

December 12, 2016

Mr. Terry Fox, L.G.  
North Carolina Department of Transportation  
Geotechnical Engineering Unit  
1589 Mail Service Center  
Raleigh, North Carolina 27699-1589

Reference: **Preliminary Site Assessment  
David and Deborah Reaves Property (Parcel #155)  
5516 Raeford Road  
Fayetteville, Cumberland County, North Carolina  
State Project: U-4405  
WBS Element 39049.1.1  
SIES Project No. 2016.0054.NDOT**

Dear Mr. Fox:

Solutions-IES, Inc., (SIES) has completed the Preliminary Site Assessment conducted at the above-referenced property. The work was performed in accordance with the Technical and Cost proposal dated September 26, 2016, and the North Carolina Department of Transportation's (NCDOT's) Notice to Proceed dated September 26, 2016. Activities associated with the assessment consisted of conducting a geophysical investigation, collecting soil samples for analysis, and reviewing applicable North Carolina Department of Environmental Quality (NCDEQ) records. The purpose of this report is to document the field activities, present the laboratory analyses, and provide recommendations regarding the property.

### **Location and Description**

The David and Deborah Reaves Property (Parcel #155) is located at 5516 Raeford Road in Fayetteville, Cumberland County, North Carolina. The property is situated on the north side of Raeford Road on the northeast quadrant of the intersection of Raeford Road and Skibo Road (**Figure 1**). According to NCDOT information, the site has been used for various business interests for many years and the potential exists that the site was a former gas station. The building was vacant on the date of the field work.

An asphalt driveway is on the east side of the building and a gravel driveway is on the west side of the building. Several concrete pads are located adjacent to the west side of the building. Further inspection during a site visit indicated that apparent vent pipes are associated with two of the pads, but no fill ports were noted (**Figure 2**). The proposed easement was not marked on the day of the field work, but the NCDOT plan sheet shows that the easement will affect almost the entire property and the NCDOT will acquire it in total.

The NCDOT requested a Preliminary Site Assessment for the right-of-way and proposed easement because of the possible historic site use as a gas station. The scope of work as defined in the Request for Technical and Cost Proposal was to evaluate the site with respect to the presence of known and unknown USTs and assess where contamination exists on the right-of-way/proposed easement. An estimate of the quantity of impacted soil was to be provided, should impacted soils be encountered.

SIES reviewed the on-line NCDEQ Incident Management database and no incident number was assigned to the site. SIES also examined the UST registration database and found no tanks registered to the property address.

### **Geophysical Survey**

Prior to SIES' mobilization to the site, Pyramid Environmental & Engineering of Greensboro, NC (Pyramid) conducted a geophysical survey to determine if USTs were present at the site. The geophysical survey consisted of an electromagnetic survey using a Geonics EM61 time-domain electromagnetic induction meter to locate buried metallic objects, and ground penetrating radar (GPR) using a Geophysical Survey Systems Inc. Utility Scan DF with a dual frequency 300/800 MHz antenna. The instruments were used specifically to locate USTs.

A survey grid was laid out along the right-of-way/proposed easement with the X-axis oriented approximately parallel to Raeford Road and the Y-axis oriented approximately perpendicular to Raeford Road. The grid was positioned to cover the accessible portions of the property, as shown on **Figure 2** of the geophysical survey report in **Attachment A**. A large portion of the property on the west side was not accessible due to woods/vegetation and a tributary to Beaver Creek.

The survey lines were spaced five feet apart and magnetic data were collected continuously along each survey line with a data logger. After collection, the data were reviewed in the field with graphical computer software. Following the electromagnetic survey, a ground penetrating radar (GPR) survey was conducted to further evaluate any significant metallic anomalies.

Access was not available to all areas of the property and no evaluation with respect to metallic USTs was performed in these areas. Several anomalies were detected with the geophysical survey that were attributed to metallic debris, underground utilities, or signage. Although no electromagnetic anomalies were detected, potential vent pipes were observed on the west side of the building and a cut off pipe was noted on the north side of the building, which prompted a GPR survey near these features. No UST was detected near the cut off pipe, but the GPR suggested possible buried metallic debris. The GPR survey indicated the presence of two non-metallic structures that were tentatively identified as septic tanks in the

area of the potential vent pipes. With respect to USTs, the geophysical survey showed no evidence of unknown metallic tanks on the accessible portions of the property. Pyramid's detailed report of findings and interpretations is presented in **Attachment A**.

### **Site Assessment Activities**

On October 25, 2016, SIES mobilized to the site to conduct a Geoprobe® direct-push investigation to evaluate subsurface soil conditions on the property. Eight direct-push holes (155-SB-1 through 155-SB-8) were advanced throughout the property (**Figure 2**). The initial three Geoprobe® borings were terminated at 8 and 10 feet below ground surface (ft bgs); however, groundwater was encountered at depths ranging from four to eight ft bgs. Therefore, the remaining borings were terminated at eight ft bgs.

The soil boring logs are included as **Attachment B**. Boring 155-SB-1 was located to assess the northern portion of the property. Borings 155-SB-2 through 155-SB-5 were placed to evaluate subsurface conditions around the potential septic tanks and boring 155-SB-8 was located near the cut off pipe to assess that area. Borings 155-SB-6 and 155-SB-7 were positioned to evaluate the subsurface conditions in front of the building along Raeford Road (see photos in **Attachment C**).

Continuous sampling using a Geoprobe® resulted in good recovery of soil samples from the direct-push holes. Soil samples were collected and contained in four-foot long acetate sleeves inside the direct-push Macro-Core® sampler. Each of the sleeves was divided into two-foot long sections for soil sample screening. Soil from each two-foot interval was placed in a resealable plastic bag and the bag was set aside for volatilization of organic compounds from the soil to the bag headspace. A photoionization detector (PID) probe was inserted into the bag and the reading was recorded (**Table 1**).

One sample from the lowest interval of each boring above saturated soil was selected for analysis. The selected soil samples were submitted to an on-site mobile laboratory for analysis of total petroleum hydrocarbons (TPH) diesel range organics (DRO) and gasoline range organics (GRO) using ultraviolet fluorescence (UVF) methodology. Each boring was backfilled with bentonite and drill cuttings to the surface after completion.

The lithology encountered by the direct-push samples was generally consistent throughout the site. The ground surface was covered with about 0.5 feet of topsoil. Below this surface cover was a light gray clayey sand. Boring 55-SB-1 encountered a soft clay at a depth of about three to five ft bgs. No bedrock was noted in any of the borings. Moderate to strong hydrocarbon odors were noted in the material at a depth of about six to eight feet in the boring 155-SB-4 through 155-SB-8.

According to the 1985 Geologic Map of North Carolina, the site is within of Coastal Plain Physiographic Province in North Carolina near the contact between the Cretaceous Black Creek and Middendorf Formations. The strata of the Black Creek Formation consist of gray to black clay, thin lenses of fine-grained sand and thick lenses of cross-bedded sand. The lithology may also include glauconite and fossils. In comparison, the Middendorf Formation consists of sand, sandstone, and mudstone that are laterally discontinuous. The soils observed at the site are consistent with the Middendorf Formation as the parent material.

## Analytical Results

The laboratory data are summarized in **Table 1** and the complete report is presented in **Attachment D**. Eight soil samples were submitted for analysis, one from each boring. Of these samples, five contained detectable GRO compounds at concentrations ranging from 11.1 to 312.4 milligrams per kilogram (mg/kg) and all eight samples contained detectable DRO compounds at concentrations ranging from 0.47 to 969.4 mg/kg. The action levels are 50 mg/kg for GRO and 100 mg/kg for DRO<sup>1</sup>. Soil sample 155-SB-4-6-8 contained 312.4 mg/kg GRO and 152.4 mg/kg DRO; soil sample 155-SB-6-6-8 contained 223.8 mg/kg GRO and 117.9 mg/kg DRO; and soil sample 155-SB-5-6-8 contained 969.4 mg/kg DRO. These concentrations are above their respective action levels.

## Contaminated Soil Volume Estimate

The UVF analytical results (**Table 1**) of the soil samples collected on October 25, 2016 indicate that three of the soil samples contained DRO or GRO concentrations above the action level. Therefore, an estimate of the volume of soil requiring possible remediation was made.

To estimate the volume of soil requiring possible remediation, only the soil samples that contained a DRO and/or GRO concentration above the respective action levels were considered. The thickness of the potentially contaminated soil was estimated from the field screening and UVF results, which indicated a thickness of two feet (**Table 1**). After estimating the potential contamination geometry using field observations and experience with similar sites and geology, SIES measured the affected section on **Figure 3** by using CAD software, which indicated a total area of about 3,275 ft<sup>2</sup>. With a two-foot contamination thickness, this calculates to a volume of about 243 bank cubic yards.

The use of DRO and GRO concentrations to determine UST closure and immediate soil removal is a valid analytical method. However, any cleanup beyond the closure is governed by risk-based methods that are based on individual constituents and do not correlate with DRO and GRO concentrations. Because of the

---

<sup>1</sup> NCDEQ, *Guidelines for North Carolina Action Limits for Total Petroleum Hydrocarbons (TPH)*, July 26, 2016,

uncertainty associated with the differences in these analytical methods, the actual volume of contaminated soil may be higher or lower.

### Conclusions and Recommendations

A Preliminary Site Assessment was conducted to evaluate the David and Deborah Reaves Property (Parcel #155) located at 5516 Raeford Road in Fayetteville, Cumberland County, North Carolina. NCDEQ databases indicate that no release incidents have been reported for the site and no USTs were registered to the property address. A geophysical survey conducted at the site did not detect USTs in the investigation area, but a pair of septic tanks may be present. Eight soil borings were advanced to evaluate the subsurface soil conditions throughout the property. Three of the analyzed soil samples detected GRO or DRO concentrations above their respective action levels. Based on the analytical results, SIES estimated approximately 243 cubic yards of potentially contaminated soil at the site.

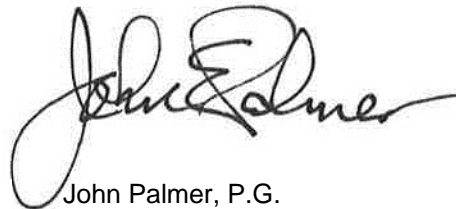
SIES appreciates the opportunity to work with the NCDOT on this project. Because compounds were detected above the action level in the soil samples, SIES recommends that a copy of this report be submitted to the Division of Waste Management, UST Section, in the Fayetteville Regional Office. If you have any questions, please contact us at (919) 873-1060.

Sincerely,

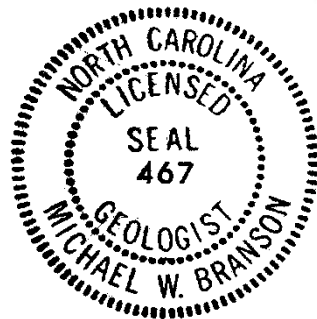


Michael W. Branson, P.G.  
Project Manager

Attachments



John Palmer, P.G.  
Senior Hydrogeologist



**TABLE 1**  
**SOIL FIELD SCREENING AND ANALYTICAL RESULTS**  
**REAVES PROPERTY (PARCEL #155)**  
**FAYETTEVILLE, CUMBERLAND COUNTY, NORTH CAROLINA**  
**STATE PROJECT: U-4405**  
**WBS ELEMENT 39049.1.1**  
**SIES PROJECT NO. 2016.0054.NDOT**

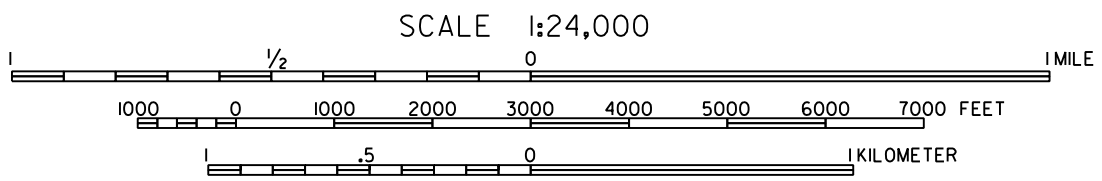
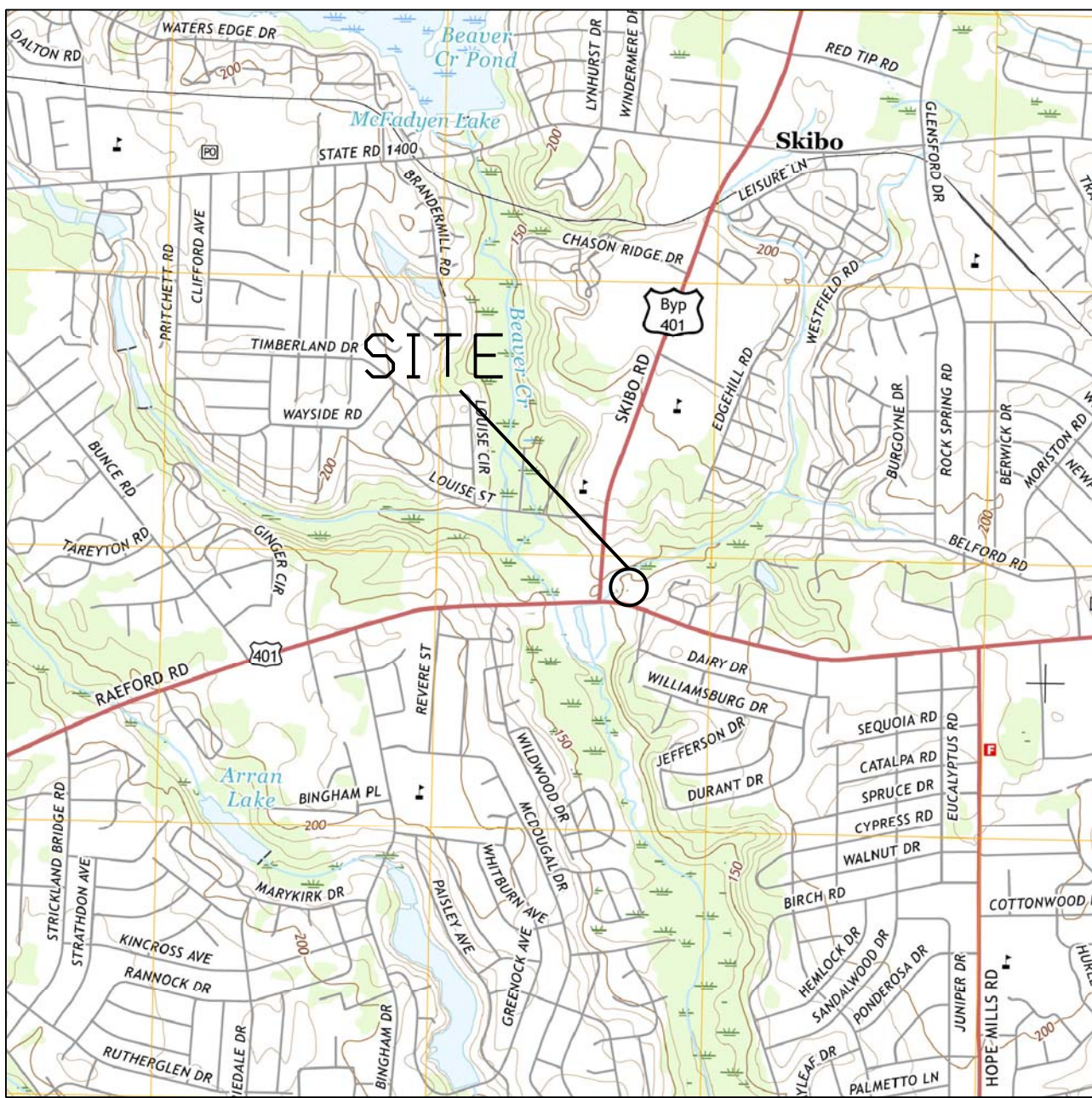
SAMPLE ID	DEPTH (ft)	PID READING (ppm)	SAMPLE ID	ANALYTICAL RESULTS (mg/kg)	
				UVF GRO	UVF DRO
Action Level (mg/kg)				50	100
155-SB-1	0 - 2	0.0			
	2 - 4	0.0			
	4 - 6	0.0			
	6 - 8	0.0	155-SB-1-6-8	<0.72	<b>49.6</b>
	8 - 10	NA			
155-SB-2	0 - 2	0.0			
	2 - 4	0.1	155-SB-2-2-4	<0.6	<b>26.1</b>
	4 - 6	NA			
	6 - 8	NA			
	8 - 10	NA			
155-SB-3	0 - 2	0.0			
	2 - 4	0.1	155-SB-3-2-4	<0.24	<b>0.47</b>
	4 - 6	NA			
	6 - 8	NA			
	8 - 10	NA			
155-SB-4	0 - 2	0.2			
	2 - 4	0.0			
	4 - 6	50.1			
	6 - 8	2,343	155-SB-4-6-8	<b>312.4</b>	<b>152.4</b>
	8 - 10	NA			
155-SB-5	0 - 2	0.0			
	2 - 4	0.0			
	4 - 6	0.1			
	6 - 8	49.8	155-SB-5-6-8	<b>14</b>	<b>969.4</b>
	8 - 10	NA			
155-SB-6	0 - 2	0.0			
	2 - 4	0.0			
	4 - 6	1.3			
	6 - 8	2,030	155-SB-6-6-8	<b>223.8</b>	<b>117.9</b>
	8 - 10	NA			
155-SB-7	0 - 2	0.0			
	2 - 4	0.1			
	4 - 6	1.6			
	6 - 8	385	155-SB-7-6-8	<b>11.1</b>	<b>29.7</b>
	8 - 10	NA			
155-SB-8	0 - 2	0.0			
	2 - 4	0.1			
	4 - 6	9.6			
	6 - 8	389	155-SB-8-6-8	<b>15.6</b>	<b>15.8</b>
	8 - 10	NA			

- 1) ft - feet
- 2) ppm - parts per million.
- 3) PID - photoionization ionization detector
- 4) mg/kg - milligrams per kilogram.
- 5) UVF DRO - Diesel range organics by UVF.
- 6) UVF GRO - Gasoline range organics by UVF.
- 7) Action level based upon NCDEQ memo *Guidelines for North Carolina Action Limits for Total Petroleum Hydrocarbons* - July 29, 2016.
- 8) Soil samples were collected on October 25, 2016.
- 9) NA - Not analyzed due to groundwater
- 10) **Bold** values are above the detection level. Shaded values are above the action level.

## FIGURES



PROJECT NUMBER 2016.0054.NDOT  
 CHECKED BY JEP  
 PROJECT MANAGER MWB  
 DATE NOVEMBER 2016  
 FILE FAYETTEVILLE PSAS



SOURCE: U.S. GEOLOGICAL SURVEY 7.5 MIN QUADRANGLE: FAYETTEVILLE, NC (2016)

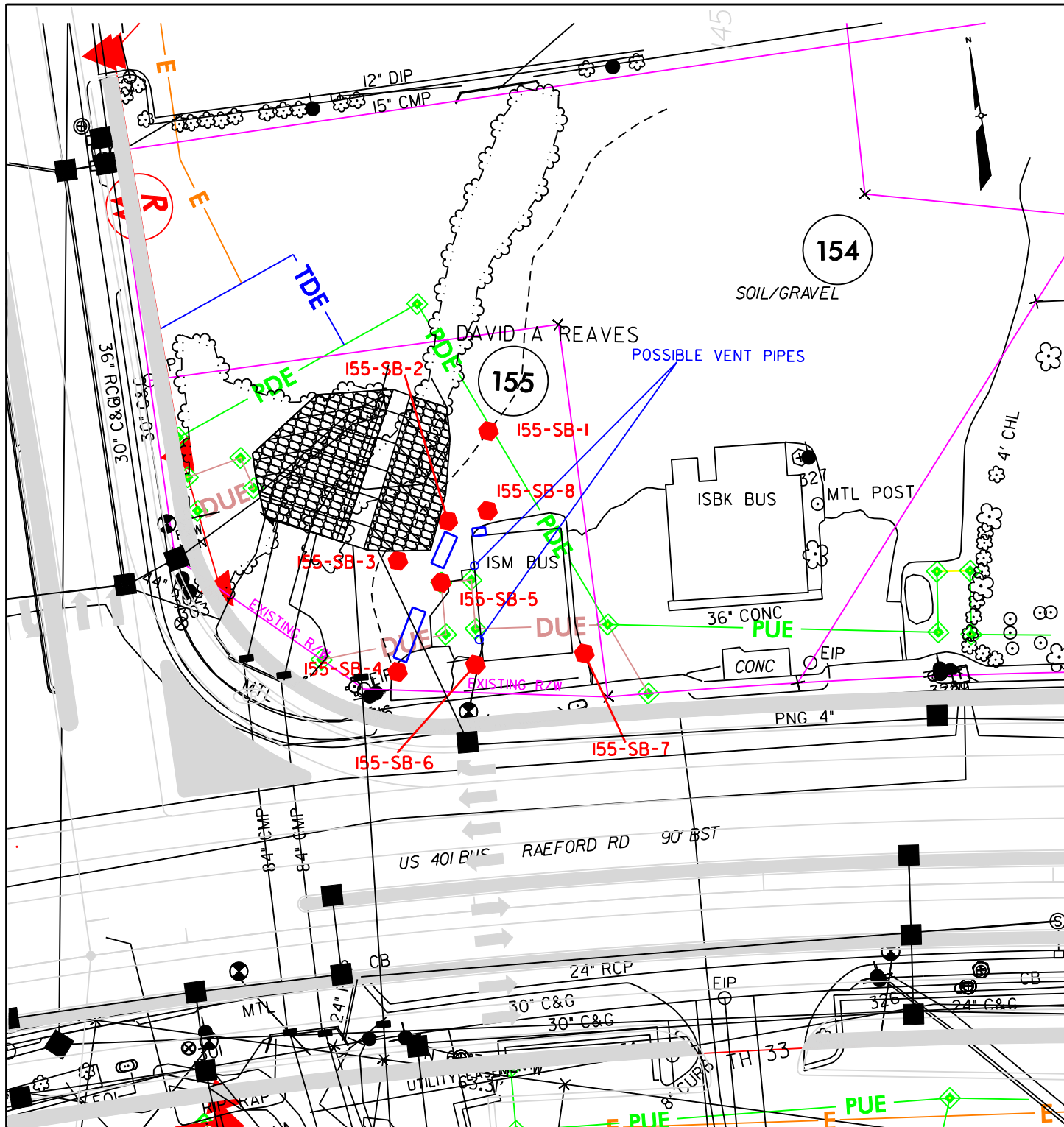
**Solutions-IES**  
 Industrial & Environmental Services  
 1101 NOWELL ROAD  
 RALEIGH, NORTH CAROLINA 27607  
 TEL: (919) 873-1060 FAX: (919) 873-1074

VICINITY MAP  
 REAVES PROPERTY (PARCEL #155)  
 FAYETTEVILLE, CUMBERLAND COUNTY NORTH CAROLINA

FIGURE  
 1

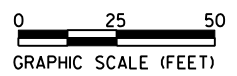


PROJECT NUMBER 2016.0054.NDOT  
 MWB  
 DRAFTER  
 JEP  
 CHECKED BY MWB  
 PROJECT MANAGER  
 DATE NOVEMBER 2016  
 PSAS  
 FILE



LEGEND

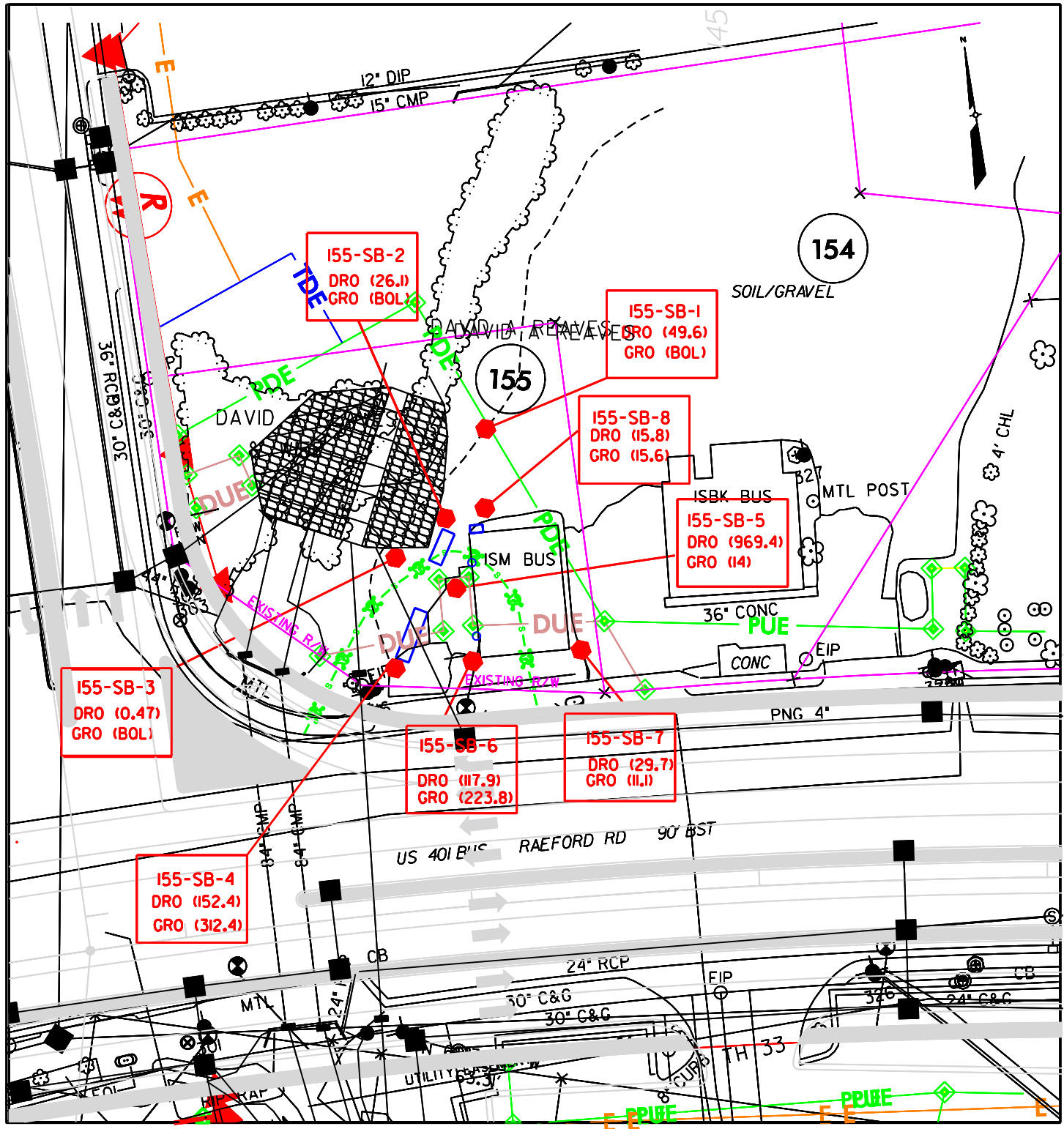
- I55-SB-1
- ◆ SOIL SAMPLE LOCATION AND IDENTIFICATION
- APPROXIMATE GEOPHYSICAL ANOMALY LOCATIONS



**Solutions-IES**  
 Industrial & Environmental Services  
 1101 NOWELL ROAD  
 RALEIGH, NORTH CAROLINA 27607  
 TEL: (919) 873-1060 FAX: (919) 873-1074

SITE MAP  
 REAVES PROPERTY (PARCEL #155)  
 FAYETTEVILLE, CUMBERLAND COUNTY, NORTH CAROLINA

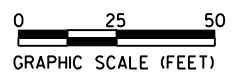
FIGURE  
 2



LEGEND

- I55-SB-1 ◆ SOIL SAMPLE LOCATION AND IDENTIFICATION
- DRO (123) TPH AS DIESEL FUEL IN MG/KG
- GRO (123) TPH AS GASOLINE IN MG/KG
- BOL BELOW QUANTITATION LIMIT

- - - s - - - s - - - ESTIMATED EXTENT OF CONTAMINATED SOIL (DRO > 100 MG/KG OR GRO > 50 MG/KG)



**Solutions-IES**  
Industrial & Environmental Services

1101 NOWELL ROAD  
RALEIGH, NORTH CAROLINA 27607  
TEL: (919) 873-1060 FAX: (919) 873-1074

SITE MAP  
REAVES PROPERTY (PARCEL #155)  
FAYETTEVILLE, CUMBERLAND COUNTY, NORTH CAROLINA

FIGURE  
3

ATTACHMENT A



PYRAMID GEOPHYSICAL SERVICES  
(PROJECT 2016-265)

# GEOPHYSICAL SURVEY


---


## METALLIC UST INVESTIGATION: PARCEL 155 – DAVID AND DEBORAH REEVES NCDOT PROJECT U-4405

5516 RAEFORD RD., FAYETTEVILLE, CUMBERLAND COUNTY, NC

NOVEMBER 4, 2016

Report prepared for: Mike Branson  
Solutions, IES  
1101 Nowell Road  
Raleigh, North Carolina 27607

Prepared by:   
Eric C. Cross, P.G.  
NC License #2181

Reviewed by:   
Douglas A. Canavella, P.G.  
NC License #1066

503 INDUSTRIAL AVENUE, GREENSBORO, NC 27406

P: 336.335.3174 F: 336.691.0648

C257: GEOLOGY C1251: ENGINEERING

**GEOPHYSICAL INVESTIGATION REPORT**  
**Parcel 155 – 5516 Raeford Road**  
**Fayetteville, Cumberland County, North Carolina**

## **Table of Contents**

Executive Summary .....	1
Introduction.....	2
Field Methodology.....	2
Discussion of Results.....	3
Summary and Conclusions .....	5
Limitations .....	5

## **Figures**

- Figure 1 – Parcel 155 Geophysical Survey Boundaries and Site Photographs
- Figure 2 – Parcel 155 EM61 Results Contour Map
- Figure 3 – Parcel 155 GPR Transect Locations and Select Images
- Figure 4 – Parcel 155 Locations of Probable Septic Tanks and Photographs

## **Appendices**

- Appendix A – GPR Transect Images

## 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

---

**Project Description:** Pyramid Environmental conducted a geophysical investigation for Solutions, IES (Solutions) at Parcel 155, located at 5516 Raeford Road, Fayetteville, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project U-4405). Solutions directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation as a total take. Conducted from October 12-17, 2016, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

**Geophysical Results:** A large portion of the EM anomalies were directly attributed to visible cultural features at the ground surface. A cut pipe was observed on the northwest side of the building located on the property. This area was investigated by GPR to determine if it may be connected to a UST. GPR did not show any clear evidence of a UST at the location of the cut pipe. This anomaly is classified as No Confidence, based on NCDOT guidelines. Additional GPR performed on the west side of the building showed evidence of two non-metallic (likely concrete) USTs. Discussions with the property owner and the geophysical data suggest these are septic tanks. The north suspected septic tank was approximately 9 feet long and 3 feet wide. The south suspected septic tank was approximately 16 feet long and 4 feet wide. Collectively, the geophysical data did not show any evidence of unknown metallic USTs at Parcel 155. However, the survey did show evidence of two probable non-metallic USTs (suspected septic tanks).

## INTRODUCTION

---

Pyramid Environmental conducted a geophysical investigation for Solutions, IES (Solutions) at Parcel 155, located at 5516 Raeford Road, Fayetteville, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project U-4405). Solutions directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation as a total take. Conducted from October 12-17, 2016, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included a commercial building surrounded by asphalt, gravel, and grass areas. Aerial photographs showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

## FIELD METHODOLOGY

---

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 is 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 October 14, 2016, 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. 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 4 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects across specific anomalies 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 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

---

### *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 in 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	Suspected Debris	☑
2	Trash Can	
3	Cut Pipe (No Confidence with respect to UST)	☑
4	Truck	
5	Water Meter	
6	Water Utility	
7	Trash Can and Debris	
8	Guy Wires	
9	Guard Rail	

A large portion of the EM anomalies recorded by the survey were directly attributed to visible cultural features such as utilities, trash cans, pipes, a truck, a water meter, guy wires and a metal guard rail. The visible cut pipe on the northwest side of the building (Anomaly 3) was investigated further by GPR to determine if it may be connected to a UST. GPR scans were also performed on the west side of the building to verify that all visible anomalies were associated with the cultural features listed above.

*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 5 GPR transects were performed at the site. Transect 1 was performed on the north side of the building, adjacent to the visible cut pipe (Anomaly 3). This transect did record an isolated horizontal reflector that could be suggestive of a buried object. Additional reconnaissance scans did not record any clear hyperbolic reflectors at this location that would be common for a UST. For this reason, this feature is classified as No Confidence with respect to a UST based on NCDOT classification guidelines.

Reconnaissance GPR was performed on the west side of the building. All metallic anomalies were verified to be associated with cultural features in this area, as listed in the above table. However, GPR transects 2-5 did record evidence of non-metallic USTs on the west side of the building. Discussions with the property owner, combined with the geophysical data, indicate that these structures are septic tanks associated with the building. Transects 2 and 3 provided evidence of a septic tank near the northwest building corner that is approximately 9 feet long and 3 feet wide. Transects 4 and 5 provided evidence of a septic tank west of the southwest building corner that is approximately 16 feet long and 4 feet wide. According to the property owner, the south tank is inactive, and the north tank is currently connected to the building's sanitary system. These two tanks are classified as probable non-metallic USTs.

Collectively, the geophysical data did not show any evidence of unknown metallic USTs at Parcel 155. However, the geophysical data did show evidence of two probable non-metallic USTs, suspected to be septic tanks, on the west side of the building.

## **SUMMARY & CONCLUSIONS**

---

Pyramid's evaluation of the EM61 and GPR data collected at Parcel 155 in Fayetteville, Cumberland 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.
- A large portion of the EM anomalies were directly attributed to visible cultural features at the ground surface.
- A cut pipe was observed on the northwest side of the building. This area was investigated by GPR to determine if it may be connected to a UST.
- GPR did not show any clear evidence of a UST at the location of the cut pipe. This anomaly is classified as No Confidence based on NCDOT guidelines.

- Additional GPR performed on the west side of the building showed evidence of two non-metallic (likely concrete) USTs. Discussions with the property owner and the geophysical data suggest these are septic tanks.
  - The north suspected septic tank was approximately 9 feet long and 3 feet wide.
  - The south suspected septic tank was approximately 16 feet long and 4 feet wide.
- Collectively, the geophysical data did not show any evidence of unknown metallic USTs at Parcel 155. However, the survey did show evidence of two probable non-metallic USTs (suspected septic tanks).

## LIMITATIONS

---

Geophysical surveys have been performed and this report was prepared for Solutions, IES 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 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 Survey Area  
(Facing Approximately East)



View of Survey Area  
(Facing Approximately Northwest)

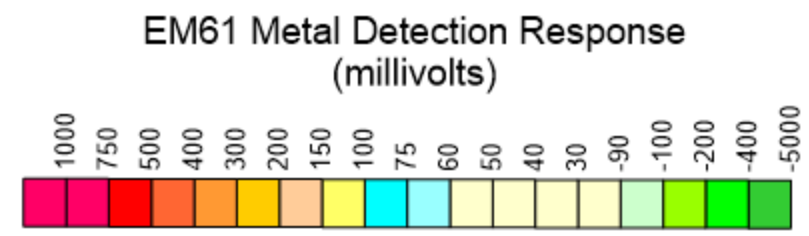
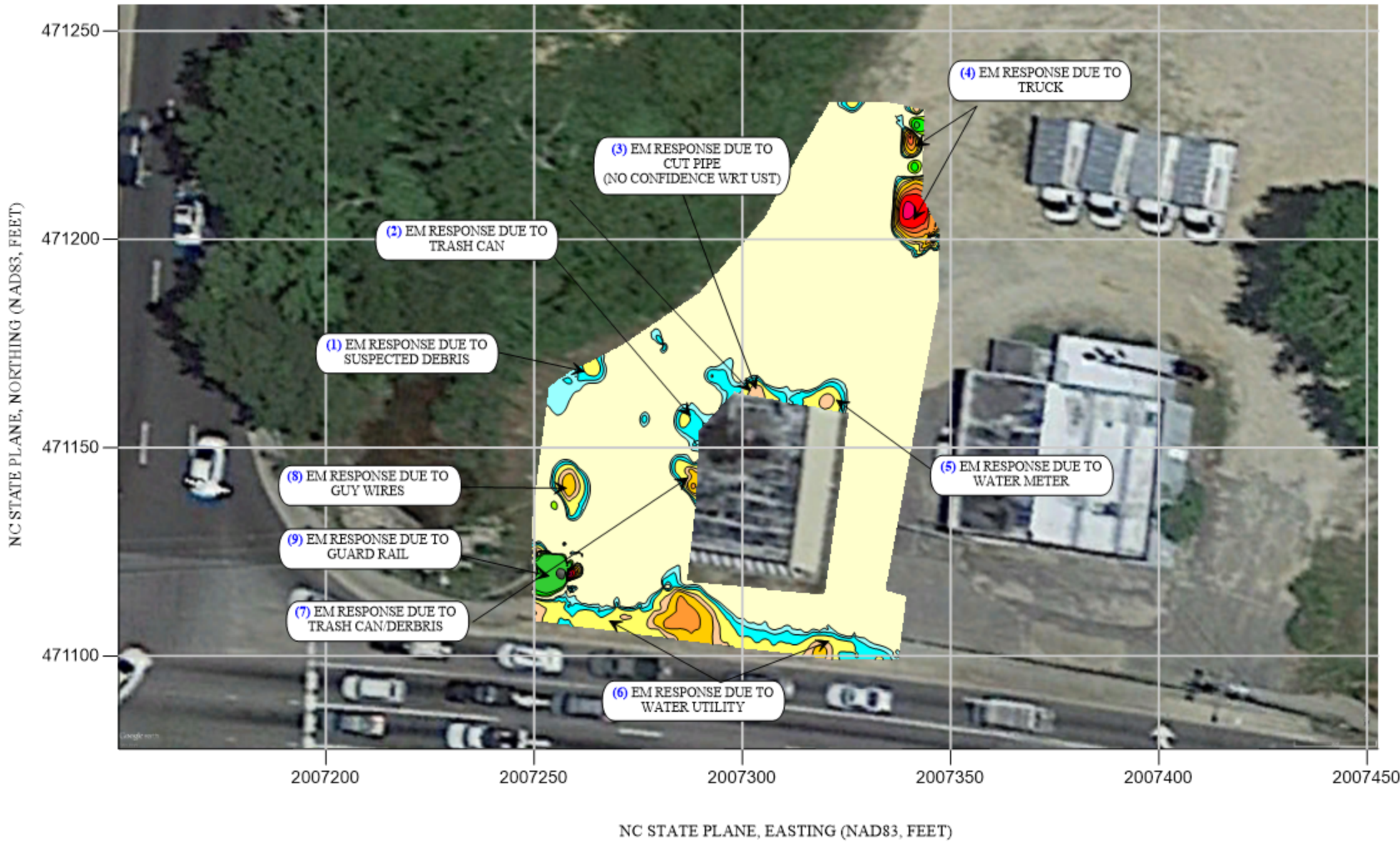
TITLE		PARCEL 155 - GEOPHYSICAL SURVEY BOUNDARIES AND SITE PHOTOGRAPHS	
PROJECT		5516 RAEFORD ROAD FAYETTEVILLE, NORTH CAROLINA NCDOT PROJECT U-4405	
		503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	10/31/16	CLIENT	SOLUTIONS, IES
PYRAMID PROJECT #:	2016-265	<b>FIGURE 1</b>	




### EM61 METAL DETECTION RESULTS

### NO EVIDENCE OF UNKNOWN METALLIC USTs OBSERVED

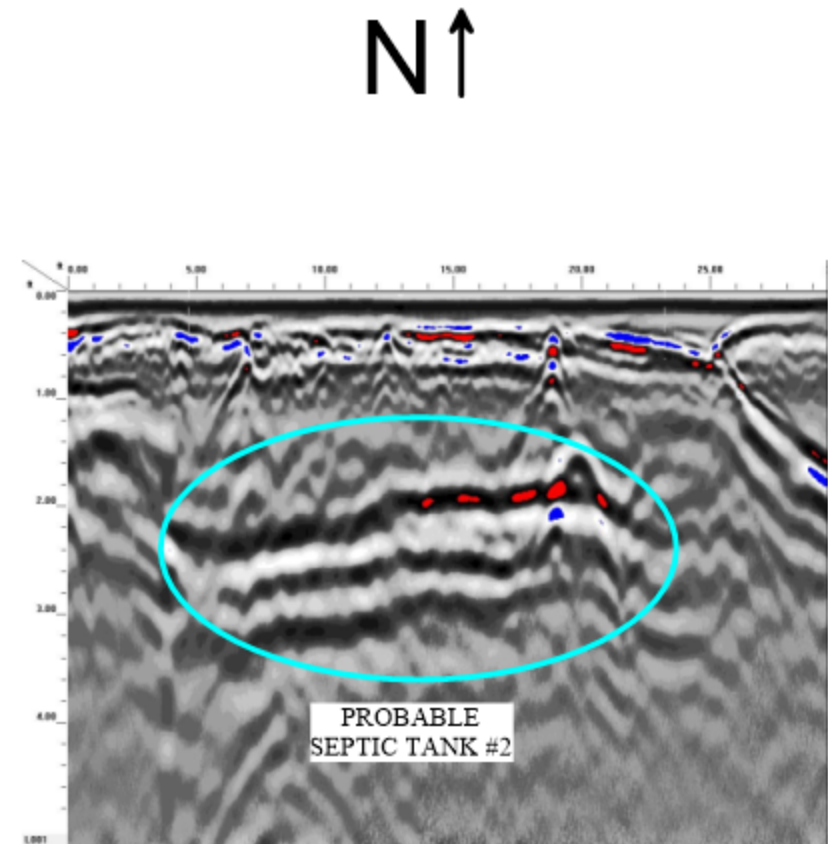
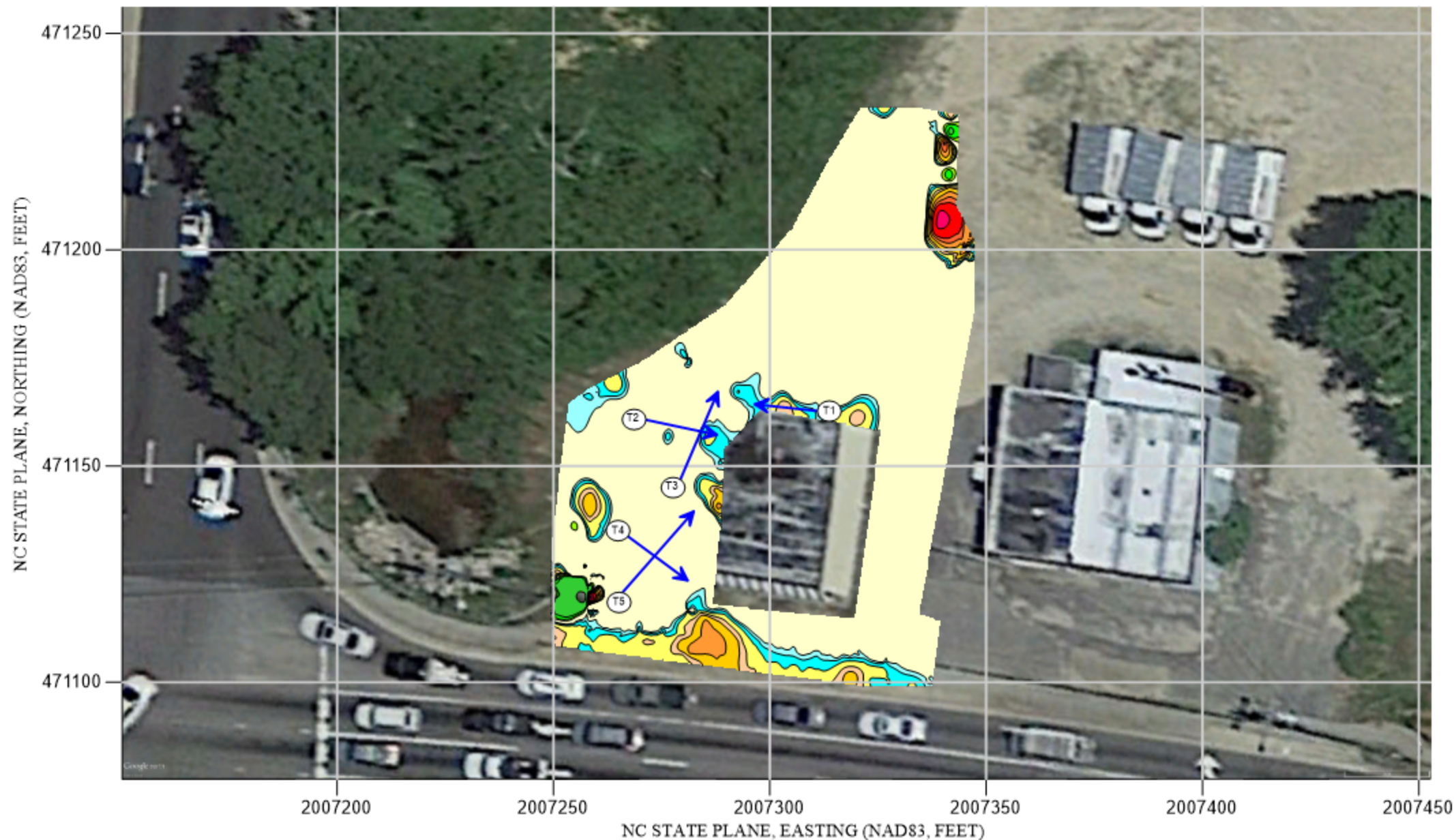
The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The differential results focus on larger metallic objects such as USTs and drums. The EM61 data were collected on October 13, 2016, using a Geonics EM61 instrument. Verification GPR data were collected using a GSSI UtilityScan DF instrument with a dual frequency 300/800 MHz antenna on October 14, 2016.



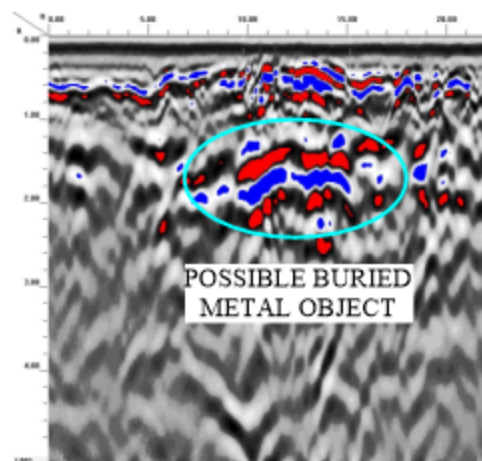
NUMBERS IN BLUE (x) CORRESPOND TO ANOMALY TABLE INCLUDED IN THE REPORT

TITLE	PARCEL 155 - EM61 RESULTS CONTOUR MAP	
PROJECT	5516 RAEFORD ROAD FAYETTEVILLE, NORTH CAROLINA NCDOT PROJECT U-4405	
	 503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	10/31/2016	CLIENT SOLUTIONS, IES
PYRAMID PROJECT #:	2016-265	<b>FIGURE 2</b>

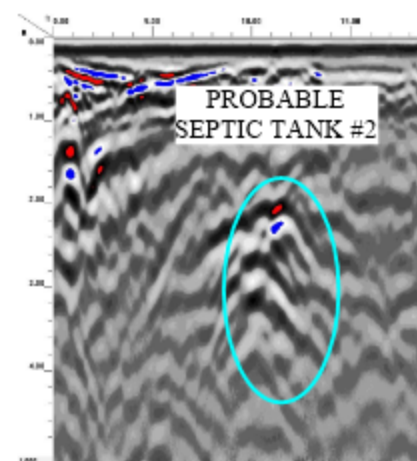
### LOCATIONS OF GPR TRANSECTS



GPR TRANSECT 5 (T5)



GPR TRANSECT 1 (T1)

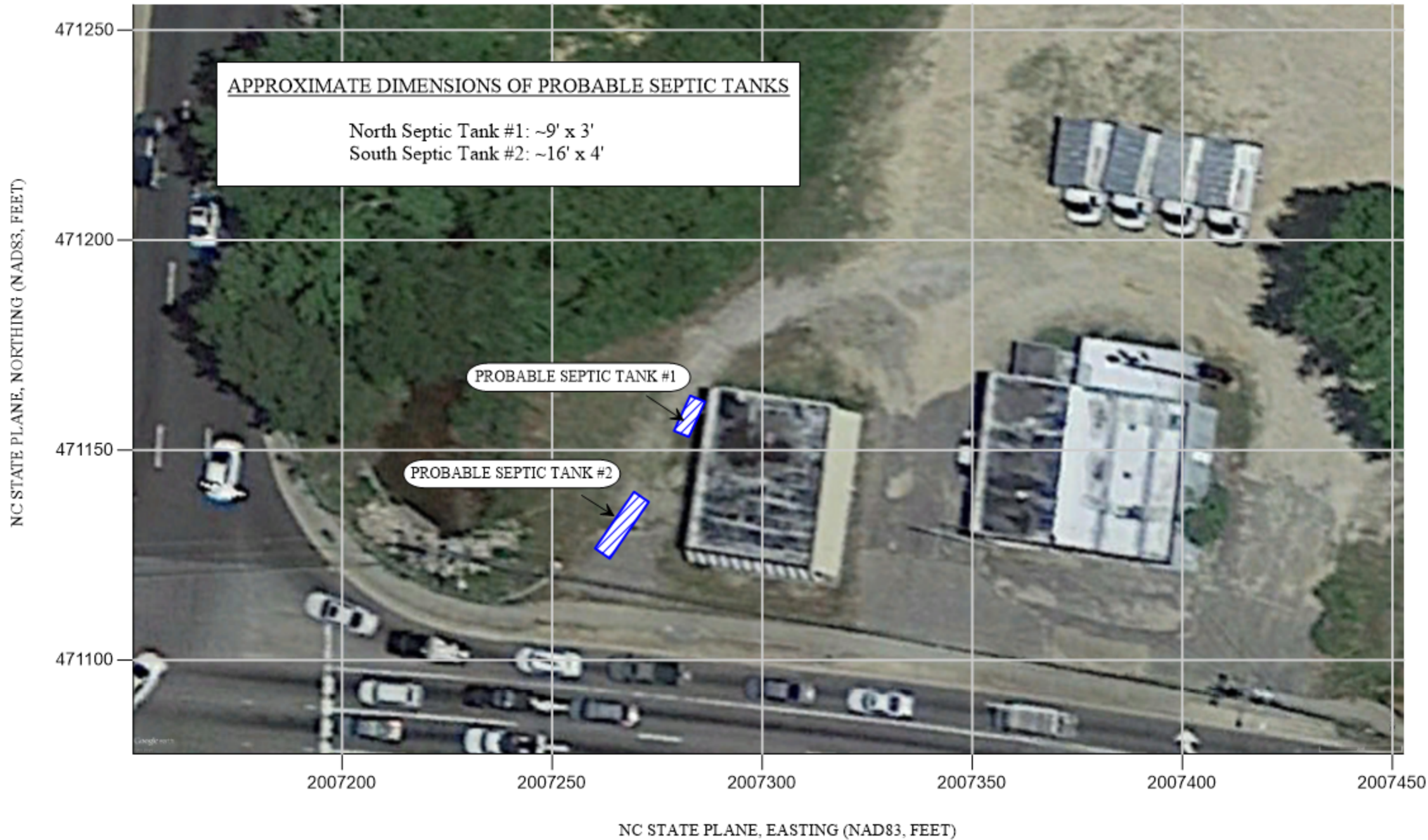


GPR TRANSECT 4 (T4)

<b>TITLE</b> PARCEL 155 - GPR TRANSECT LOCATIONS AND SELECT IMAGES	
<b>PROJECT</b> 5516 RAEFORD ROAD FAYETTEVILLE, NORTH CAROLINA NCDOT PROJECT U-4405	
503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
<b>DATE</b>	10/31/2016
<b>CLIENT</b>	SOLUTIONS, IES
<b>PYRAMID PROJECT #:</b>	2016-265
<b>FIGURE 3</b>	




## Parcel 155 - Approximate Locations of Probable Septic Tanks



LOCATION OF NORTH SEPTIC TANK #1

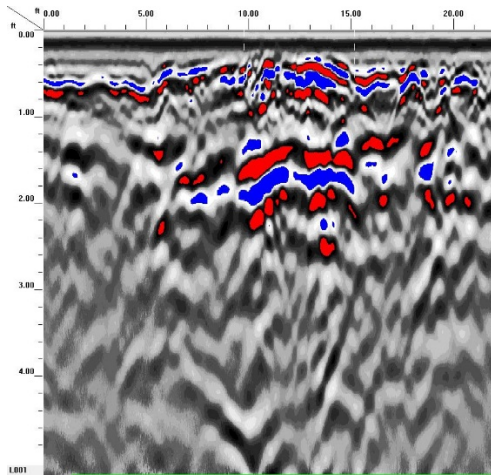


LOCATION OF SOUTH SEPTIC TANK #2

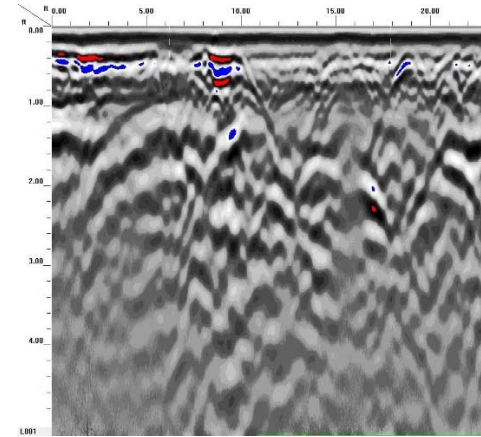
TITLE	PARCEL 155 - LOCATIONS OF PROBABLE SEPTIC TANKS AND PHOTOGRAPHS		
PROJECT	5516 RAEFORD ROAD FAYETTEVILLE, NORTH CAROLINA NCDOT PROJECT U-4405		
		503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	10/31/2016	CLIENT	SOLUTIONS, IES
PYRAMID PROJECT #:	2016-265	<b>FIGURE 4</b>	



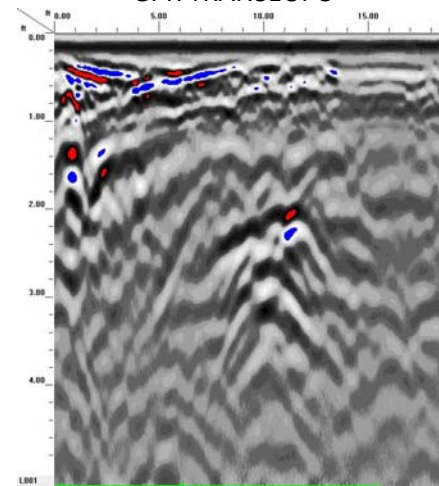
## **Appendix A – GPR Transect Images**



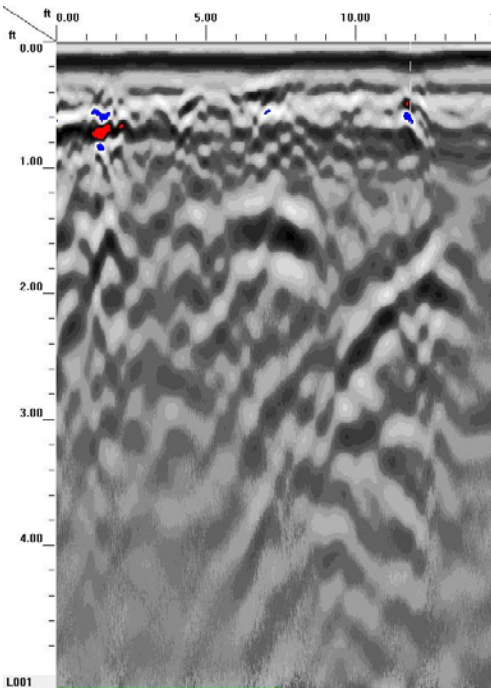
GPR TRANSECT 1



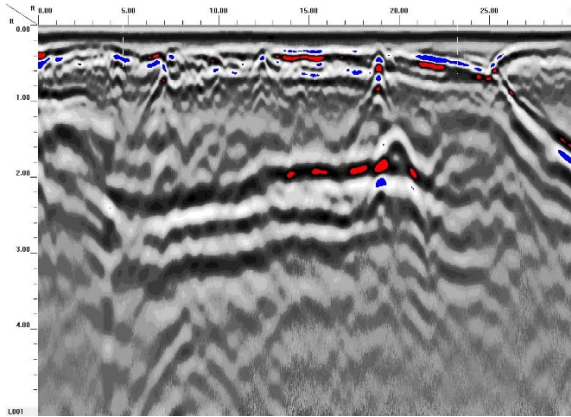
GPR TRANSECT 3



GPR TRANSECT 4



GPR TRANSECT 2



GPR TRANSECT 5

ATTACHMENT B

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 10 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ftbgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ftbgs)
	Sample ID and Interval	Recovery				
0						0
1		100%	0.0		Light grey clayey sand. Dry.	1
2						2
3		100%	0.0			3
4					Light grey soft clay. Dry	4
5						5
6	155-SB-1-6-8	100%	0.1		Light grey clayey sand. Dry.	6
7						7
8						8
9		100%	NA		Light grey clayey sand. Saturated.	9
10					End of Boring	10

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1				0.0	Light grey clayey sand. Dry.	1
2	155-SB-2-2-4	100%				2
3			0.1			3
4						4
5				NA	Light grey clayey sand. Saturated.	5
6	100%					6
7			NA			7
8						8

End of Boring

Notes: 1) NA - Not available, PID reading not collected.

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1				0.0	Light grey clayey sand. Dry.	1
2	155-SB-3-2-4	100%				2
3			0.1			3
4						4
5				NA	Light grey clayey sand. Saturated.	5
6	100%					6
7			NA			7
8						8

End of Boring

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1			0.2		Light grey clayey sand. Dry.	1
2		100%				2
3			0.0			3
4						4
5			50.1		Light grey clayey sand with black staining and hydrocarbon odors. Dry.	5
6	155-SB-4-6-8	100%				6
7			2,343			7
8					End of Boring	8



BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1						1
2		100%				2
3			0.0		Light grey clayey sand. Dry.	3
4						4
5			0.1			5
6	155-SB-5-6-8	100%				6
7			49.8		Light grey clayey sand with hydrocarbon odors. No staining observed. Dry.	7
8					End of Boring	8

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1						1
2		100%				2
3			0.0		Light grey clayey sand. Dry.	3
4						4
5			1.3			5
6	155-SB-6-6-8	100%				6
7			2.030		Light grey clayey sand with black staining and hydrocarbon odors. Dry.	7
8					End of Boring	8

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1				0.0		1
2		100%				2
3				0.1	Light grey clayey sand. Dry.	3
4						4
5				1.6		5
6	155-SB-7-6-8	100%				6
7				385.0	Light grey clayey sand with black staining and hydrocarbon odors. Dry.	7
8					End of Boring	8

BORING LOCATION: Parcel #155, Fayetteville, NC	PROJECT NUMBER: 2016.0054.NDOT
DRILLING CONTRACTOR: Regional Probing Services	DATE STARTED: 10/25/2016 DATE FINISHED: 10/25/2016
DRILLING METHOD: Direct Push      BOREHOLE DIAMETER: 2.25"	TOTAL DEPTH (ft bgs): 8 ft bgs SCREEN INTERVAL (ft bgs): NA
DRILLING EQUIPMENT: Geoprobe 5410	NORTHING: NA EASTING: NA
SAMPLING METHOD: Macro Core	INITIAL DTW: NA FINAL DTW: NA
LOGGED BY: Samuel McIntyre	CHECKED BY:

DEPTH (ft bgs)	SAMPLES			PID (ppm)	DESCRIPTION OF MATERIALS	DEPTH (ft bgs)
	Sample ID and Interval	Recovery				
0						0
1				0.0	Light grey clayey sand. Dry.	1
2		100%				2
3			0.1			3
4					Light grey clayey sand with black staining and hydrocarbon odors. Dry.	4
5			9.6			5
6	155-SB-8-6-8	100%				6
7			389.0			7
8					End of Boring	8

ATTACHMENT C



PHOTO 1 - VIEW OF SOIL BORING LOOKING WEST  
AND SHOWING CUT OFF PIPE

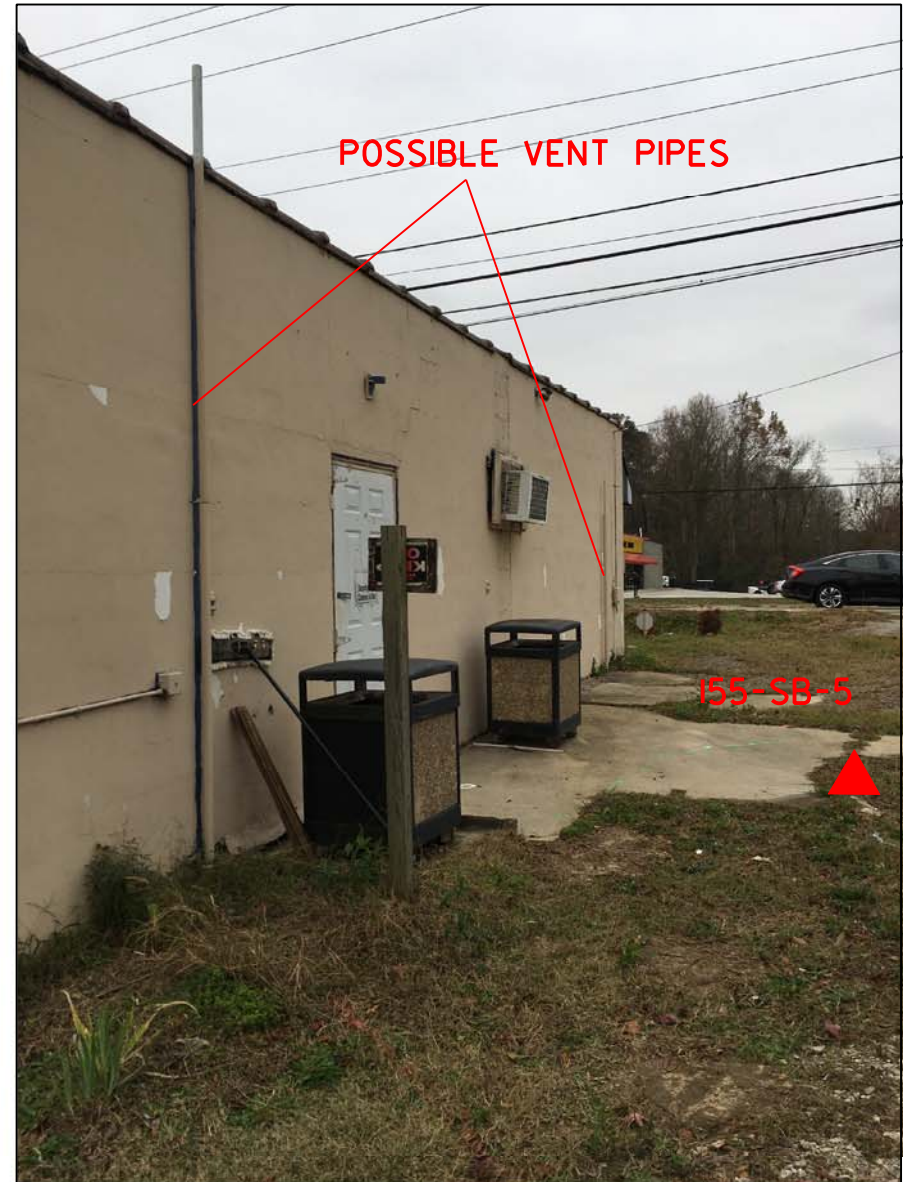


PHOTO 2 - VIEW OF SOIL BORING LOOKING SOUTH  
AND SHOWING POTENTIAL VENT PIPES



PHOTO 3 - VIEW OF SOIL BORINGS LOOKING SOUTH



PHOTO 4 - VIEW OF SOIL BORINGS LOOKING SOUTH



PHOTO 5 - VIEW OF SOIL BORINGS LOOKING EAST



PHOTO 6 - VIEW OF SOIL BORINGS LOOKING NORTH





PHOTO 7 - VIEW OF SOIL BORING LOOKING NORTHEAST



PHOTO 8 - VIEW OF SOIL BORING LOOKING WEST

ATTACHMENT D



### Hydrocarbon Analysis Results

**Client:** NCDOT  
**Address:** SITE 155: 5514 Raeford Rd  
 Fayetteville, NC

**Samples taken** 10/25/2016  
**Samples extracted** 10/25/2016  
**Samples analysed** 10/25/2016

**Contact:** **Operator** Candy Elliott

**Project:** 2016.0045.NDOT

											U04049		
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	155-SB-1-6-8	28.8	<0.72	<0.72	49.6	49.6	38.6	1.9	0.033	0	83.2	16.8	Deg Fuel (FCM) 79%
s	155-SB-2-2-4	23.9	<0.6	<0.6	26.1	26.1	9.8	0.46	0.007	0	81.8	18.2	Deg.PHC (FCM) 61.8%
s	155-SB-3-2-4	9.4	<0.24	<0.24	0.47	0.47	0.38	0.02	<0.001	0	82.2	17.8	Deg Fuel (FCM) 59.6%
s	155-SB-4-6-8	57.9	<1.4	312.4	152.4	464.8	45.8	1.8	0.006	87.2	12.5	0.3	Deg Gas (FCM) 62.6%
s	155-SB-5-6-8	44.3	<1.1	14	969.4	983.4	274.1	11.2	0.038	4.8	92.7	2.5	Deg.Kerosene (FCM) 83.3%
s	155-SB-6-6-8	48.4	<1.2	223.8	117.9	341.7	34.4	1.4	<0.005	86.7	13.1	0.2	Deg Gas (FCM) 60.5%
s	155-SB-7-6-8	45.3	<1.1	11.1	29.7	40.8	16.4	0.69	0.005	40.4	57.3	2.3	Deg.Fuel (FCM) 87.6%
s	155-8-6-8	27.6	<0.69	15.6	15.8	31.4	8	0.36	0.004	68.3	27.4	4.3	Deg.PHC (FCM) (BO) 52.8%
s	154-SB-4-8-10	29.4	<0.73	<0.73	5.2	5.2	3.8	0.16	0.003	0	89.4	10.6	V.Deg.PHC (FCM) 53.9%
Initial Calibrator QC check <span style="background-color: green; color: white; padding: 2px;">OK</span>													

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

QED Hydrocarbon Fingerprints

Project: 2016.0045.NDOT

10/25/2016

