GEO-GRAF

GEOPHYSICAL INVESTIGATIONS

GEOPHYSICAL INVESTIGATION REPORT
UTILITY LOCATING & MAPPING
700 NORTH RAILROAD STREET
TAMAQUA, PENNSYLVANIA
19 JANUARY 2018

Prepared for:

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Project Manager:
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Prepared by:

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Project Manager:
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Project Number: 010918B

Project Summary:

This report contains the findings of a nonintrusive geophysical subsurface investigation performed by Geo-Graf, Inc. (GGI) on January 9, 2018, at 700 North Railroad Street in the Borough of Tamaqua, Schuylkill County, Pennsylvania. The Investigation was conducted in accordance with the GGI Nonintrusive Geophysical Subsurface Investigation Proposal Number 3920, dated December 19, 2017.

The accessible sections of the specified search areas were investigated by GGI in an attempt to locate and map metallic and non-metallic near-surface utilities and anomalies that could impact proposed intrusive efforts.

Detected known utilities were field-marked in standard identifying colors. Detected unidentified utilities and subsurface anomalies were also field-marked. Site findings were documented by GGI to produce the Subsurface Utility Maps (***SUMs***) that accompanies this report.

Identities of the detected utilities were based on inferences from surface features, the provided archival mapping, and/or knowledge of local personnel. If a detected possible utility signature could not be identified in this manner it was categorized as an "unknown utility" and field-marked with white paint.

Scope of Work

Perform a nonintrusive geophysical subsurface investigation within the accessible sections of the specified search areas in an attempt to detect and map metallic and nonmetallic subsurface utilities and underground anomalies.

The nonintrusive geophysical delineation techniques utilized include collection and interpretation of data from Ground Penetrating Radar (GPR), Radio Frequency (RF), Magnetic (MAG), and/or Electromagnetic (EM) instrumentation. The collected site data will be analyzed and correlated with the findings presented on a color plan-view ***SUM***.

Specified Search Areas

700 N Railroad St

The accessible sections of a 1,000 ft^2 area at the southern end of the site were specified for investigation.

615 N Railroad St

The accessible sections of an approximately 4,000 ft^2 area along the front of the building were specified for investigation.

Geophysical Investigation

On January 9, 2018, GGI performed a nonintrusive geophysical subsurface investigation as directed by Rachel Burkart – CPTS.

Investigative Procedure

GGI initially investigated the accessible sections of the specified search area using EM and MAG in an attempt to locate subsurface metallic utilities and underground anomalies. Findings were field-marked in white paint and subsequently documented by GGI.

RF pipe tracing techniques were also utilized in both direct pipe contact and induction modes in an attempt to locate and field-mark metallic underground utilities. Identified utilities were field-marked in standard identifying colors. Unidentified, or unknown, utilities were field-marked in white paint. The locations of the detected utilities were documented by GGI.

GPR profiles were completed in both the north-south and east-west directions in an attempt to delineate subsurface metallic and nonmetallic utilities and underground anomalies. The GPR data was collected utilizing a 400 *MHz* antenna system. Possible utility and anomaly locations observed from the field data were field-marked and their locations documented by GGI.

Geophysical Instrumentation

The following is a list and brief description of the geophysical instrumentation utilized for this investigation.

GPR

A Geophysical Survey Systems, Inc. Subsurface Interface Radar System 3000 GPR unit was used for this investigation. Profiles collected on site are digitally recorded for subsequent data analysis and post-processing at the GGI office.

Antenna Systems

Each GPR antenna operates at a different center band frequency that's measured in megahertz (*MHz*). The use of the different antenna systems is based on the fact that the higher the antenna frequency, the greater the GPR image resolution (ability to detect smaller-sized targets), but at the cost of signal penetration depth. Thus the converse is true, the lower the antenna frequency, the deeper the signal penetration, but at the cost of image resolution. For most projects the GGI field crew will carry five GPR antenna systems which range from 1500 *MHz* to 120 *MHz*. Additional antennas and configurations can be used for unique applications.

Data Interpretation

The GPR data profiles recorded at this site are downloaded from the collection unit for storage and analysis. Various computerized post-processing techniques are used in an attempt to improve the data resolution. Each profile is individually reviewed and the findings correlated with data from the other geophysical instruments used in this investigation. Profiles best representing the targets-of-concern are selected and annotated for inclusion in this report.

Applications

GPR data can be collected and used to delineate underground metallic and nonmetallic tanks, drums and utilities. The data can also be interpreted to delineate utility leaks, sinkholes and voids, geologic features such as near-surface consolidated rock and contamination plumes. GPR is the only nonintrusive technique capable of mapping burials within a cemetery. Other applications include the delineation of buried artifacts and historical structures, as well as, use in the structural engineering fields (concrete floor/wall analysis, post-tensioned cable locating).

RF

A Vivax-Metrotech model VM-810, and/or a Radiodetection model CAT-4 instrument were used for this investigation. RF techniques are capable of electrically tracing metallic pipes and cables. The instruments operate in either conductive (direct pipe contact) or inductive (inducing current onto pipe when a direct pipe contact is inaccessible) modes.

Applications

RF techniques are used to locate and field-marked underground metallic utilities.

EM

An Aqua-tronics Tracer, model A-6 was used for this investigation. EM techniques operate by inducing and measuring the returning electric field on subsurface metallic objects. Data is obtained in the field and can be recorded via a separate data collection unit.

Applications
EM techniques are utilized to delineate the location subsurface utilities as well as the location and boundaries of large buried metallic objects including tanks, drum piles and foundations among other things. EM is also capable of defining areas that contain conductive subsoil.

MAG
A Dunham and Morrow model MAG PRO II Magnetic Gradiometer was used for this investigation. The instrument operates by measuring the remnant vertical magnetic fields that naturally emanate from iron objects. Data is obtained in the field and can be recorded via a separate data collection unit.

Applications
MAG techniques are used to detect buried valve and manhole covers, individual drums or drum piles and assist in the detection of utilities, tanks and other anomalous features.

Findings
Refer to the color plan-view ***SUM*** for the plotted findings.

Subsurface Utilities
Subsurface utilities were detected and field-marked within the investigated areas. Utilities that could be identified were marked with standard identifying colors. Unidentified or unknown utilities were marked with white paint.

The estimated maximum GPR signal penetration achieved at this site is approximately 8′ below grade. Thus, features existing at or below this depth will go undetected.

Subsurface Anomalies – 615 N. Railroad St
GPR data signatures indicating the location of two adjacent underground storage tanks (USTs) were delineated off the NE corner of the building. One UST measured 4′ x 10′-8″ (1,000-gallon) and the second tank measured 64″ x 12′ (2,000-gallon). Estimated depth to the tops of the tanks is 3′ below grade.

GPR Anomalies
Typically, subsurface targets delineated by GPR could be associated with utilities, isolated debris, foundational remnants, buried concrete, or certain identifiable features such as USTs, septic tanks, drums, buried reinforced concrete, etc.

EM Anomalies
Typically, EM-detected subsurface anomalies can represent buried metallic features such as tanks, drums, foundations (containing rebar), utilities, and/or metallic debris. EM anomalies can represent areas containing conductive subsoil.

MAG Anomalies

Typically, MAG-detected subsurface anomalies are representative of buried iron-containing features such as tanks, drums, foundations (containing rebar), metallic debris, certain utilities, buried valve, manhole, and/or well covers, etc.

Recommendations

GGI always recommends careful ground-truthing to verify all investigative findings. All services provided by GGI are performed under the disclaimer found on the cover page of this report. Also note, just because features or anomalies were not detected by the geophysical techniques within the investigated area, does not preclude the possibility that they could exist and go undetected.

Respectfully submitted,

Jamieson Graf, President

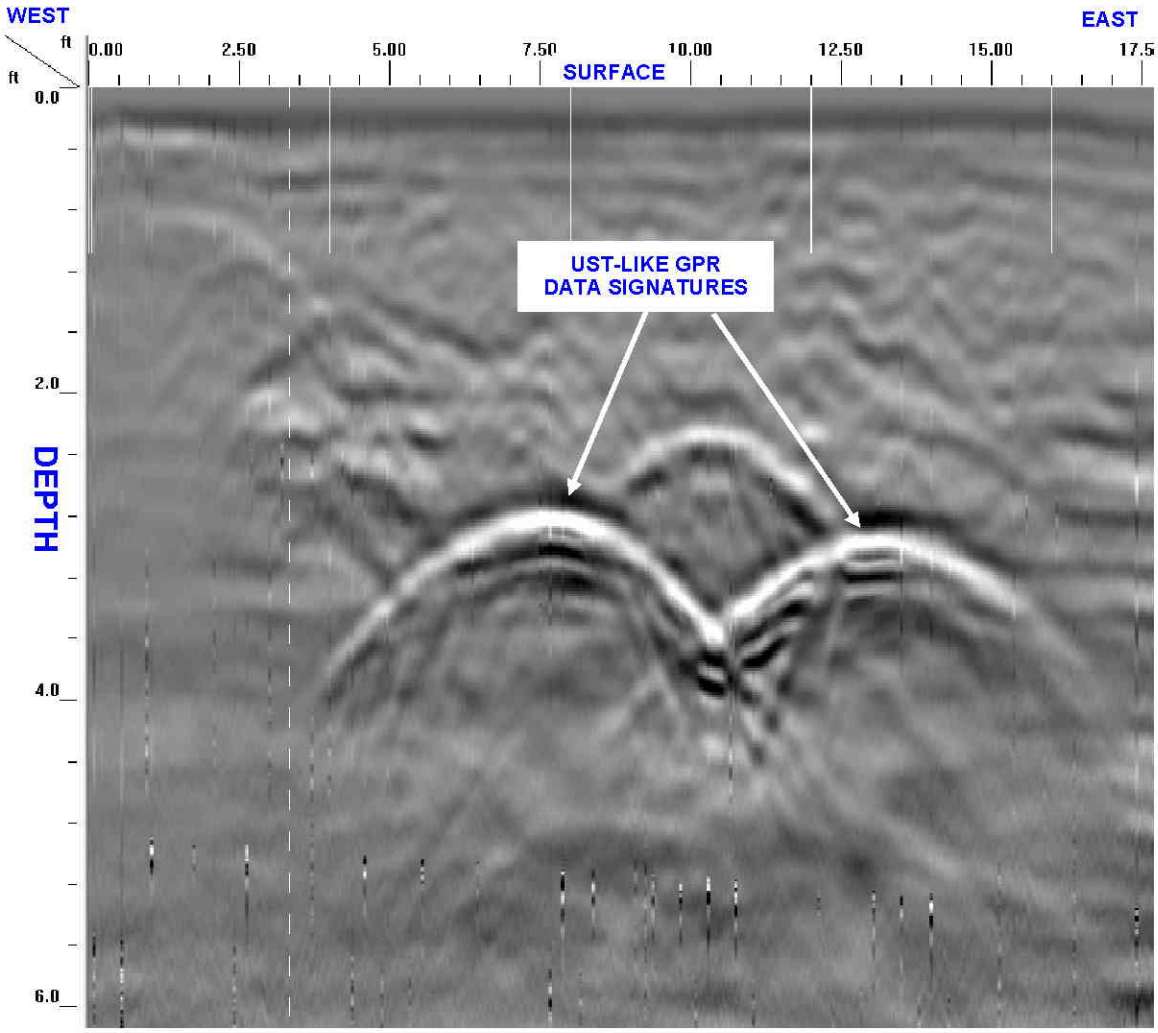


Figure 1-GPR Data Profile
Representative GPR data profile. The profile extends from west to east over the detected tanks (refer to the ***SAM***). Shown in this profile are the UST-like GPR data signatures indicating the location of two USTs, a 1,000-gallon (48″-diameter) and a 2,000-gallon (64″-diameter). Depth to the tops of the tanks based on GPR data approximations is 3′ below grade. 400 *MHz* GPR antenna system, edited from 50 *ns*.

Figure 2 – Site Photograph – 700 N. Railroad St

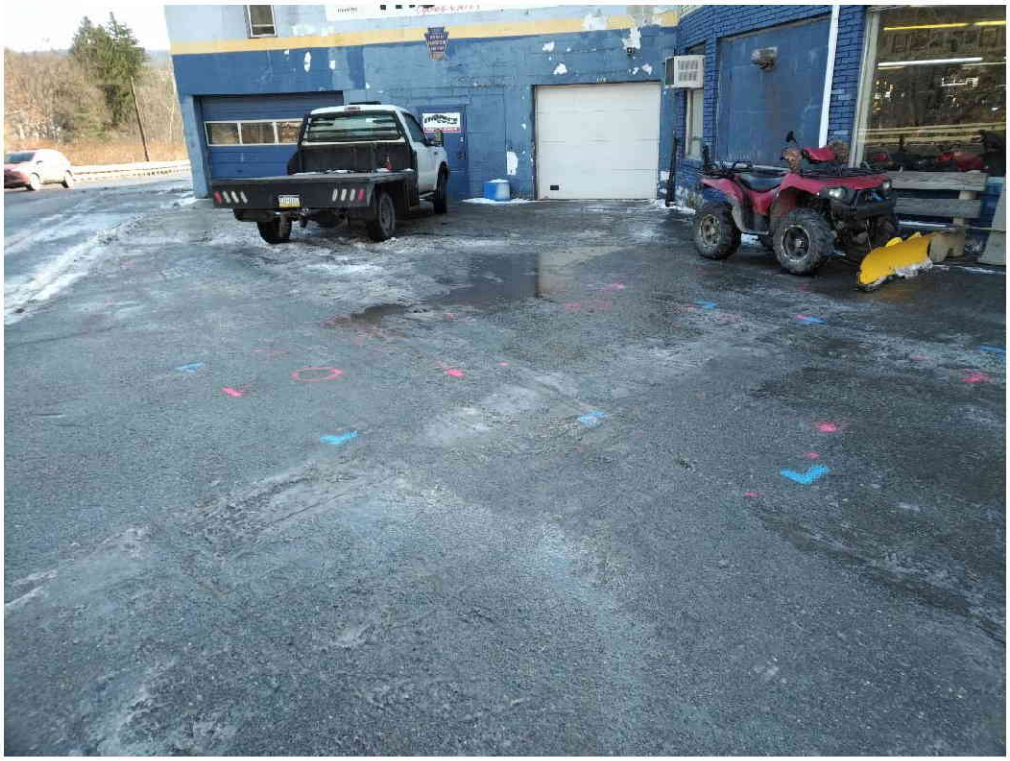
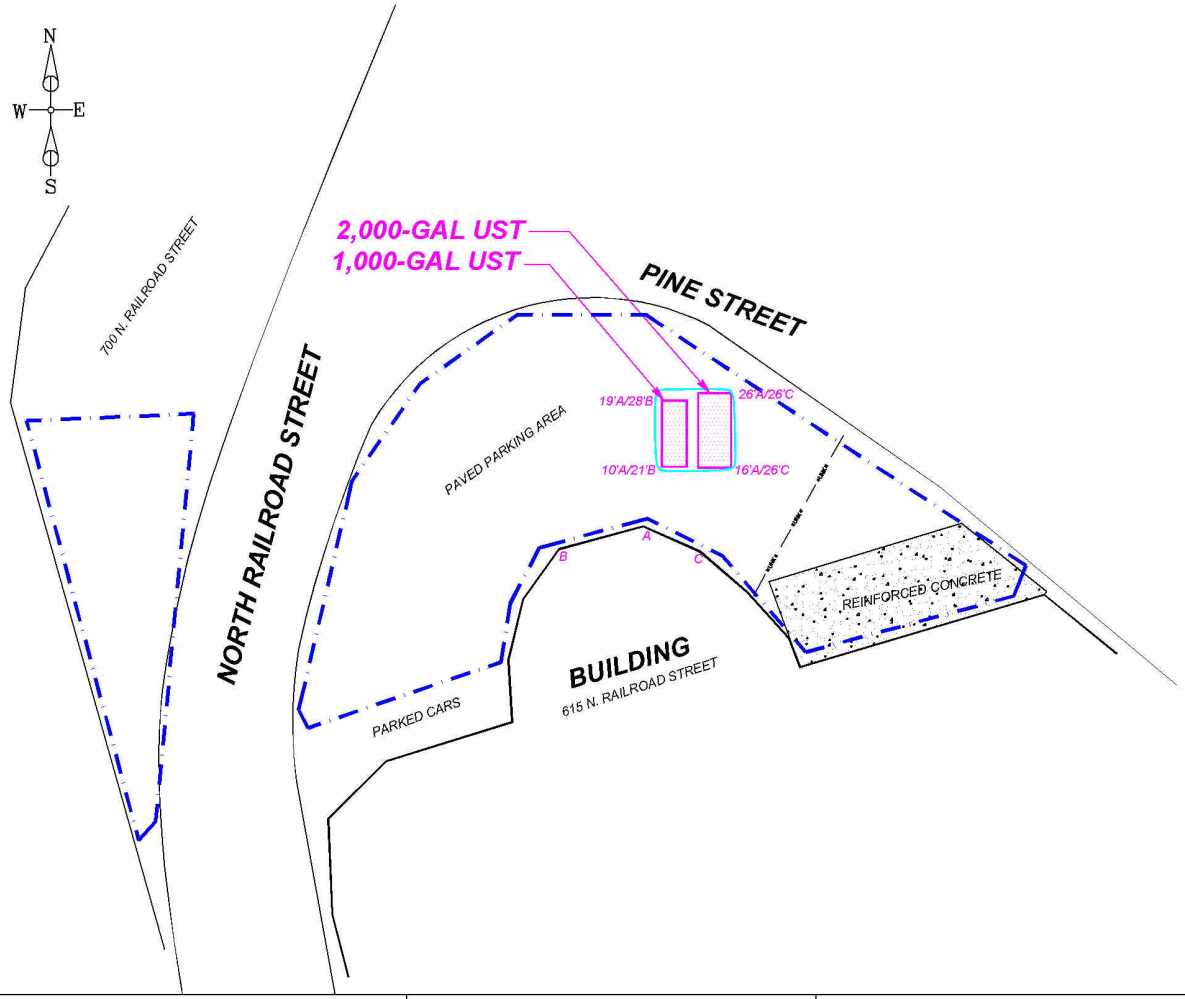


Figure 3 – Site Photograph – USTs Corners (blue paint) – 615 N. Railroad St



SUBSURFACE UTILITIES

Subsurface utilities were detected and field-marked within the investigated areas. Utilities that could be identified were marked with standard identifying colors. Unidentified or unknown utilities were marked with white paint.

The estimated maximum GPR signal penetration achieved at this site is approximately 8′ below grade. Thus, features existing at or below this depth will go undetected.

SUBSURFACE ANOMALIES - 615 N. RAILROAD ST

GPR data signatures indicating the location of two adjacent underground storage tanks (USTs) were delineated off the NE corner of the building. One UST measured 4′ x 10′-8″ (1,000-gallon) and the second tank measured 64″ x 12′ (2,000-gallon). Estimated depth to the tops of the tanks is 3′ below grade.

GPR Anomalies

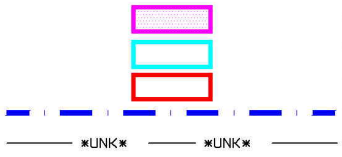
Typically, subsurface targets delineated by GPR could be associated with utilities, isolated debris, foundational remnants, buried concrete, or certain identifiable features such as USTs, septic tanks, drums, buried reinforced concrete, etc.

EM Anomalies

Typically, EM-detected subsurface anomalies can represent buried metallic features such as tanks, drums, foundations (containing rebar), utilities, and/or metallic debris. EM anomalies can represent areas containing conductive subsoil.

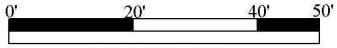
MAG Anomalies

Typically, MAG-detected subsurface anomalies are representative of buried iron-containing features such as tanks, drums, foundations (containing rebar), metallic debris, certain utilities, buried valve, manhole, and/or well covers, etc.



GGI recommends careful ground-truthing to verify and correlate all investigation findings. Recommended ground-truthing methods are hand digging or *Soft-Dig* (pot-holing) excavating.

The accessible sections of the search area, as shown, were investigated by Geo-Graf, Inc. (GGI) using Ground Penetrating Radar (GPR), Radio Frequency (RF), Electromagnetic (EM), and Magnetic (MAG) (where/when applicable) nonintrusive geophysical subsurface techniques in an attempt to detect and map metallic and nonmetallic subsurface utilities and underground anomalies.



SCALE: 1" = 20'

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SUBSURFACE ANOMALY MAP

GEOPHYSICAL INVESTIGATION FINDINGS
700 NORTH RAILROAD STREET
TAMAQUA, PENNSYLVANIA

PREPARED FOR:	SIZE	BASE MAPPING FILE:	GEO-GRAF, INC. PROJECT NUMBER:	REV
CENTER POINT TANK SERVICES	B		010918B	A
DATE:	SCALE	FILE NAME:		DRAWN BY / SHEET
JANUARY 19, 2018	1" = 20'	010918B-CPTS.DWG		JG / 1/1