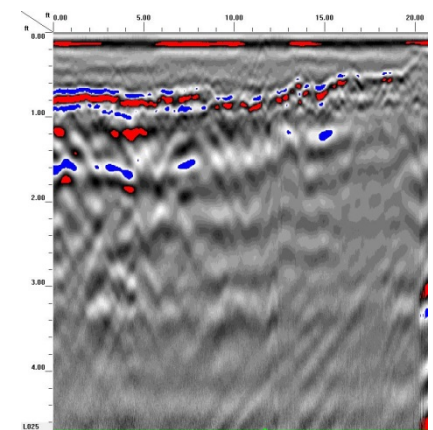
GPR TRANSECT 19



GPR TRANSECT 17

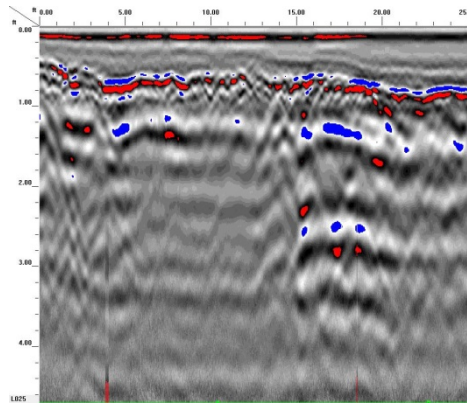


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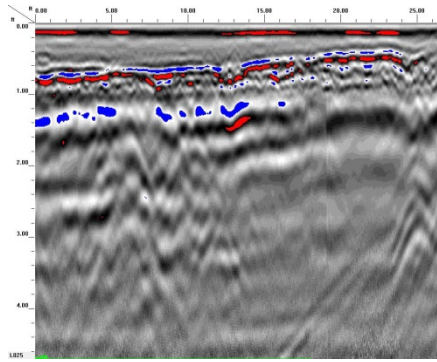


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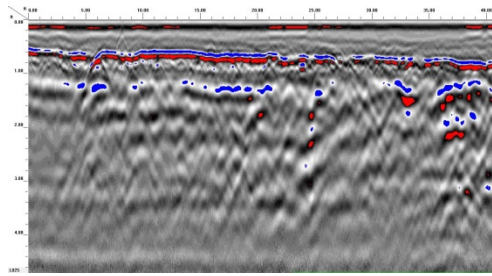




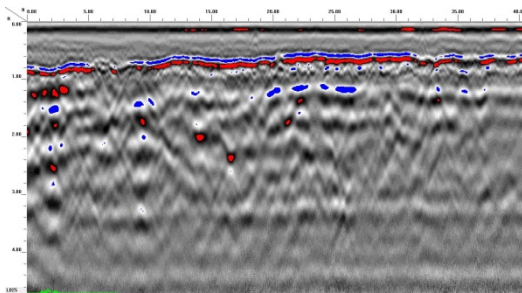
GPR TRANSECT 22



GPR TRANSECT 23



GPR TRANSECT 24



GPR TRANSECT 25



**APPENDIX III**  
**GEOPROBE LOGS**



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 8.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.5	Petroleum Odors not Observed in Boring
		Dry, Tan, Medium SAND (SW)			
	2.0	Dry, Tan, Medium to Coarse SAND (SP)	2.0	0.7	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			4.0	0.7*	
	6.0	Dry, Tan-Red, Medium to Coarse Sandy CLAY (CL)	6.0	0.6	
	7.0	Dry, Tan, Medium to Coarse SAND (SP)	7.0	0.6	
	8.0	Geoprobe Refusal on Very Dense SANDS at 8 feet.	8.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.9	Petroleum Odors not Observed in Boring
	1.0	Moist, Red-Brown, Silty CLAY with Mica (CL)	1.0	0.6	
		Moist, Red-Brown, Fine Sandy SILT with Mica (ML)	2.0	0.8	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			3.0	0.7	
			4.0	0.7	
			5.0	0.8	
			6.0	1.1*	
			7.0	1.0	
	8.0	Moist, Red-Tan, Fine Sandy SILT with Mica (ML)	8.0	0.9	
	9.0	Moist, Tan, Fine Sandy SILT with Mica (ML)	9.0	0.9	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.1	Surficial Organic Soils	0.0	0.6	Petroleum Odors not Observed in Boring
		Dry, Brown, Sandy CLAY (CL)			
	1.0	Dry, Dark Brown, Sandy CLAY (CL)	1.0	0.6	
			2.0	0.8	
	3.0	Moist, Orange-Tan, Sandy Silty CLAY (CL)	3.0	0.6	
			4.0	0.7	
	5.0	Moist, Orange-Brown, Sandy CLAY (CL)	5.0	0.9*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	6.0	Moist, Orange-Brown, Fine to Medium SAND (SP)	6.0	0.6	
	7.0	Moist, Orange-Brown, Sandy SILT (ML)	7.0	0.5	
			8.0	0.6	
			9.0	0.4	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.6	
		Dry, Gray, Fine to Coarse SAND (SW)			
	2.0	Dry, Gray and Tan, Fine to Coarse SAND (SW)	2.0	0.6	
			4.0	1.4	
			6.0	10.6	Petroleum Odor
	8.0	Moist, Dark Brown, Fine Sandy SILT (ML)	8.0	208*	Petroleum Odor
					*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ F&R.GDT 8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	4.8	Sweet Glue Like Odor
	1.0	Moist, Red-Brown, Sandy CLAY with Mica (CL)			
	1.0	Moist, Red-Brown, Fine Sandy Silty CLAY with Mica (CL)	1.0	9.1*	Sweet Glue Like Odor *Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	2.0	Moist, Red-Brown, Fine Sandy SILT with Mica (ML)	2.0	7.8	Sweet Glue Like Odor
	3.0		3.0	5.5	Sweet Glue Like Odor
	4.0		4.0	7.3	Sweet Glue Like Odor
	5.0	Moist, Red-Brown, Fine Sandy Silty CLAY with Mica (CL)	5.0	7.2	Sweet Glue Like Odor
	6.0	Moist, Orange-Tan, Fine Sandy Silty CLAY with Mica (CL)	6.0	5.4	Sweet Glue Like Odor
	7.0	Moist, Tan, Fine Sandy SILT with Mica (ML)	7.0	4.4	Sweet Glue Like Odor
	8.0	Moist, Orange-Tan, Fine Sandy SILT with Mica (ML)	8.0	7.5	Sweet Glue Like Odor
	9.0	Moist, Tan, Silty Fine SAND with Mica (SM)	9.0	6.0	Sweet Glue Like Odor
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.8	
	1.0	Moist, Gray, Silty Sandy CLAY (CL)	1.0	1.1	
	2.0	Moist, Gray, Silty Sandy Clay and Moist, Red-Brown, Sandy CLAY (CL)	2.0	1.0	Organic Laden Material
	3.0	Moist, Dark Gray, Silty Sandy CLAY with Mica (CL)	3.0	1.5	Organic Laden Material
	4.0		4.0	1.8	
	5.0	Moist, Red-Tan, Sandy Silty CLAY with Mica (CL)	5.0	4.6	Petroleum Odor
	6.0	Moist, Red-Brown, Fine Sandy Silty with Mica (ML)	6.0	10.4	Petroleum Odor
	7.0		7.0	16.7	Petroleum Odor
	8.0		8.0	25.5*	Petroleum Odor
	9.0		9.0	15.6	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP Petroleum Odor
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.





**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	1.0	Petroleum Odors not Observed in Boring
		Moist, Red-Brown, Sandy CLAY (CL)			
	1.0	Moist, Red-Brown, Sandy Silty CLAY (CL)	1.0	0.8	
	2.0	Moist, Red-Brown, Sandy Silty CLAY (CL) with Mica	2.0	0.8	
	3.0	Moist, Red-Tan, Sandy Silty CLAY (CL) with Mica	3.0	0.9	
	4.0		4.0	0.9	
	5.0	Moist, Red-Tan, Fine Sandy SILT (ML)	5.0	0.8	
	6.0	Moist, Red-Brown, Fine Sandy SILT (ML)	6.0	1.0	
	7.0	Moist, Tan-Black, Silty Fine to Medium SAND (SM)	7.0	1.4*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	8.0		8.0	1.1	
	9.0		9.0	0.7	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	1.0	Petroleum Odors not Observed in Boring
		Moist, Dark Gray, Sandy CLAY (CL)			
	1.0	Moist, Gray-Tan, Sandy CLAY (CL)	1.0	0.8	
	2.0	Moist, Black, Sandy CLAY (CL)	2.0	0.8	
	3.0	Moist, Tan, Sandy CLAY (CL)	3.0	0.7	
	4.0		4.0	0.6	
	5.0	Wet, Tan, Sandy CLAY (CL)	5.0	0.7	
	6.0	Moist, Tan, Sandy CLAY (CL)	6.0	0.8	
	7.0		7.0	1.4	
	8.0	Moist, Tan, Silty CLAY (CL)	8.0	2.3	
	9.0	Wet, Tan, Silty CLAY (CL)	9.0	3.7*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.4	Petroleum Odors not Observed in Boring
		Moist, Tan-Gray, Sandy CLAY (CL)			
	1.0	Moist, Tan, Sandy Silty CLAY (CL)	1.0	0.6	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			2.0	0.5	
			3.0	0.5	
			4.0	0.8*	
			5.0	0.5	
			6.0	0.7	
	7.0	Moist, Tan, Sandy Silty CLAY (CL) with White Gravel	7.0	0.7	
	8.0	Moist, Tan-Fine, Silty Fine SAND (SM)	8.0	0.8	
	9.0	Moist, Silty Fine to Coarse SAND (SM)	9.0	0.5	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**Project No:** 66T-0097

**Elevation:** Existing Ground Surface

**Drilling Method:** Geoprobe

**Client:** NCDOT

**Total Depth:** 10.0'

**Hammer Type:** N/A

**Project:** B-5121/B-5317 Morris Comm. (Parcel #10) **Boring Location:** See Plan

**Date Drilled:** 7/22/15

**City/State:** Raleigh, NC

**Driller:** Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.4	Petroleum Odors not Observed in Boring
		Moist, Orange-Tan, Silty CLAY (CL) with Mica	1.0	0.7	
	2.0	Moist, Orange-Tan, Sandy Silty CLAY (CL) with Mica	2.0	0.8	
	3.0	Moist, Orange-Tan, Sandy CLAY (CL) with Mica	3.0	0.8	
			4.0	0.6	
			5.0	1.0	
			6.0	1.2*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	7.0	Moist, Tan-Brown, Silty Fine to Medium SAND (SM) with Mica	7.0	1.1	
			8.0	1.0	
			9.0	0.9	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE\_LOG\_B5121\_GEOENV\_GEOPROBEBORELOGS\_PARCEL10.GPJ\_F&R.GDT\_8/21/15

\*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



**APPENDIX IV**

**SITE PHOTOS**

B-1



**Photo #1:** A view of boring location B-1, facing north.



B-2

**Photo #2:** A view of Boring B-2, facing south.



B-3

**Photo #3:** Boring location B-3, facing north.



B-4

**Photo #4:** A view of boring location B-4, facing east.

B-5



**Photo #5:** A view of Boring B-5, facing west.

B-6



**Photo #6:** A view of Boring B-6, facing west.





B-7

**Photo #7:** A view of boring location B-7, facing north.



B-8

**Photo #8:** A view of Boring B-8, facing north.



B-9

**Photo #9:** A view of boring location B-9, facing east.



B-10

**Photo #10:** A view of Boring B-10, facing south.



**APPENDIX V**

**LABORATORY ANALYTICAL RESULTS**



### Hydrocarbon Analysis Results

**Client:** F & R  
**Address:** Raleigh, NC

**Samples taken**  
**Samples extracted**  
**Samples analysed**

Wednesday, July 22, 2015  
Thursday, July 23, 2015  
Friday, July 24, 2015

**Contact:** Ben Whitley

**Operator**

F. Owen

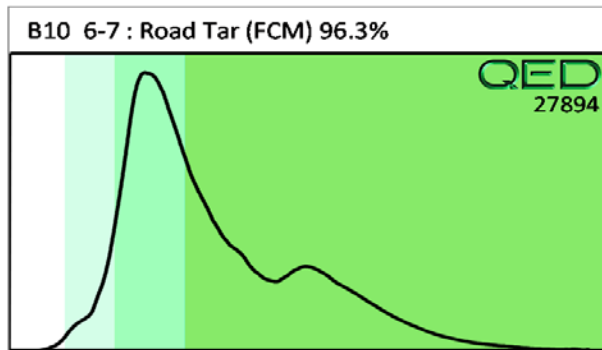
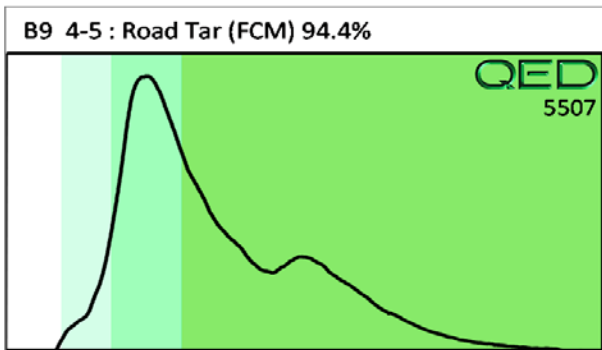
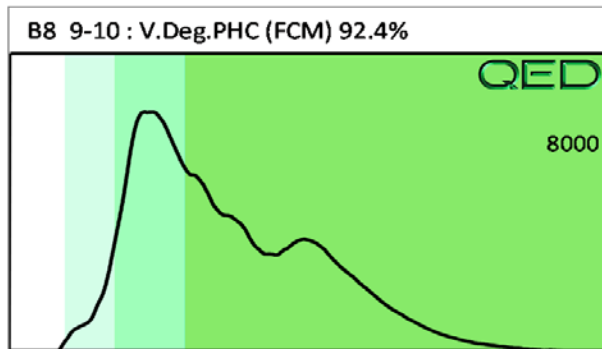
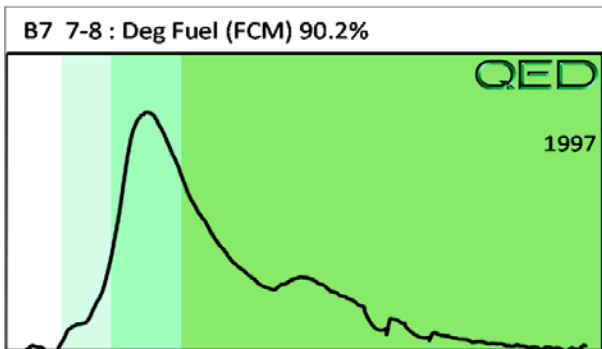
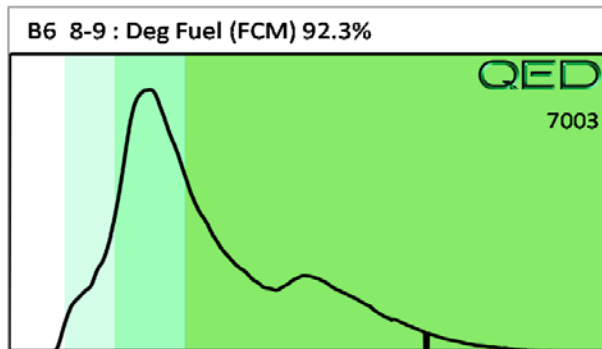
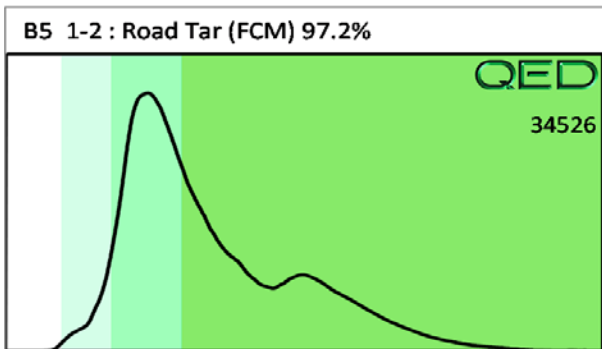
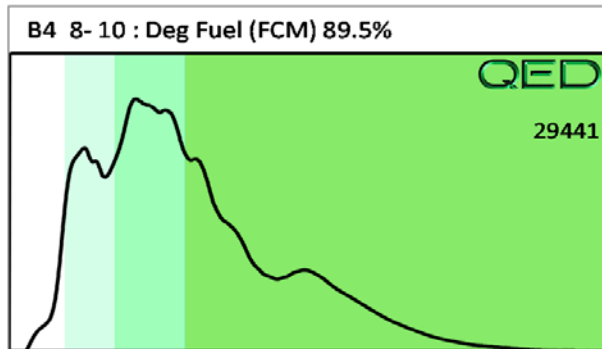
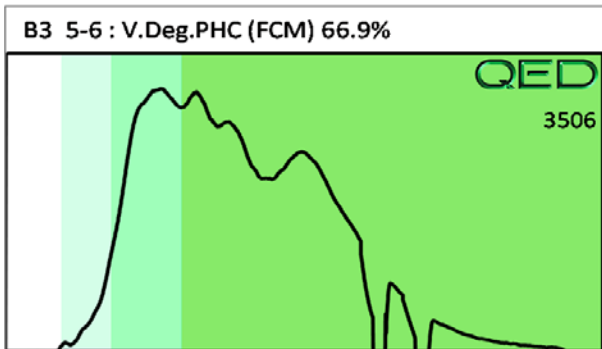
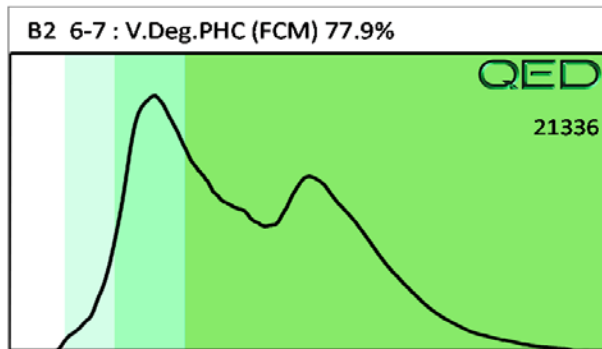
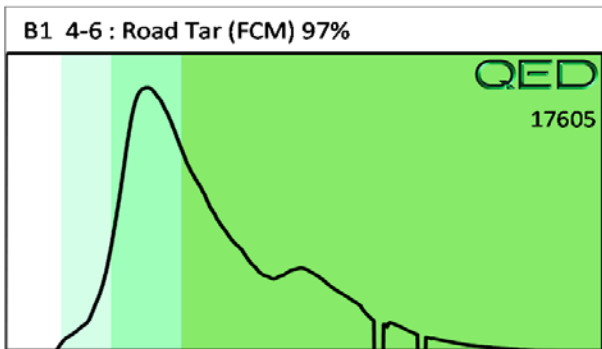
**Project:** NC DOT Parcel 10 B-5121/ B-5317

Fingerprints Only													
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
										% light	% mid	% heavy	
s	B1 4-6	301.8	<15.1	<7.5	173.4	173.4	152.1	22.7	0.46	0	87.5	12.5	Road Tar (FCM) 97%
s	B2 6-7	22.2	<1.1	<0.56	24	24	22.7	4	0.078	0	86.4	13.6	V.Deg.PHC (FCM) 77.9%
s	B3 5-6	22.8	<1.1	<0.57	2.1	2.1	2.1	0.25	0.014	0	82.1	17.9	V.Deg.PHC (FCM) 66.9%
s	B4 8- 10	21.7	<1.1	30.8	95.9	126.7	65.2	2.5	0.021	34.8	62.4	2.9	Deg Fuel (FCM) 89.5%
s	B5 1-2	22.0	<1.1	<0.55	30.7	30.7	25.3	3.6	0.03	0	90.1	9.9	Road Tar (FCM) 97.2%
s	B6 8-9	23.6	<1.2	<0.59	12.9	12.9	7.7	0.31	0.012	0	94.1	5.9	Deg Fuel (FCM) 92.3%
s	B7 7-8	338.0	<16.9	<8.5	53.8	53.8	24.7	0.93	<0.17	0	91.4	8.6	Deg Fuel (FCM) 90.2%
s	B8 9-10	21.7	<1.1	<0.54	7.8	7.8	7.1	0.33	0.004	0	89.1	10.9	V.Deg.PHC (FCM) 92.4%
s	B9 4-5	236.4	<11.8	<5.9	43.9	43.9	34.5	5.6	0.038	0	91.2	8.8	Road Tar (FCM) 94.4%
s	B10 6-7	29.5	<1.5	<0.74	30.2	30.2	25.1	1.2	0.015	0	93.1	6.9	Road Tar (FCM) 96.3%
Initial Calibrator QC check			OK			Final FCM QC Check			OK			102.7%	

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values are not corrected for moisture or stone content

Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:- FCM = Results calculated using Fundamental Calibration Mode : % = confidence for sample fingerprint match to library

(SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present





## Chain of Custody Record and Analytical Request Form

Sample ID	Sample Collection		Initials	TAT Requested		
	QED UVF	Date		Time	24 Hour	48 Hour
Parcel 6 B-1	7-8°	7-22-15	1000	PAW		X
B-2	5-6°		1050			
B-3	7-8°		1015			
B-4	3-4°		1040			
B-5	8-9°		1100			
B-6	0-1.5°		1115			
Parcel 10 B-1	4-6°		1200			
B-2	6-7°		1210			
B-3	5-6°		1330			
B-4	8-10°		1350			
B-5	1-2°		1405			
B-6	8-9°		1430			
B-7	7-8°		1445			
B-8	9-10°		1505			
B-9	4-5°		1520			
B-10	6-7°		1545			

Client: F&F

Contact: Ben Whitley

Phone: 919-630-5661

Email: bwhitley@fandr.com

Project Reference:  
NC DOT B-5121 / B-5317

Each sample will be analyzed for total  
BTEX, GRO, DRO, TPH and PAH

Each sample will generate a fingerprint representative of the petroleum product within the samples. Electronic data will be submitted to the email above.

FR	7-23-15	1800	UPS	7-23-15	1800
Relinquished by	Date/Time		Accepted by	Date/Time	
			<i>[Signature]</i>	7-24-15 10:30	
Relinquished by	Date/Time		Accepted by	Date/Time	
Relinquished by	Date/Time		Accepted by	Date/Time	

**SHIP TO:**  
QROS, LLC  
420 Raleigh Street, Suite E  
Wilmington, NC 28412

Hannah King  
hannahk@qrosllc.com  
(704)-654-7391

**ATTENTION**

When shipping, please DO NOT submerge sample vials in ice or water. This is to avoid dilution errors and contamination. To keep the samples cool we suggest using a freezer pack or a bag of ice sealed that will not leak.

\* Please send results for Parcels 6 and 10 on separate spreadsheets

SINCE



1881

