FINAL REPORT
Geophysical Survey
Bisonite Paint Company
Town of Tonawanda, Erie County, New York

Prepared for

Groundwater and Environmental Services, Inc.
495 Aero Drive Suite 3
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Prepared by

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Applus RTD Work Order Number: 07.020857/001

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1 INTRODUCTION

On June 14th, 2017 Applus RTD conducted a geophysical survey at the former Bisonite Paint Company at 2268 Military Road in Tonawanda, New York. The survey was performed within the defined area of interest as shown in Figure 1-1. The goal of the geophysical survey is to identify subsurface structures and utilities, and their associated subsurface infrastructures, throughout the site and in the vicinity of proposed boring locations. The geophysical techniques of Electromagnetic Induction (EMI), Ground Penetrating Radar (GPR) and the RadioDetection (RD) method were used on the site to characterize the subsurface conditions. The following sections provide a detailed analysis of the work performed and the results obtained from the geophysical investigation.

LEGEND

Site Outline

Scale 1:480

25 0 25 50 75

US survey foot

NAD83 / New York West (ftUS)

Geophysical Investigation - NYSDEC Site No. 915010

Figure 1-1 Site Map
NYSDEC Tonawanda Bisonite Paint
2268 Military Road Tonawanda, New York

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Created by: Mark Saunders *Checked by: Eric Rickert* *Date: 06/21/2017*

2 SURVEY METHODOLOGY

2.1 ELECTROMAGNETIC INDUCTION (EMI)

2.1.1 Description

The electromagnetic induction (EMI) method was used to characterize the subsurface conductivity and to determine the likely presence of buried metallic objects, namely large diameter pipes in the subsurface. The method (and instrument) work by transmitting a primary magnetic field into the ground which subsequently creates electrical current in the ground. This current flows into a conductor (e.g., soil layer or metal object) and is known as an eddy current. These eddy currents generate a secondary magnetic field, which is then measured by the instrument and used to determine the conductivity of the Earth or presence of metal material.

The GSSI EM-Profiler, a frequency domain EM instrument, was utilized for this investigation. Frequency domain instruments are capable of transmitting and recording various frequencies of the EM signal. The frequencies ranged from 1-16 kHz. The frequency of the EM wave field determines the depth of penetration; higher frequency is used for shallow penetration and low frequencies are used for deeper investigations. Soil condition also plays an important role on how deep and EM signal will penetrate.

The EM signal records two components - the Quadrature and the Inphase. The Quadrature (imaginary part of the EM signal) is measured in PPM (parts per million). The Inphase component (real part of the EM signal) is measured in PPM as well and is more an indication of the presence of metal targets. Conductivity is derived from the Quadrature data and has units of mS/ft (milliSiemens/foot).

2.1.2 Field Design

The design of the EM survey was set up to cover the entire accessible portion of the property. A Global Position System (GPS) was interfaced with the EM-Profiler. A nominal line spacing of approximately five feet was used. Sampling frequency was set at 0.5 Hz (samples/second) which equates to a data point approximately every 2.0 – 3 feet with normal walking pace. The instrument was calibrated according to manufacturer's instructions. The data were collected in the vertical dipole orientation at frequencies of 4,000 Hz 9,000 Hz and 14,000 Hz. Profiles were oriented along the short axis of the site.

2.2 GROUND PENETRATING RADAR

2.2.1 Description

GPR surveys were performed using Geophysical Survey Systems, Inc. (GSSI) Dual Frequency (DF) GPR as well as GSSI 200 MHz unit. The DF contains two center frequencies of 300 and 800 MHz with depths of investigation from 9 feet to 3 feet respectively. The DF unit is a multi-channel unit that automatically displays, processes, and records cross-sectional variable color profiles of subsurface materials.

The GPR method uses high frequency radio waves to acquire relatively shallow subsurface information. Short pulses of electromagnetic energy are radiated downward into the subsurface from the transmitting antenna. A portion of the energy is reflected back to the receiving portion of the antenna, where the control unit continuously processes variations in the reflected signal, and such is graphically displayed. The amplitude and frequency of the reflected signals are caused by variations in electrical properties of subsurface materials (utilities). Reflections are produced whenever the energy pulse travels through a material with different electrical conduction properties or dielectric permittivity than from which it originated. Strength and amplitude of the reflection is determined by the difference in the dielectric constants and conductivities of the two materials.

The ability of the GPR system to resolve buried targets depends on the physical size and relative dielectric contrast of an object/feature with respect to the surrounding material dielectric properties. Detection capability also depends on the frequency of the antenna used. Higher frequency antennas will be able to “see” smaller targets; however, are limited to shallow depths. Low frequency antennas are not able to “see” small targets; however, are able to penetrate to greater depths. Consequently, not every subsurface feature can be identified using the GPR method.

2.2.2 Field Design

For this survey, the GPR system was set to a dielectric constant suitable for the survey medium. Based on known site conditions, a dielectric constant of "8" (which corresponds to soil type, etc.) was used for the survey profiles. GPR profiles were collected across the AOI at approximately 5 foot intervals in two orthogonal directions across the accessible portions of the AOI. Profiles were oriented approximately parallel to and perpendicular to the long and short axis of the site.

2.3 RADIODETECTION (RD)

2.3.1 Description

The RadioDetection (RD) method was used to locate metallic utilities. The RadioDetection RD8000 precision locator is designed for optimal locating performance for all industries and utilities. RD delivers a powerful digital signal analysis platform and provides the operator with a comprehensive suite of reliable and accurate signals. The multifunctional RD8000 range represents RadioDetection's most advanced pipe, cable and RF marker locators, offering a wide choice of locate functions and advanced connectivity options.

Locators do not find pipes; they locate the magnetic field around a pipe or utility, known as Electromagnetic Induction (EMI). This magnetic field is created by an alternating current traveling along the line. The magnetic field forms a cylindrical shape around the utility and is known as the signal. There are two types of locations methods, passive and active.

Passive refers to the natural energy traveling along a pipe, typically in the form of power (50/60Hz energy) radiating along a pipe or radio from very low frequency waves emanating through the air and ground.

Active location method is based on the practice of applying a signal to the ground or to a utility. There are three ways to perform an active locate; direct connection (connecting directing to a utility), signal clamp (clamping a utility pipe with a special clamp to induce signal), and induction (creating a magnetic field on the ground to energize the utilities nearby).

2.3.2 Field Design

The design of the RadioDetection survey was set up to trace the underground electric lines using a passive survey mode and an active survey mode was used to trace the locations of utilities at the survey site.

2.3.3 Quality Control

As part of the RadioDetection Survey, known points of origin (e.g. electric lines that are mapped to an electric service manhole and water lines that are mapped to a fire hydrant) are compared to suspected and unknown utilities. Comparisons are made to known utilities at the site and in the vicinity to unknown utilities to compare to possible ambient frequency response and level of response to induced frequencies.

3 SURVEY RESULTS

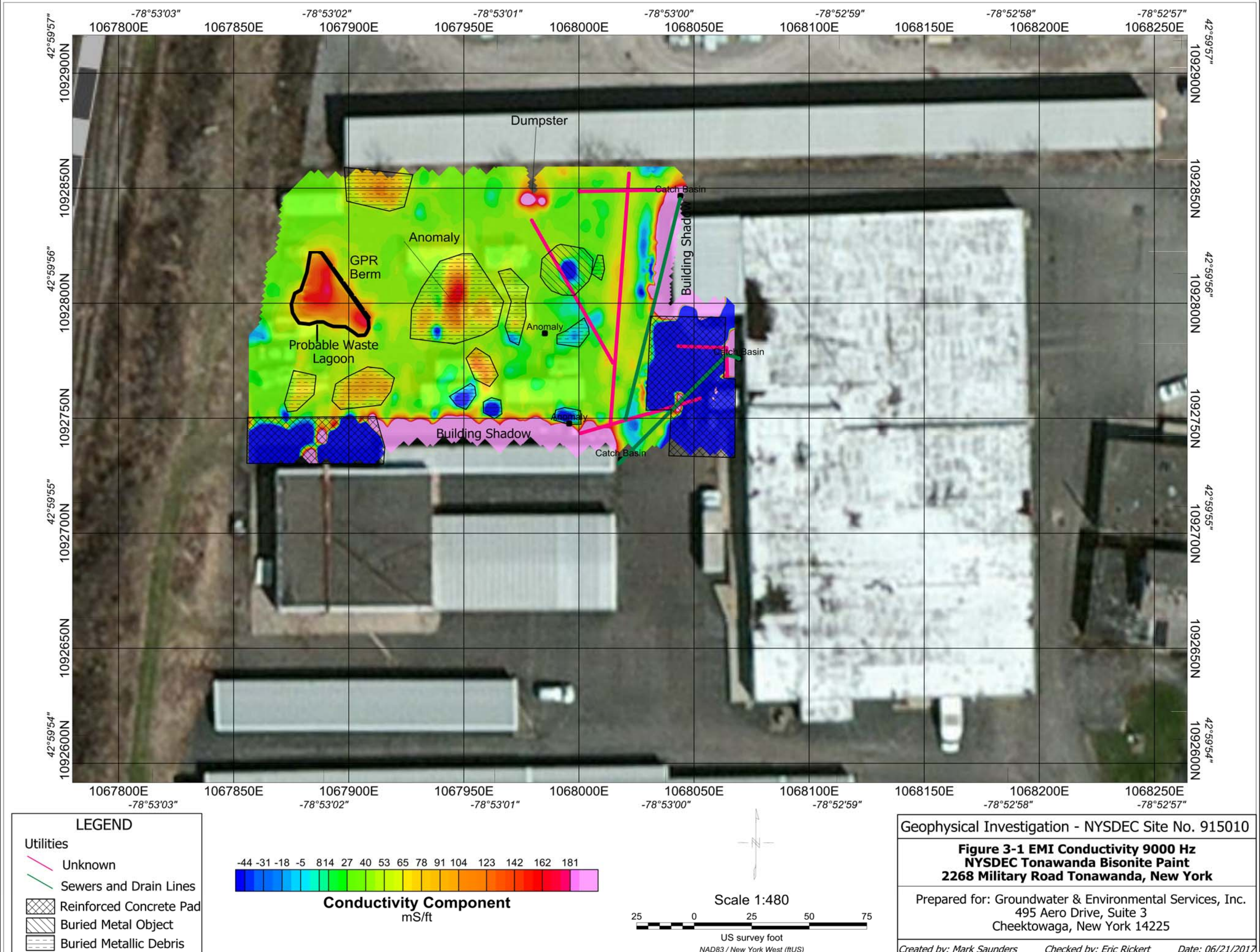
A geophysical survey was performed at the former Bisonite Paint Company site. EMI, GPR, and RadioDetection were used to survey the site. The AOI was the accessible portions of an open parking lot measuring approximately 115 feet by 205 feet. An overview of the AOI is shown in Figure 1-1.

The 9000 Hz EMI Conductivity and Inphase Data with the results of the survey overlain are shown in Figures 3-2 and 3-3, respectively. EM data and GPR data were acquired across the entire accessible portion of the AOI. The AOI was surveyed with RadioDetection equipment to locate possible utilities. The results are an integrated interpretation of the GPR, RD and EMI results. Located lines include sewer and drain lines and unknown possible utilities.

The maps include the EMI response from a dumpster, the building shadows and the reinforced concrete pads at the site. Other EMI responses that are not attributable to surface metallic objects are shown in several portions of the site. One large amplitude EMI anomaly on the western portion of the site has been interpreted as the probable location of the former waste lagoon. Several lower magnitude anomalies are present at the site and have been identified as buried metal debris. These locations do not have a single or large coherent GPR anomaly for these EMI anomalies. In the eastern portion of the AOI a paired positive and negative EMI moderate strength anomaly is present that is interpreted to be a buried metal object. The GPR signature for this object is that of a buried metal object rather than scattered smaller objects is approximately 6 feet along the transect. A portion of a GPR transect crossing the buried metal object is show in Figure 3-3.

There are several scattered GPR anomalies that do not correspond to linear features. This is common in urban fill materials. The office review of the data did not reveal any additional utilities based on the GPR data. A leveling layer of fill was noted and is observed for the majority of the AOI at the site and measures approximately 1 to 2 feet in depth. The geophysical data does not provide information about the material make up of this fill layer and it does not show if this is fill for leveling the site or for a different purpose. The depth of GPR penetration was 3 to 5 feet in survey area.

The main goal of the survey was to attempt to locate the historic waste lagoon and determine the locations of utilities in the vicinity of proposed borings. The apparent conductivity and elevated inphase response in the western portion of the AOI appears to correspond with the reported location of the historic waste lagoon. No discernable continuous trench to the probable lagoon location was noted.



Geophysical Investigation - NYSDEC Site No. 915010

Figure 3-1 EMI Conductivity 9000 Hz
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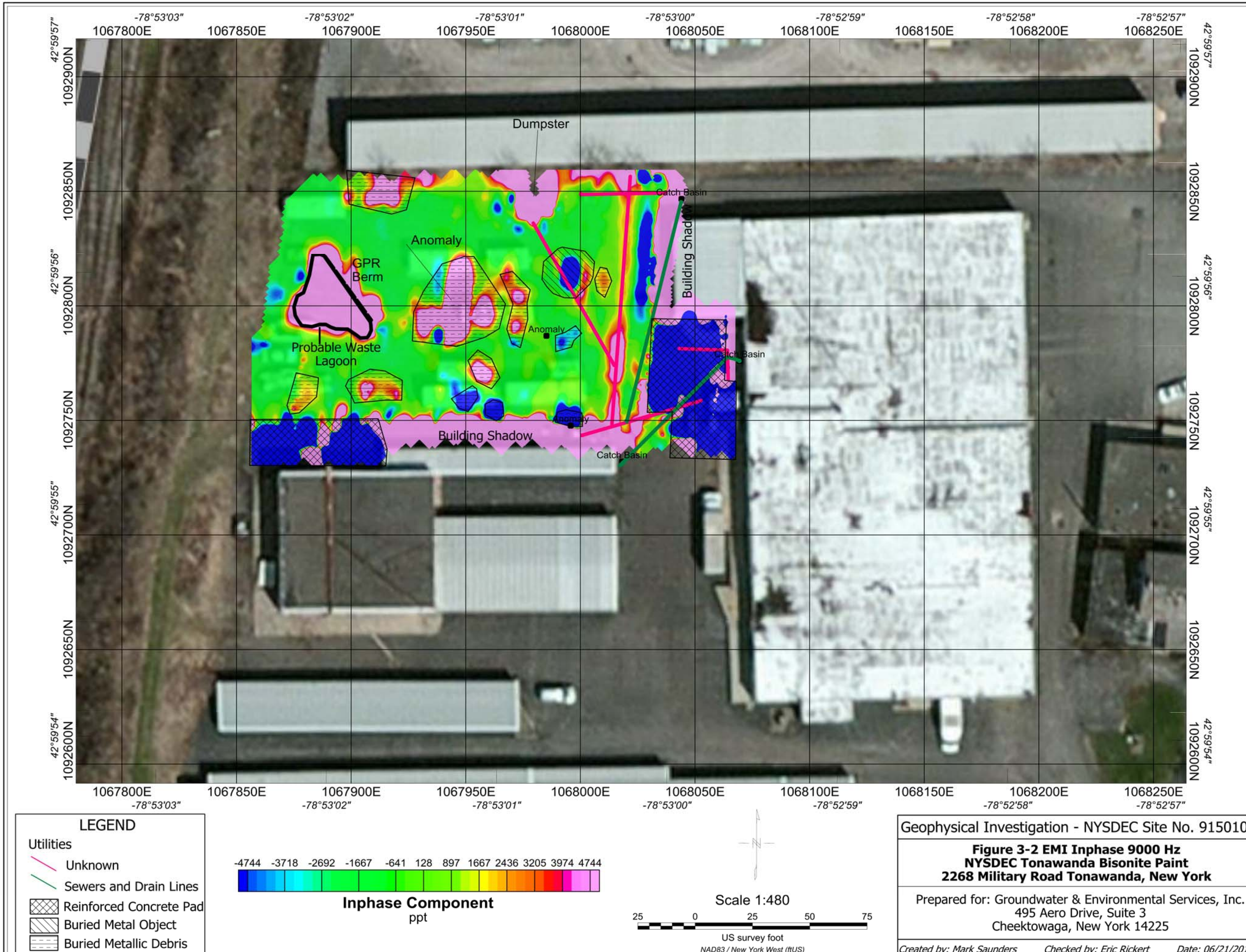

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Figure 3-2 EMI Inphase 9000 Hz
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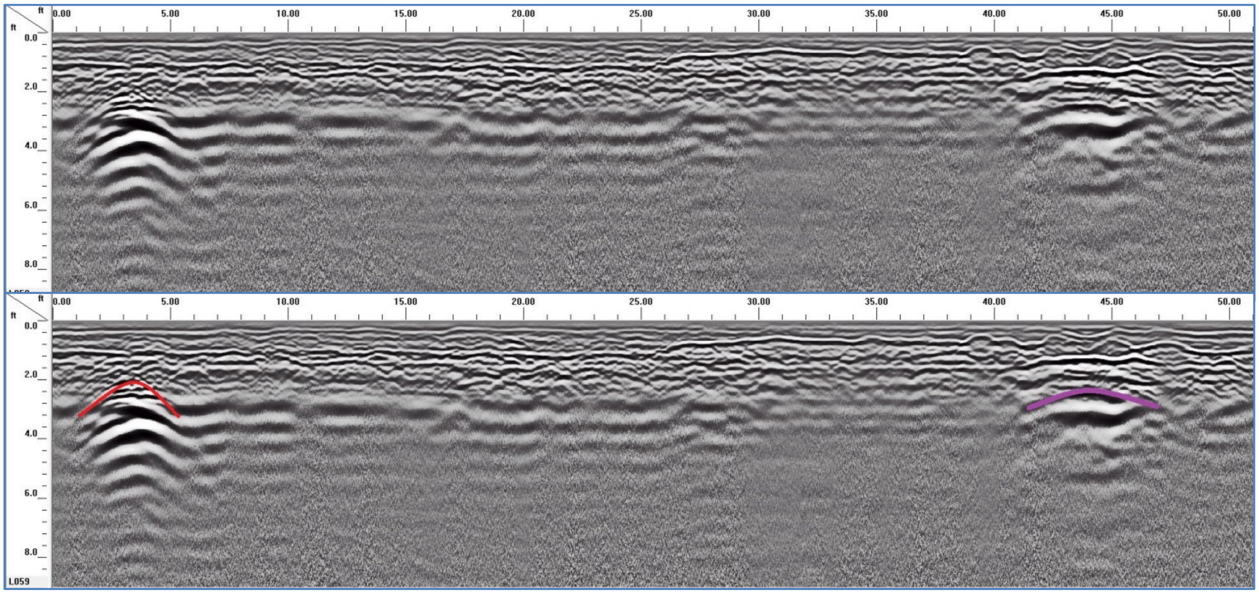

Figure 3-3 Portion of GPR Transect with Drain Line (in red on left) and Buried Metal Object (on the right in purple)

4 SUMMARY

In summary, the area of interest was surveyed with EMI, GPR, and RadioDetection methods to determine the possible location of a waste lagoon and determine the location of possible utilities in the vicinity of proposed borings. Additionally, the location of a possible trench to the waste lagoon was identified of possible interest. The EMI anomaly in the western portion of the AOI has been identified as being in the approximate historic location of the waste lagoon. Several utilities were marked in the field and shown in the figures. Several EMI anomalies that are not related to surface metallic objects are present at the site and may be related to buried metal debris. The possible waste trench has not been identified based on the geophysical data.

5 LIMITATIONS

Applus RTD performs geophysical services (for locating utilities, subsurface features) in compliance with latest available industry standard practices and guidance. Although these guidance's establish criteria for stringent quality control, it must be understood that due to the complexities in the electrical properties inherent in various materials (i.e. dielectrics) these methods have limitations. As a result of these conditions some utilities or objects may go undetected by geophysics and may require other methods to identify them. Therefore Applus RTD makes no guarantee with respect to the location of any subsurface objects.