

SUBSURFACE INVESTIGATION REPORT

Electromagnetic Induction, Magnetic Detection & *GPR Survey*

**Blackburn, Eva Property (Parcel 180)
American Autobody
302 Spruce Street
Greenville, North Carolina**

July 19, 2012

**Report prepared for:
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Subsurface Investigation Report
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1.0 PURPOSE

Stantec Consulting Services Inc. performed a subsurface investigation utilizing surface Ground Penetrating Radar (GPR), Magnetic Detection and Electromagnetic Induction (EM) to survey the subject site located at 302 Spruce Street on the north side of Spruce Street just west of the intersection of Myrtle Street.

This facility currently operates as an automobile body shop. According to NCDENR's UST Section Registry one (1) tank was removed in 1988. Location of the former UST tank bed was not observed. No groundwater incidents were noted for this property.

ATC Associates representative Mr. Justin C. Ballard, P.G. provided information and maps identifying the geophysical survey area to Stantec personnel prior to conducting the investigation.

Survey was conducted at the request of Justin C. Ballard, P.G. on September 19th 2012.

The purpose of this investigation was to:

- Survey for detectable structures (UST) and other subsurface anomalies.

The specified survey area was described as 302 Spruce Street on the north side of Spruce Street just west of the intersection of Myrtle Street.

A map depicting this area is included herein.

1.1 LIMITING CONDITIONS

In the event portions of the subject site were not accessible due to obstructions and/or stored items, those areas will be noted as inaccessible. An attempt was made to be as thorough as

possible in the survey process. The surveyed area was defined, at the time of the investigation, by the Client. Client representative on site was Aaron Leff with ATC Associates of North Carolina.

In order to accurately conduct a radar survey, linear scans were made across the target area. Confined, obstructed or non-level areas which restrict the scanning pattern can impede the data collected and reduce the accuracy of the desired results.

The assessment of this site is based on our professional evaluation of the data gathered, and our experience with the properties with surface ground penetrating radar within this setting and scope. The evaluation rendered in this report meets the standards of our profession and was conducted in accordance with generally accepted guidelines for EM, Magnetic Detection and GPR surveys. It is generally recognized that the results of the EM, Magnetic Detection and GPR are non-unique and may not represent actual subsurface conditions.

Note: A diligent effort has been made to obtain the highest quality data and make useful interpretations.

Analysis of data was accomplished by visual inspection in the field and then recording the data for post processing.

1.2 APPROACH

Multiple tools involving differing technologies were used in this investigation.

For the GPR analysis, the entire subject survey area was divided logistically into manageable/workable sections.

These isometric sections represent the arrangement of the survey scans. Within these sections, scans were made in an orthogonal pattern on two foot centers. This provided two separate data sets for each section.

For Magnetic Detection and Electromagnetic Induction the area was systematically scanned in such a pattern so to cover over 100% of the accessible portions of the site. This is possible due to the size and shape of the resulting fields produced from the sensors thus resulting in an “overlapping” of each transect covered.

2.0 METHODOLOGY

2.1 EQUIPMENT

Ground Penetrating Radar (GPR)

The GPR method transmits electromagnetic waves, which are pulsed at discrete distance/ time intervals.

The transmitted pulse radiates through the earth whereby a portion of the energy is reflected from interfaces of contrasting electrical properties (e.g. pavement and soil interface, soil stratigraphic changes and buried metallic objects) while the remaining energy continues until reaching additional reflectors where the process is repeated.

Reflected energy is received by the antennae and recorded for later processing and interpretation. Factors such as soil moisture, clay content, and variations in the dielectric constants of materials control the effectiveness of the GPR method. Wet conductive soils severely attenuate GPR signals and thus the effective depth of exploration.

The presence of foreign products leached into the soil can eschew the data collected thereby affecting the images.

GPR energy cannot transmit through ferrous objects since metal acts as a pure reflector.

Stantec employed a MALA X3M/GPR digital radar unit with a 250 MHz center frequency, bistatic antenna to survey the site. The instrument was configured to detect moderately shallow reflectors within the geologic strata. The chosen instrument configuration facilitates the analysis. The GPR system unit was configured for data collection as follows:

- Trigger Source: Cart
- Range: 0-66 ns
- Samples per Scan: 250-512
- Sampling Frequency: 10852.27 to 7234.85 MHz
- Vertical High Pass Filter: 15 Samples
- Vertical Low Pass Filter: 5 Samples
- Point Interval: 0.669 to 0.906 in
- Pulses/Ft: 108.48

Software utilized for the collection and analysis of these data included:
RAMAC Ground Vision GPR Software version 3. 1. 19. (5).

2.2 EQUIPMENT

Electromagnetic (EM) and Magnetic Detection

The magnetic detection method is a LF (30 to 300 kHz) or VLF (below 30 kHz) receiver for detecting electromagnetic fields which radiate off of metallic objects. Magnetic locators operate on a simple principal.

An electronic transmitter and receiving antennae are mounted on a support structure. The two antennae are mounted a fixed distance apart aligned opposing so that the magnetic field measured by one sensor is negative of the magnetic field measured by the other. Each measures the average magnetic field component along their axis i.e. the magnetic field component along the longitudinal axis between the antennae.

This is calibrated in the field to a position (setting) which is neutral to the earth's natural magnetic field. When a metallic object is introduced within this field, it is detected as a differing field. This differing magnetic field is the field of interest.

Stantec employed this method of locating buried metallic objects as a compliment to GPR for the subject site.

Stantec selected the following instruments for this particular task:

- Subsurface Magnetic Locator ML-1M
- Schonstedt GA-52Cx. HeliFlux magnetic field sensors—drive frequency 7.5 KHz.
- RadioDetection 8000 T-10 model utilizing 512 hertz, 8 KHz, 33 KHz, 65 KHz, 50/60 hertz, long wave radio frequencies

3.0 DATA PROCESSING AND ANALYSIS-GPR

Stantec calculated the average radar propagation velocity for the subject sites. This procedure is necessary to provide reasonably accurate depth estimates for reflection events in the subsurface strata.

The average radar velocity for the site was estimated. It should be noted that the dielectric constants and hence the corresponding radar propagation velocities did vary by an order of degree(s) of magnitude across the surveyed area. Additionally, radar propagation velocity decreases with depth in most geologic sections.

Data processing of the GPR data prior to interpretation included band pass filtering, background removal, horizontal smoothing, trace editing, and time gain adjustments. After processing, the data profiles were reviewed for analysis. These processing techniques were applied to the GPR data to provide the highest quality data and therefore facilitate the overall interpretation process.

4.0 RESULTS & CONCLUSIONS

Stantec Consulting Services Inc. has completed a subsurface investigation of the subject site.

Multiple methods and technologies were used where permitted by the environment.

Survey scans were made throughout the targeted area.

The survey revealed anomalies within the subject site.

Target A: An area approximately six (6) foot by four (4) foot in size was noted. This discovery was made using Surface Ground Penetrating Radar and Magnetic Detection. Small metallic objects were detected here. Multiple hyperbolae were noted within the disturbed walls of earth strata. This may be indicative of trash dumped on a site and buried. A sketch of this area is included on page 10.

Target B: An area approximately nine (9) foot by five (5) foot in size was noted. This discovery was made using Surface Ground Penetrating Radar and Magnetic Detection. Small metallic objects were detected here. Multiple hyperbolae were noted within the disturbed walls of earth strata. This may be indicative of trash dumped on a site and buried. A sketch of this area is included on page 10.

Target C: An area approximately eleven (11) foot by five (5) foot in size was noted. This discovery was made using Surface Ground Penetrating Radar and Magnetic Detection. Small metallic objects were detected here. Multiple hyperbolae were noted within the disturbed walls of earth strata. This may be indicative of trash dumped on a site and buried. A sketch of this area is included on page 10.

1. Two (2) storm drains and one (1) storm manhole were visually detected on the property. Non tonable storm pipe was found in the parcel. This was detected using Surface Ground Penetrating Radar. A sketch of this area is included on page 10.
2. A water service was detected on the property at the southeast corner of the building to Spruce Street. This was discovered using Electromagnetic Induction with 33 and 65 kHz frequencies. A sketch of this area is included on page 10.
3. A gas service line was detected from the meter at the west side of the building to Spruce Street. This was discovered using Electromagnetic Induction with 33 and 65 kHz frequencies. A sketch of this area is included on page 10.
4. An Electric secondary cable was discovered from the west side of the building traveling west to a light pole. This was detected using Electromagnetic Induction with 33 and 65 kHz frequencies. A sketch of this area is included on page 10.
5. A telephone cable was detected at the front of the parcel dropping from a pole and traveling east off of the property. This was discovered using Electromagnetic Induction with 8 and 33 kHz frequencies. A sketch of this area is included on page 10.
6. A Gravity Sanitary pipe was detected at the southeast corner of the building. This was detected using Surface Ground Penetrating Radar. A sketch of this area is included on page 10.
7. Multiple automobiles were on the site inside the fenced in area. These vehicles were non mobile and interfered with magnetic and GPR signals creating a large area where discoveries were impossible with these technologies.



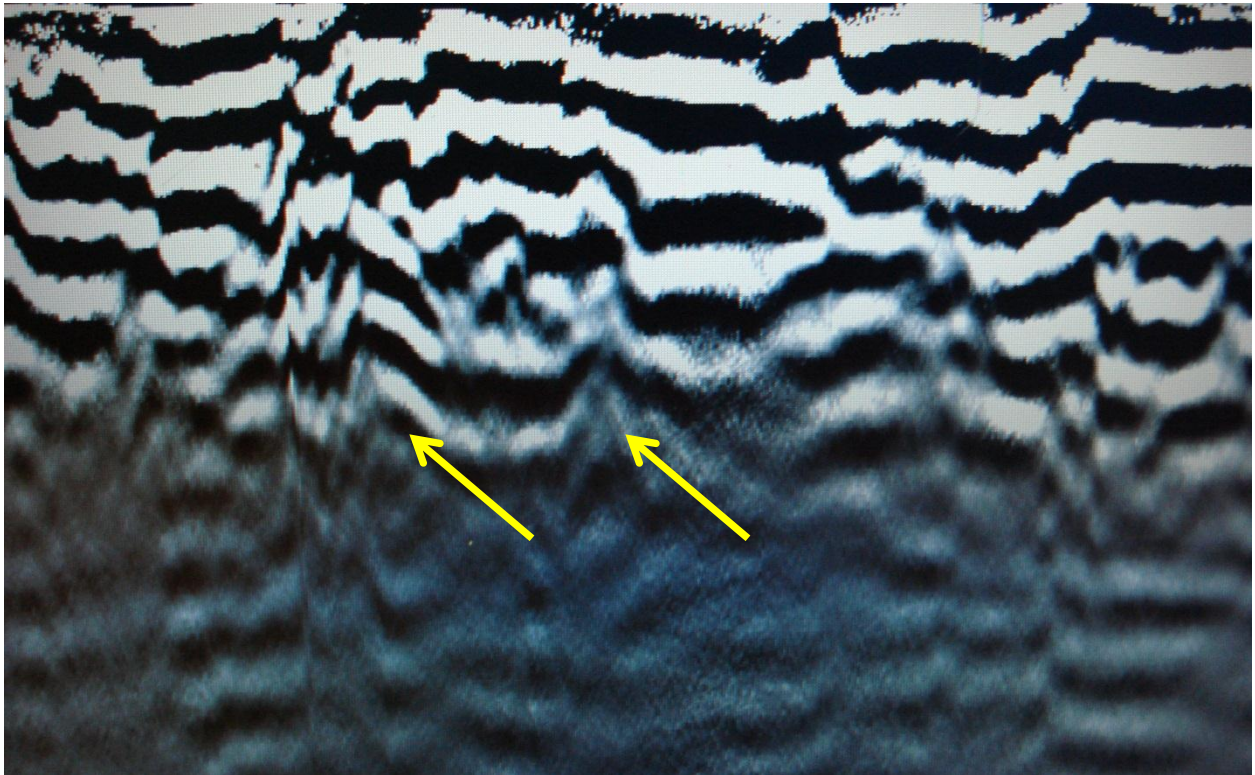
West side of parcel Gas service from street to building



East side of parcel telephone, sanitary and storm shown in picture



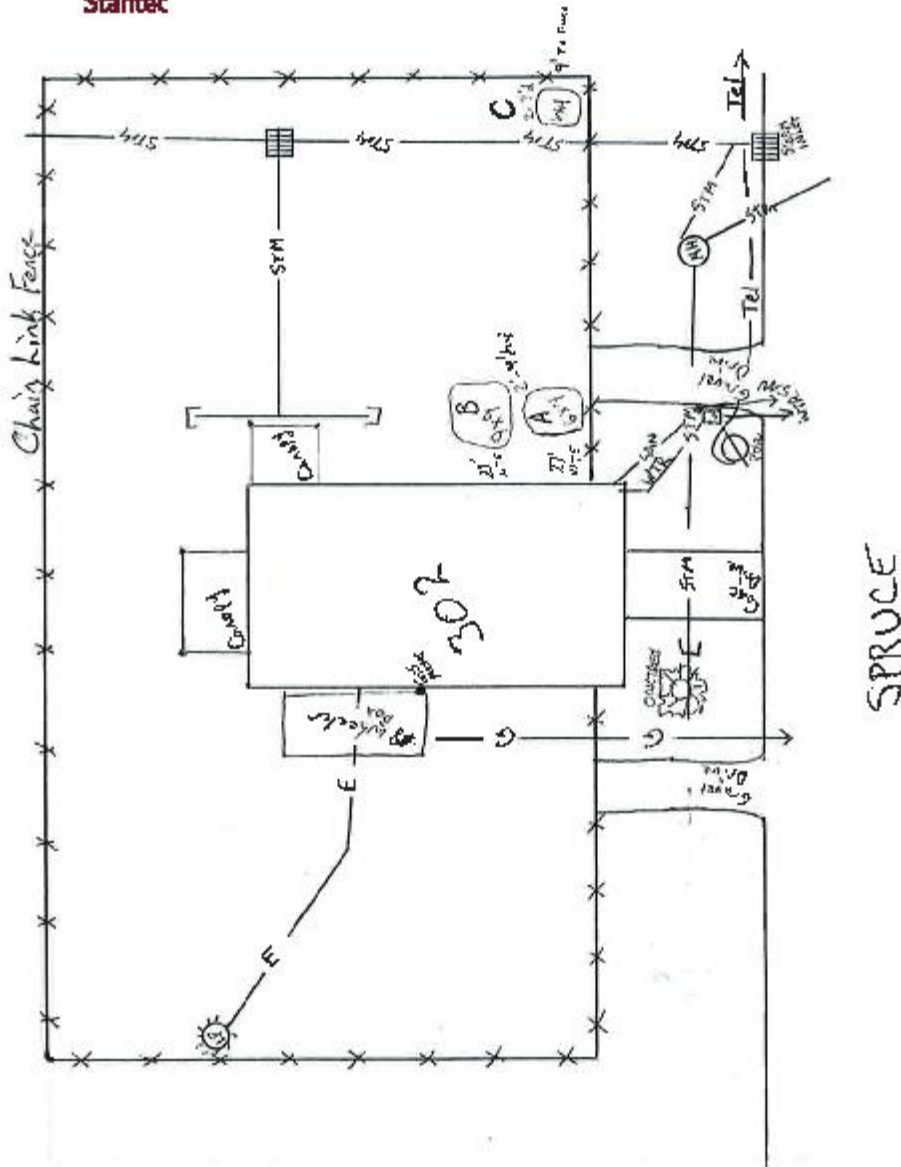
Target A



Hyperbolic images over Target A showing a variety of buried reflective material



Stantec



Designed by:

Checked by:



Printed on 100% recycled paper with soy-based inks.

