ATTACHMENT A

Ground Penetrating Radar Report

Results of Geophysical Pilot Investigation
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Prepared For:

Antea Group
Valhalla, New York 10595

Dates of Investigation: **April 29 and May 1, 2013**

Submitted By:

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1.0 Introduction

On April 29 and May 1, 2013, NAEVA Geophysics, Inc. conducted geophysical investigations at the former Anaconda Wire and Cable Company, which is located at 1 River Street in Hastings-on-Hudson, New York. The purpose of the investigation was to determine the thickness of the concrete pavement and delineate detectable voids beneath the concrete pavement. Because of the uncertainties regarding the depth of penetration and usefulness of GPR data at this site, this investigation was conducted as field trials in the form of pilot programs within eight selected portions of the site, as indicated on the Antea-supplied Figure 2R and Table 1. The results of this survey will be compared with future ground truth activities, such as coring and video camera inspection, in order to determine the feasibility of a full scale GPR survey, as discussed with the Antea site representative during the Work Risk Assessment Tool (WRAT) meeting conducted on April 16, 2013.

The site has been divided into 20 separate areas of concern. The eight areas chosen for this pilot program were: Area 1 is the site of former Building 15, which is located between the North and South Boat Slips. Area 3 is the North Boat Slip shoreline. Area 4 is located east and south of the South Boat Slip. Area 6 is the shore area between the Northwest Corner Area and Area 2. Area 7 is along the west side of the existing Building 52. Area 15 is the location of a 48-inch storm drain between North Boat Slip and former Buildings 72 and 72A. Area 19 is located at the southeast corner of the site where subsidence occurred near a known vault that is now covered by under metal plates. We were unable to complete the survey in Area 2 due to time limitations.

2.0 Methods and Instrumentation

The instruments used for this investigation were a Sensors and Software Noggin^{plus} Ground Penetrating Radar (GPR) system with a 1,000 MHz antenna, a Malå GPR system with a 250 MHz antenna, a Subsite 950 utility locator, and a Trimble Pathfinder ProXRT Global Positioning System (GPS) with an external dual-frequency antenna.

The Noggin GPR system consists of three major parts: a shielded transmitter/receiver antenna, a Digital Video Logger (DVL), and a battery unit. For this investigation, these major parts were mounted in a SmartCart which is a 4-wheeled chassis with an integrated odometer.

During operations, the GPR's transmitter radiates a short pulse of electromagnetic energy into the concrete. When this pulse strikes an interface between layers of material having different electrical properties, a portion of the energy is reflected back to the surface, while the remaining energy continues on to the next interface. The GPR records these reflections versus time in nanoseconds (two-way travel time), or depth when using an appropriate radar velocity, and displays them real-time via the monitor as a vertical column of data on the screen. As the GPR moves, the integrated odometer triggers the system to collect data at a fixed scan interval of 0.48 inches. As the individual data lines build up, they create a continuous image. These profiles are then examined for horizontal and parabolic reflections that could be interpreted as representing voids, bottom of concrete pavement, rebar, conduits, or other buried objects.

GPR can often provide high-resolution cross-sectional images of buried objects, but its suitability is site-specific. In general, better results are obtained in dry, resistive, older concrete than in wet, less cured or conductive material. Lower frequency signals provide greater depth of penetration, but less resolution, than higher frequency antennas. The 1,000 MHz shielded antenna is commonly used for concrete and pavement infrastructure assessment, reinforcement bar investigation, and internal/sub slab void detection.

The Trimble GPS was utilized for creating a geo-referenced culture map. The GPS consists of a Pathfinder ProXRT receiver with a GLONASS satellites option, a Nomad 800GXC hand-held computer with a Terrasync software package for data recording, and a Tornado external dual-frequency antenna mounted on a 2-meter (6.56 feet) carbon fiber range pole. The GPS data was post-processed using Pathfinder Office software at our Congers, New York office to achieve subfoot accuracy. After the post processing, the GPS data was exported into AutoCAD® format and used to produce the map in New York East State Plane coordinates (NYESPC).

3.0 Field Operations

Survey grids of parallel lines were established at the requested line spacing within the accessible portions of Areas1, 3, 4, 6, 7 and 19. Grid north is roughly parallel to the Hudson River. The local coordinates of each grid are measured from the base point on their southwest corners 0E (Easting)/0N (Northing). The grid nodes were marked on the surface with green paint dots at regularly spaced intervals. The purpose of the sampling grid was to facilitate a systematic approach to data collection and the reacquisition of target locations.

The instrument was calibrated at the location of a known void located near the south end of the North Boat Slip using standard hyperbola matching and known depth methods. The concrete thickness as well as the rebar spacing and its orientation were also hand measured at their exposures in a cut-out through the concrete in the void. Once the instrument was properly calibrated to the concrete type, continuous GPR data profiles were collected along traverses at a fixed scan interval of 0.48-inch along each grid line. The line number, sampling direction, and starting/ending locations of each line were hand recorded in a field notebook. Because of its cart-mounted configuration, the SmartCart GPR was well suited for use over the relatively open and smooth surface.

To investigate the 48-inch storm drain in Area 15, a radio frequency transmitter beacon was advanced into the pipe from a manhole access point using a fiberglass rod, and the Subsite receiver was utilized to delineate the pipe. The Malå GPR system with a 250 MHz antenna was also utilized to search for the pipe in this area.

4.0 Data Processing and Interpretation

To maximize the interpretability of the subsurface images, the GPR data were transferred to a computer and processed using Ground Penetrating Radar Imaging Software GPR-SLICE before more definitive interpretations were made at NAEVA's Congers office. First, the GPR data were converted to the software's specific format. The starting and end points of each line were individually checked against the written field notebook for accuracy. The proper gain was applied to the raw data while "dc-drift" or "wobble" noise was filtered out during the data conversion. This dc-drift or wobble noise is commonly seen in all GPR data from all equipment manufactures and manifestes itself when the raw radar scan at depth drifts away from the 0 signal amplitude. Then, several data processing features, such as bandpass filtering and migration, were applied for removing unwanted frequencies in the radar pulses and hyperbolas. Finally, the cross-sectional view of each data profile was created.

5.0 Results

5.1 Calibration

The concrete thickness at the location of the known void was measured to be 7 inches. The rebar spacing is approximately 6 inches for east-west oriented top and bottom layers and approximately 12 inches or larger for the north-south oriented middle layer. Our visual inspection revealed extended to the limit of our view in all directions. Exposed support beams beneath the floor hold it up. The velocity of the GPR's signal at this location was determined to be 0.33 feet per nanosecond, which was applied to process the GPR data collected during this project. It should be noted that the velocity decreases with increasing moisture content of the subsurface materials. Consequently, it affects the calculation of the concrete thickness. We anticipated that the presence of voids would create a high signal amplitude at the bottom of the concrete floor as compared to the concrete/soil contact. Unfortunately, this calibration area has extensive voids therefore we were unable to collect GPR data over the transition from known voids to known no voids.

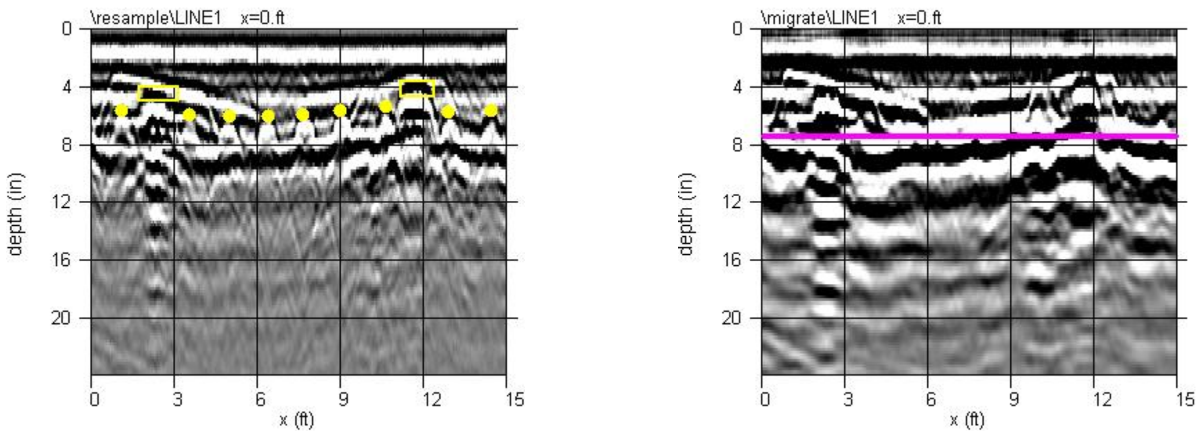


Figure 1. GPR data profiles collected from east to west over the location of the known void. Gain was applied to the data for increasing the signal strength (left), and migrated data (right). Yellow circles are rebar, yellow rectangles are support beams, and the void is below pink line (bottom of the concrete floor).

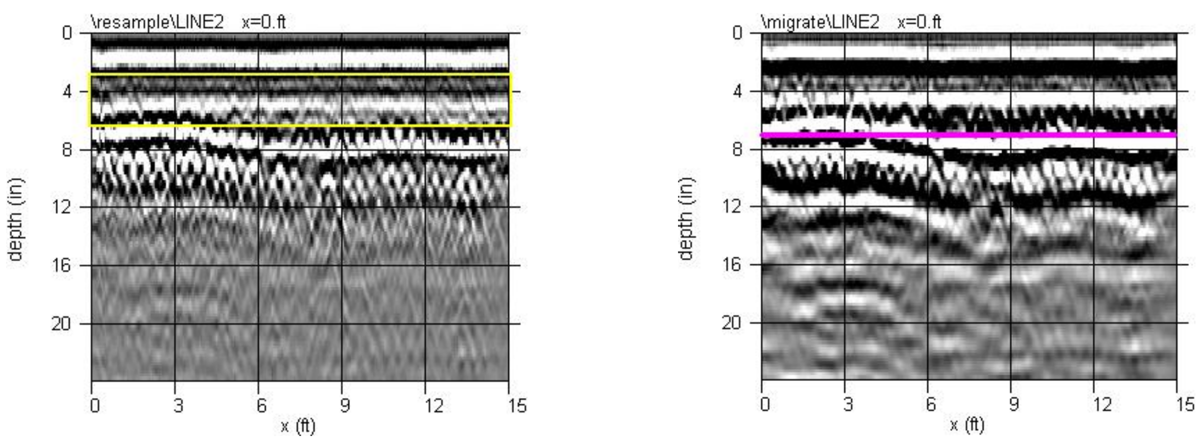


Figure 2. GPR data profiles collected from south to north over the location of the known void. Gain was applied to the data for increasing the signal strength (left), and migrated data (right). Yellow rectangle is top and bottom layers of rebar, and the void is below pink line.

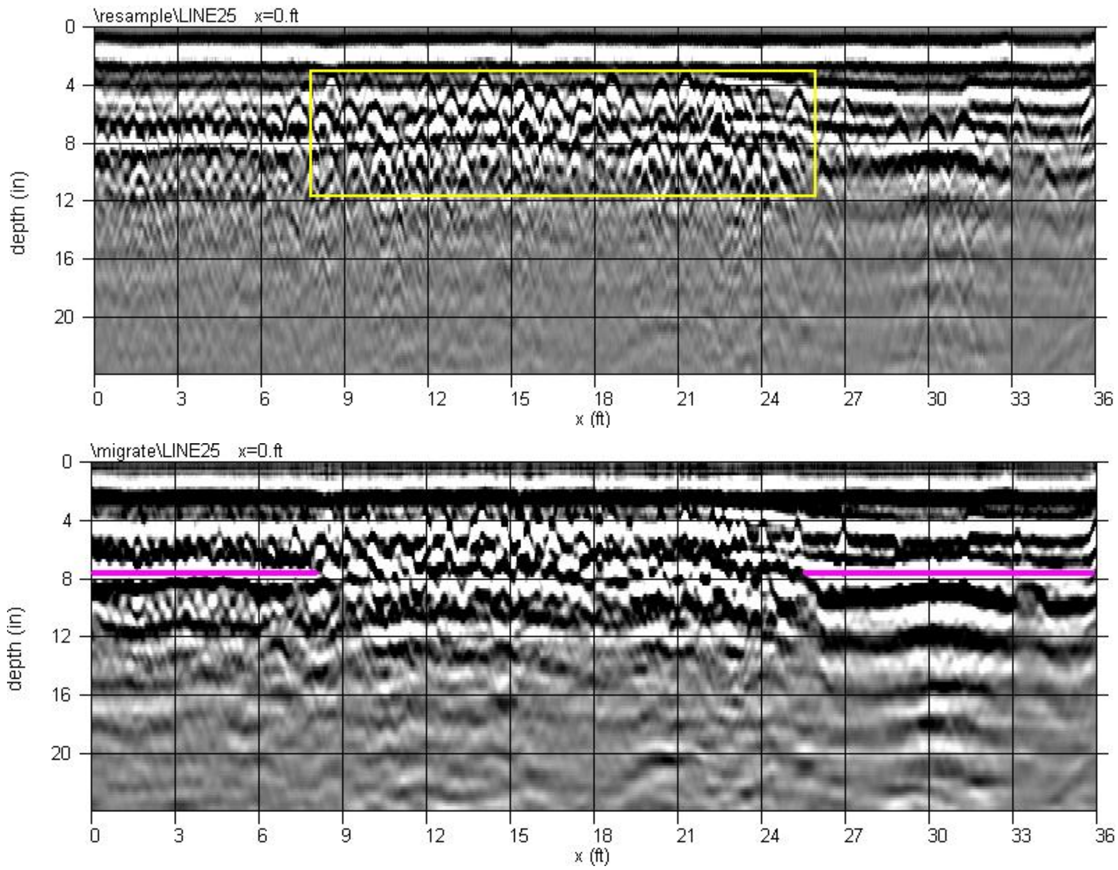


Figure 3. GPR data profiles collected from north to south over the location of the known void. The GPR profiles indicated the area of rebar within the yellow rectangle (top) disturbs the image below (bottom). Pink lines below indicate voids.

The GPR data profiles collected over rebar spacing of 12-inch or larger indicate the reflections of voids more strongly than the ones collected over the smaller rebar spacing (see Figure 1 and 2). Several GPR data profiles also revealed that the combination of the smaller rebar spacing and uneven buried depth influences the detection of the voids (see Figure 3).

5.2 Area 1

Three east-west transects, separated by about 180 feet, were collected and named Line "A", "B", and "C" from north to south (see Plate 1). The length of each transect is 165 feet with line break in the middle due to the presence of a fence line (Appendix A). The Trimble GPS unit was utilized for mapping start/end coordinates of each transect. The surface condition was open and smooth. Portions along these traverses contained visible de-laminations on the surface and residual soil remaining above slightly subsided areas of the concrete surface. The average concrete thickness along these lines is estimated to be around 12 inches. All profiles indicate strong reflections around a depth of 12 inches that could be interpreted as the presence of voids. Area 1 is also located near the shoreline and just south of the location where we observed the large extended voids beneath the concrete floor. Due to site specific safety concerns, we were unable to visually inspect along the shoreline for evidence of voids.

5.3 Area 3

Eighteen east-west transects and two north-south transects were collected within approximately 100 by 310-foot area (see Plate 2). The area of investigation contains raised former building foundations, with some rough surfaces due to portions of the area being covered with bricks, and indications of subsurface utilities, such as catch basins, manhole covers, and a fire hydrant.

Line 0N was collected along the southern edge of the area in an east-west direction between station 15E and 100E (see Figure 4 below). The thickness of the concrete is around 10 to 12 inches between 15E and 67E where suspected voids may exist beneath the concrete. The area east of 67E is covered by bricks.

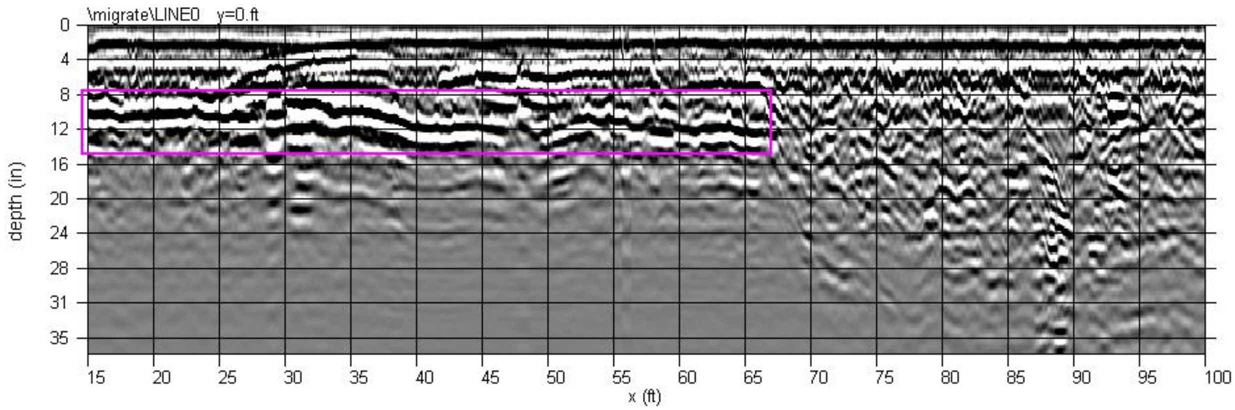


Figure 4. GPR data profile of Line 0N collected in east-west direction. The western end of the line is on the left (15 ft) and the eastern end of the line is on the right (100 ft). The pink rectangle indicates strong reflections that could be associated with suspected voids beneath the concrete.

Line 10N was collected in an east-west direction between station 25E and 100E (see Figure 5 below). The locations of suspected voids are 25E to 36E and 58E to 79E. Unknown features are also detected within brick filled area between 82E and 94E. The thickness of the concrete is inconclusive, but is probably around 10 to 12-inches based upon the depth of the suspected voids.

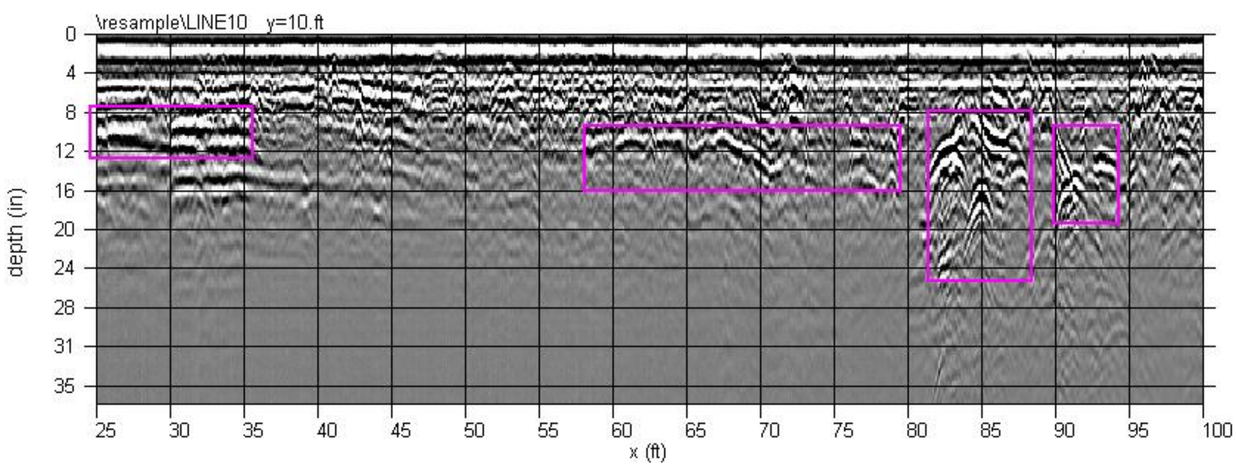


Figure 5. GPR data profile of Line 10N collected in east-west direction. The western end of the line is on the left (25 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with suspected voids beneath the concrete and unknown features within brick filled area.

Line 20N was collected in an east-west direction between station 25E and 100E (see Figure 6 below). The locations of suspected voids as well as the thickness of the concrete are inconclusive, however, an unknown feature was detected between 86E and 89E; similar to the one seen in Line 10N.

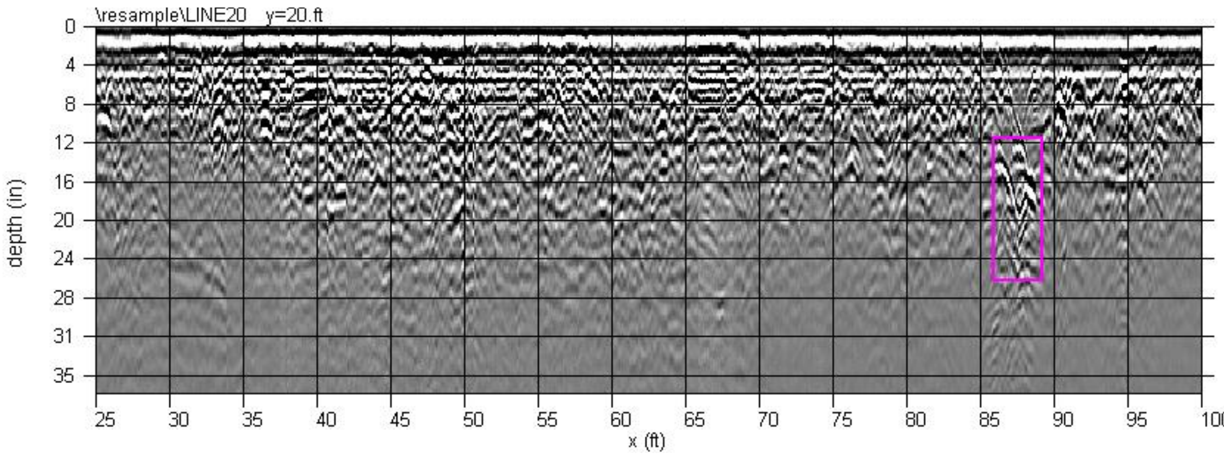


Figure 6. GPR data profile of Line 20N collected east-west. The western end of the line is on the left (25 ft) and the eastern end of the line is on the right (100 ft). The pink rectangle indicates unknown features within brick covered area.

Line 40N was collected in an east-west direction between station 25E and 100E (see Figure 7 below). The location of suspected voids is between 25E and 48E. The thickness of the concrete is inconclusive, but probably around 10 to 12-inch thick based upon the depth of suspected voids.

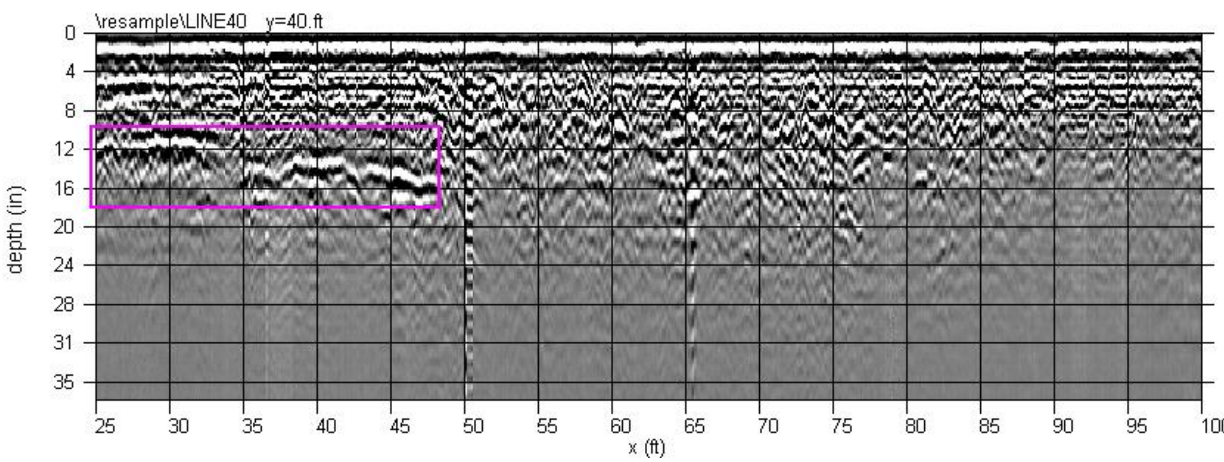


Figure 7. GPR data profile of Line 40N collected east-west. The western end of the line is on the left (25 ft) and the eastern end of the line is on the right (100 ft). The pink rectangle indicates suspected voids.

Line 60N was collected in an east-west direction between station 20E and 100E (see Figure 8 below). The thickness of the concrete is around 16 to 18 inches beneath an access driveway between 20E and 34E where suspected voids or de-lamination within the concrete may exist (hyperbolic reflections of rebar are visible in the profile). Other suspected voids are 40E to 68E within the former building foundation. Unknown features are also detected from 81E to 85E and 88E to 91E.

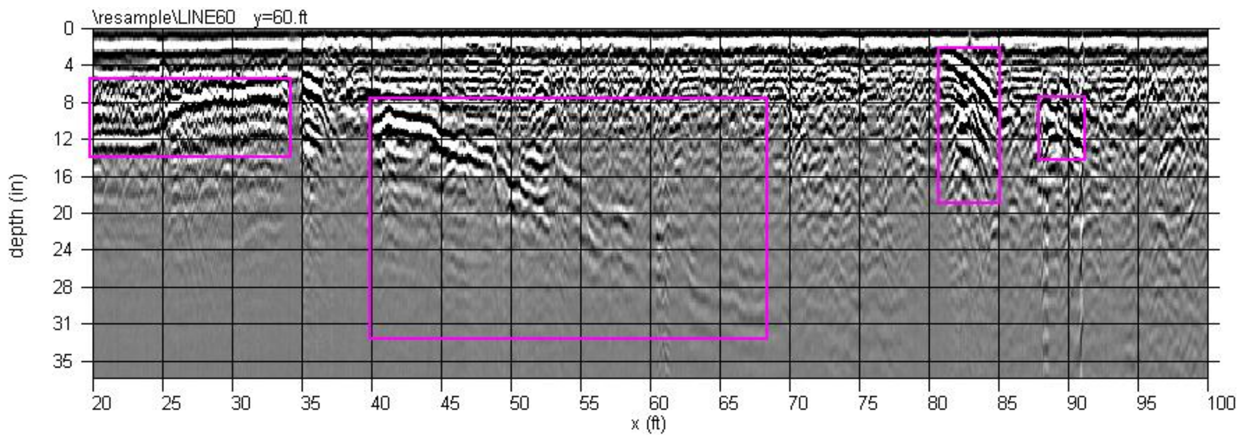


Figure 8. GPR data profile of Line 60N collected east-west. The western end of the line is on the left (20 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate the strong reflections that could be associated with suspected voids and unknown features.

Line 80N was collected in an east-west direction between station 20E and 100E (see Figure 9 below). The thickness of the concrete should be similar to Line 60N beneath the driveway and about 18 to 24 inches between 56E and 70E (hyperbolic reflections of rebar are visible in the profile). The locations of suspected voids are 20E to 34E within an access driveway and 36E to 56E, 63E to 68E, and 95E to 96E within the former building foundation.

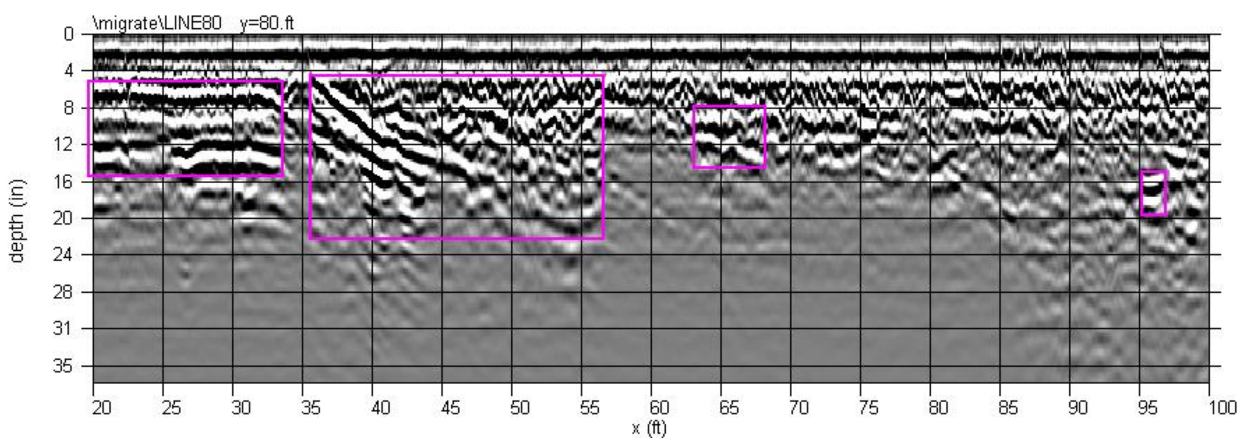


Figure 9. GPR data profile of Line 80N collected east-west. The western end of the line is on the left (20 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate the strong reflections that could be associated with the suspected voids.

Line 100N was collected in an east-west direction between station 20E and 100E (see Figure 10 below). The thickness of the concrete is around 16 inches beneath the driveway where de-lamination may exist around 4 inches below grade between 20E and 34E. A layer of rebar is also detected around 20 to 24 inches between 61E and 80E. The locations of suspected voids are 20E to 34E within an access driveway and 36E to 61E within the former building foundation.

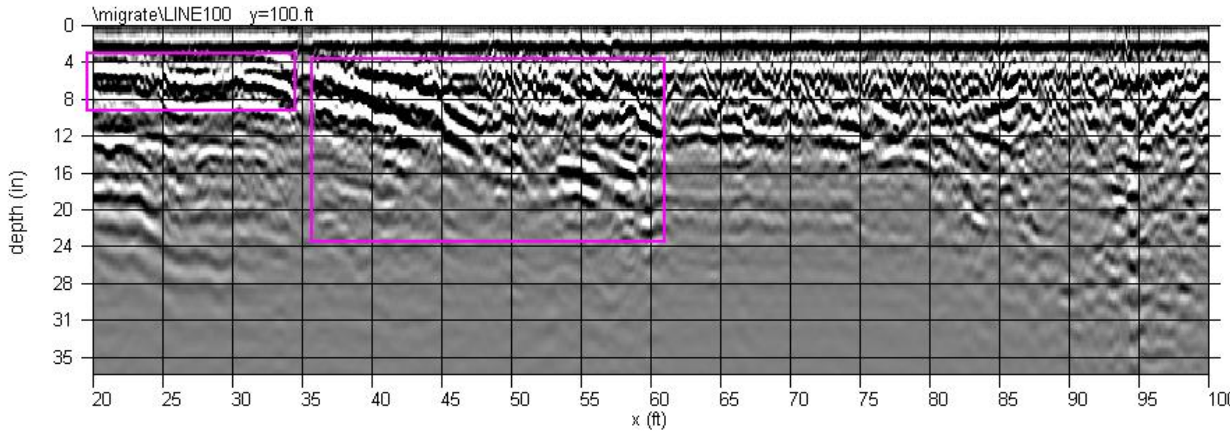


Figure 10. GPR data profile of Line 100N collected east-west. The western end of the line is on the left (20 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate the strong reflections that could be associated with suspected voids.

Line 120N was collected in an east-west direction between station 10E and 100E (see Figure 11 below). The thickness of the concrete varies around 18 to 26 inches between 74E and 95E as hyperbolic reflections of rebar are visible. The locations of suspected voids are 10E to 35E, 43E to 67E, and 74E to 91E.

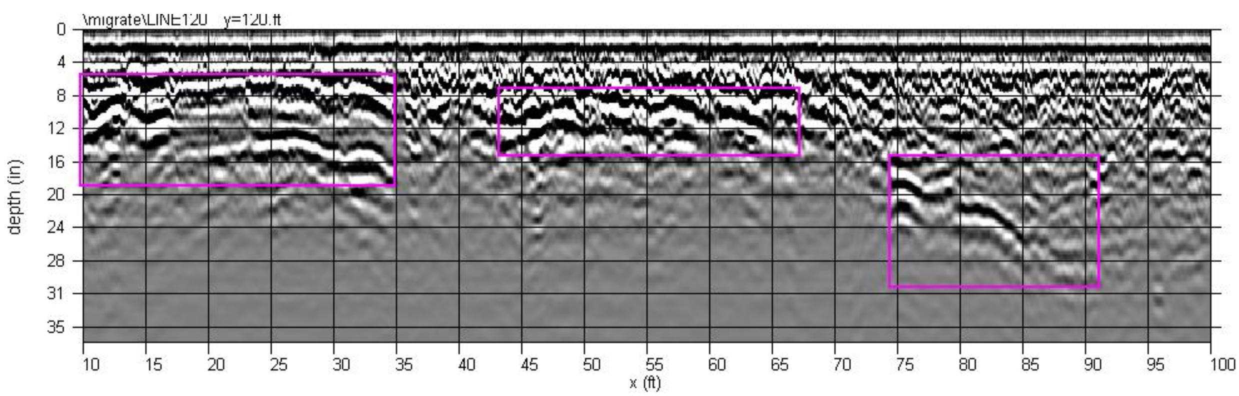


Figure 11. GPR data profile of Line 120N collected east-west. The western end of the line is on the left (10 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with the suspected voids.

Line 140N was collected in an east-west direction between station 10E and 100E (see Figure 12 below). The thickness of the concrete within an octagonal foundation is 14 to 16 inches between 64E and 81E. The locations of de-lamination and/or suspected voids are 14E to 34E, 36E to 63E, 64E to 78E, and 81E to 100E.

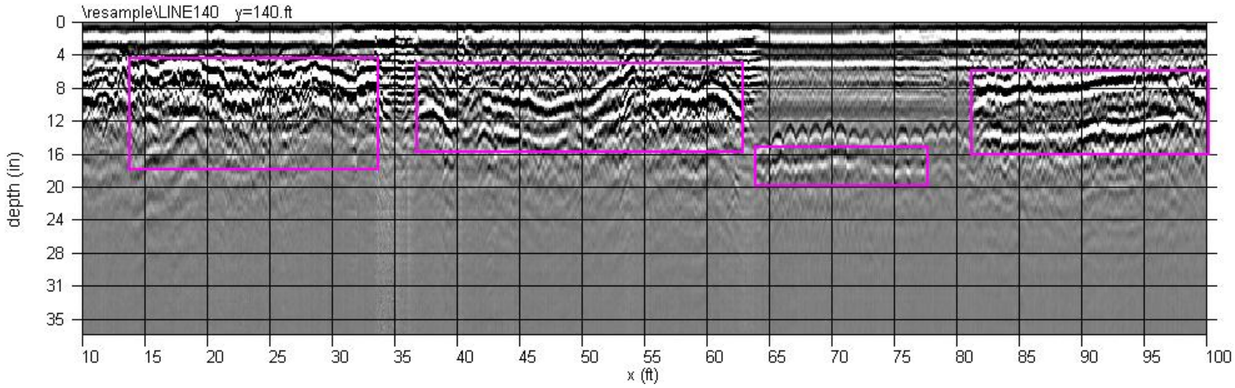


Figure 12. GPR data profile of Line 140N collected east-west. The western end of the line is on the left (10 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with suspected voids.

Line 160N was collected in an east-west direction between station 10E and 100E (see Figure 13 below). The thickness of the concrete within an octagonal foundation is 14 to 16 inches between 57E and 89E. The locations of de-lamination and/or suspected voids are detected throughout the line.

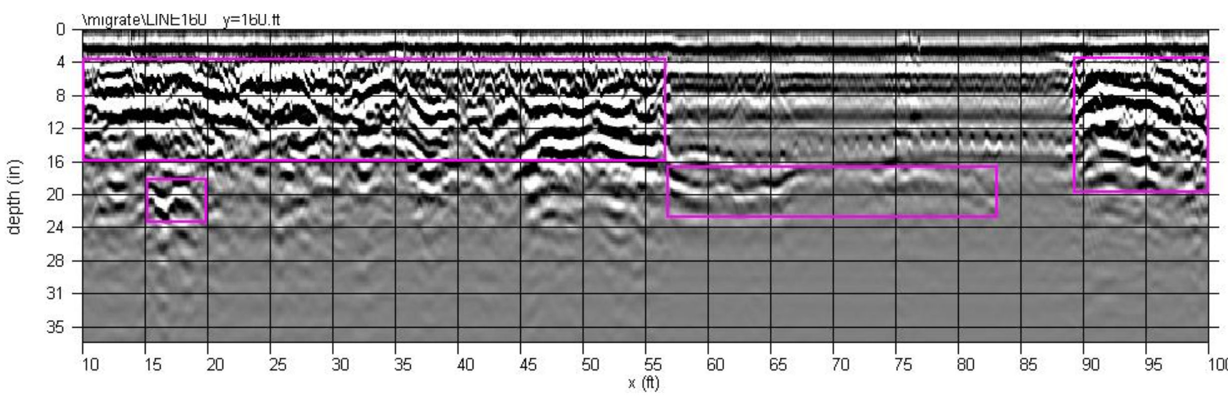


Figure 13. GPR data profile of Line 160N collected east-west. The western end of the line is on the left (10 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 180N was collected in an east-west direction between station 10E and 100E (see Figure 14 below). The thickness of the concrete is inconclusive, and locations of possible de-lamination and/or suspected voids are detected throughout the line.

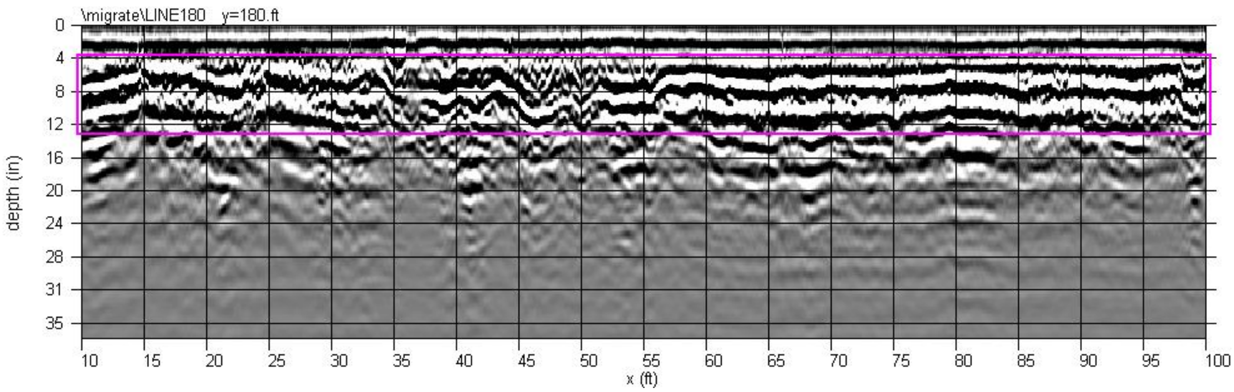


Figure 14. GPR data profile of Line 180N collected east-west. The western end of the line is on the left (10 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 200N was collected in an east-west direction between station 10E and 100E (see Figure 15 below). The thickness of the concrete as well as the locations of voids is inconclusive due to poor penetration of GPR's signal, which could be caused by tight rebar spacing and/or de-lamination at a shallow depth.

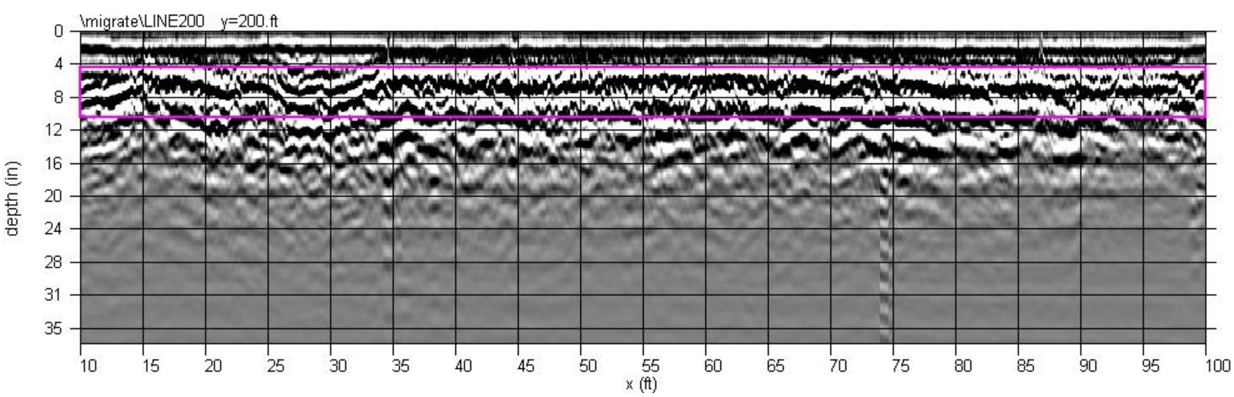


Figure 15. GPR data profile of Line 200N collected east-west. The western end of the line is on the left (10 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles could be associated with de-laminations and/or suspected voids.

Line 220N was collected in an east-west direction between station 5E and 100E (see Figure 16 below). The thickness of the concrete is inconclusive. The locations of suspected de-laminations and/or voids are between 26E and 98E.

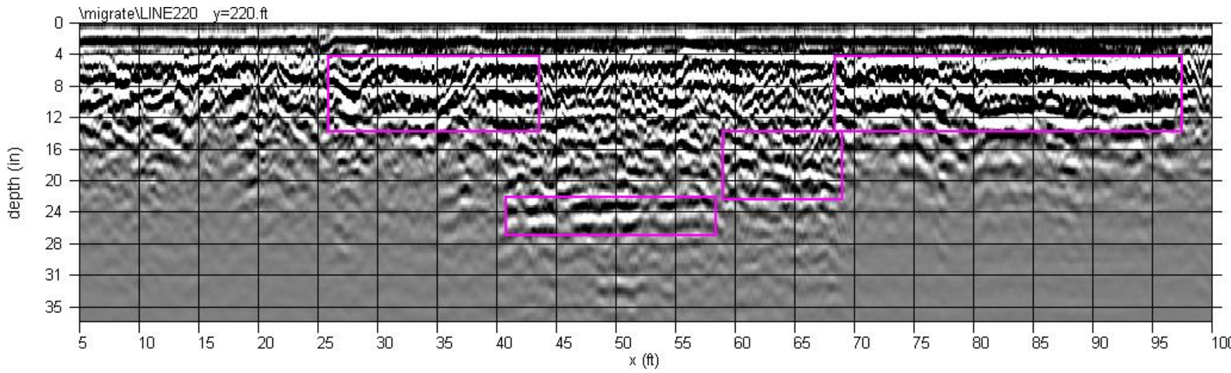


Figure 16. GPR data profile of Line 220N collected east-west. The western end of the line is on the left (5 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate the strong reflections that could be associated with de-laminations and/or suspected voids.

Line 240N was collected in an east-west direction between station 5E and 100E (see Figure 17 below). The thickness of the concrete is inconclusive, and the de-lamination and/or suspected voids may exist at a shallow depth throughout the line.

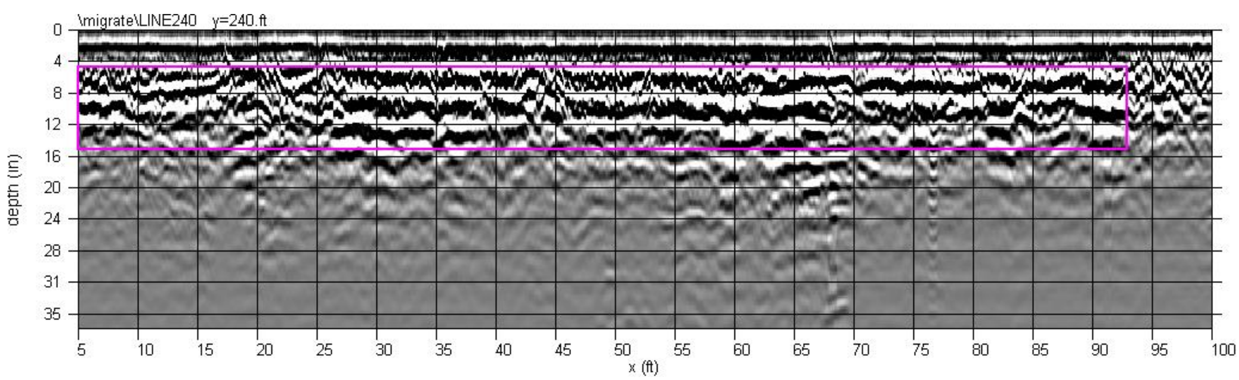


Figure 17. GPR data profile of Line 240N collected east-west. The western end of the line is on the left (5 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 260N was collected in an east-west direction between station 5E and 100E (see Figure 18 below). The thickness of the concrete is inconclusive. The locations of suspected de-laminations and/or voids are 5E to 30E, 70E to 75E, and 82E to 89E.

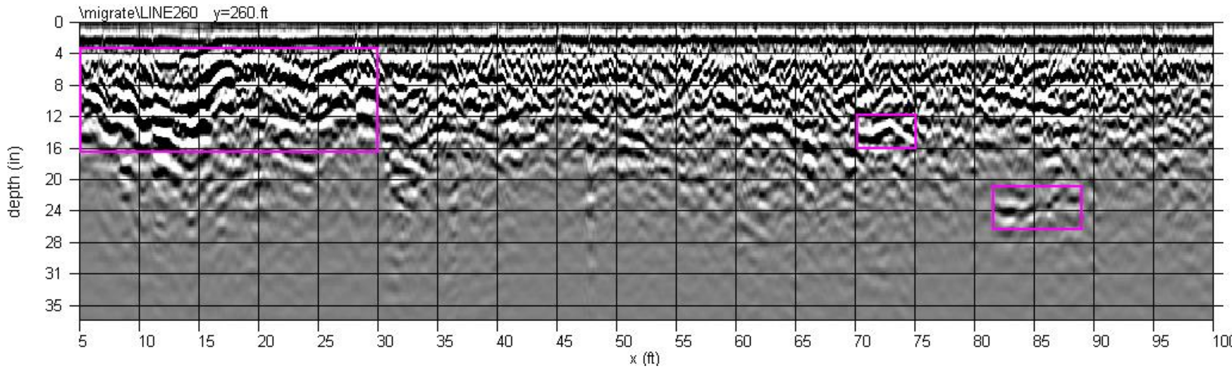


Figure 18. GPR data profile of Line 260N collected east-west. The western end of the line is on the left (5 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 280N was collected in an east-west direction between station 5E and 100E (see Figure 19 below). The thickness of the concrete is around 16 to 20 inches between 5E and 18E. The locations of de-laminations and/or suspected voids are 5E to 42E, 44E to 49E, 51E to 63E, and 84E to 98E.

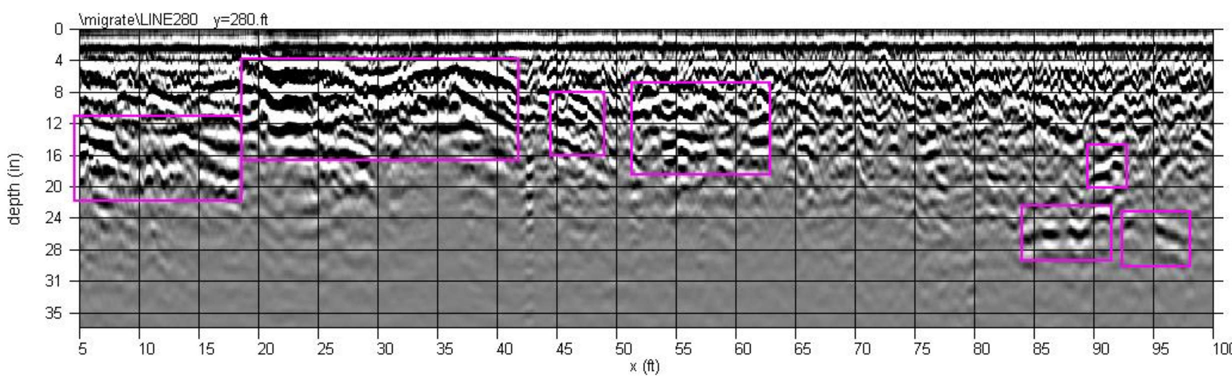


Figure 19. GPR data profile of Line 280N collected east-west. The western end of the line is on the left (5 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 300N was collected in an east-west direction between station 5E and 100E (see Figure 20 below). The thickness of the concrete within a former building foundation is at least 8 to 10 inches from 36E to 80E, and 10 to 14 inches from 80E to 100E. De-lamination and/or suspected voids may exist throughout the line.

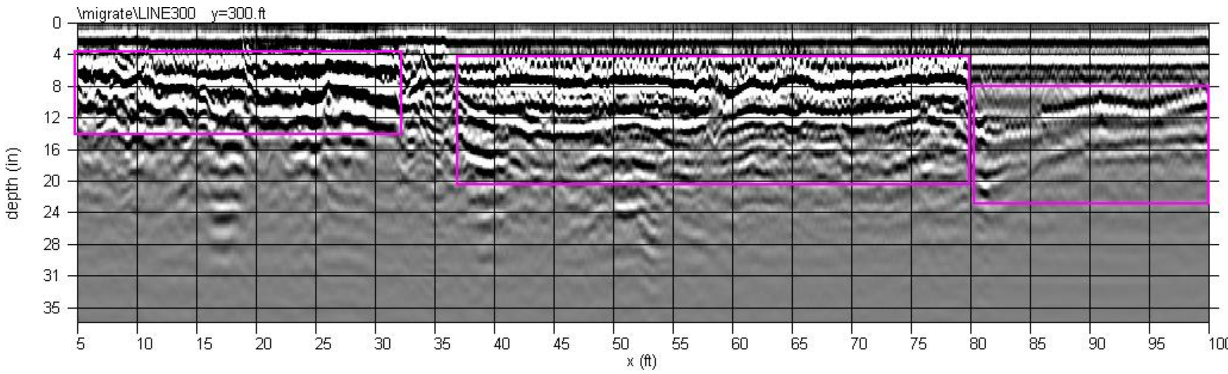


Figure 20. GPR data profile of Line 300N collected east-west. The western end of the line is on the left (5 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate strong reflections that could be associated with de-laminations and/or suspected voids.

Line 310N was collected in an east-west direction between station 0E and 100E (see Figure 21 below). The thickness of the concrete within a former building foundation is at least 8 to 10 inches from 36E to 100E. De-lamination and/or suspected voids may exist throughout the line.

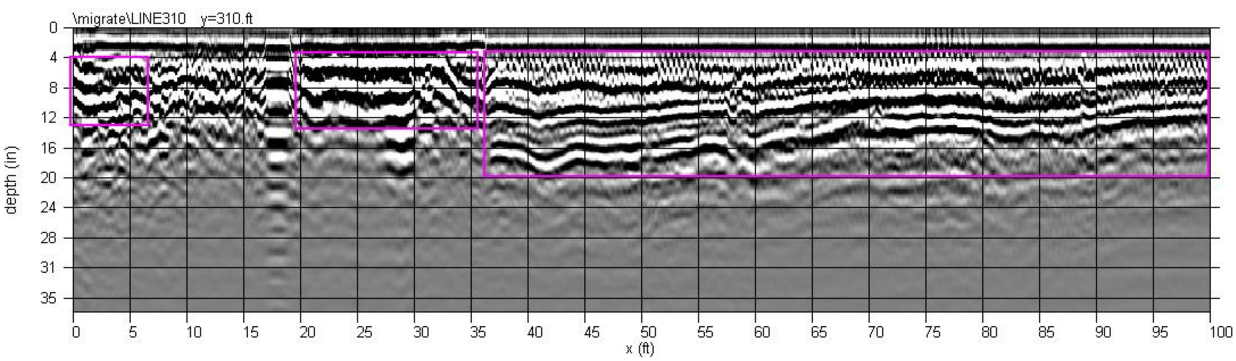


Figure 21. GPR data profile of Line 310N collected east-west. The western end of the line is on the left (0 ft) and the eastern end of the line is on the right (100 ft). The pink rectangles indicate the strong reflections that could be associated with de-laminations and/or suspected voids.

Two north-south transects were collected along 30E and 70E on the grid (see Appendix B). The length of each transect is 310 feet. The locations of suspected voids are highlighted with pink rectangles. After reviewing all profiles, the locations of suspected voids as well as de-laminations and anomalous features were plotted on the map (Plate 2).

5.4 Area 4

Ten east-west transects were collected at the east side of the South Boat Slip and ten north-south transects were collected at the south side of the slip within approximately 210 by 280-foot L-shaped area. The area of investigation contains raised former building foundations, rough surfaces due to portions of the area being covered with vegetations/debris, and indications of subsurface utilities, such as catch basins, manhole covers, and trenches. The area was encroached upon by chain-link fences for an access driveway along the eastern portion of the site.

All GPR profiles were inspected for concrete thickness and suspected voids as demonstrated in 5.2 Area 3. The locations of suspected voids were indicated on Plate 3.

The average concrete thickness of this area is estimated to be around 8 inches, with the exception of the two octagonal foundations at the southwest corner of the site, which have a concrete thickness of approximately 12 inches, and the foundation along the southern edge that is about 10 inches thick.

5.5 Area 6

One north-south transect, designated Line "D", was collected across the area parallel to and about 100 feet east of the shoreline (see Plate 4). The line is 690 feet with two line breaks. The primary purpose of this investigation was to search for subsurface utilities using the GPR. The locations of suspected voids in concrete-paved areas are also indicated on the map. The area of investigation along the line had an open and smooth surface, with the exception of the Northwest Corner Area that was covered.

The first section is 430 feet in length along a concrete paved area. The GPR profile revealed wire-mesh within the pavement, a trench-like feature at 26N, and suspected conduits at 57N, 73N, 95N, and 194N. The second section is 70 feet in length, between 470N and 540N, and is on a raised concrete pad. The thickness of the concrete pad is estimated to be about 10 to 12-inch with a 7-inch rebar spacing. The third section is 125 feet in length between 565N and 690N in the Northwest Corner Area. The locations of suspected voids were also indicated on the map.

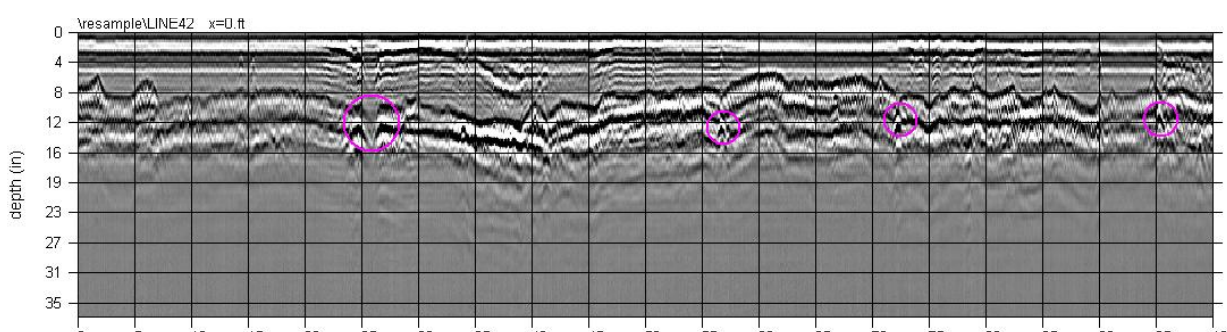


Figure 22. GPR data profiles of Line "D" collected north-south. The southern end of the line is on the left (0 ft) and the eastward to the right. The pink circles are suspected locations of conduits.

5.6 Area 7

One north-south transect, named Line "E", was collected parallel to existing Building 52, about 50 feet west of the exterior wall (see Plate 4). The line is 580 feet long, with a line break between 250N and 260N due to the presence of a chain-link fence. The primary targets of this area are thickness of concrete slabs and the locations of voids. The area of investigation along the line had an open and smooth surface. The average thickness of concrete pavement is estimated to be about 12-inch with wire-mesh from 0N to 250N, 260N to 382N, and 471N to 488N. The locations of suspected voids are depicted on the map.

5.7 Area 15

NAEVA opened a manhole cover (NYESPC; 661683.60, 787501.57) over the 48-inch storm drain, which is located near grid coordinates 100E/210N in Area 3, and inspected the interior for associated piping. Due to high tide, we were unable to observe the full extent of the vault. The Subsite utility locator, in conjunction with a transmitter beacon and fiberglass push rod, was utilized to delineate the pipe westward for approximately 80 feet to where a metal plate was placed over an open void near grid coordinates 5E/210N in Area 3. In a similar fashion, the line was traced eastward for approximately 100 feet through a catch basin (NYESPC; 661778.40, 787502.02) in front of the former Buildings 72 and 72A (see Plate 2). No traceable signal was obtained within the foundation of the former buildings, which may suggest the pipe may be of a metal construction or the transmitting signal could be interfered with by the foundation. The storm drain probably continues eastward beneath the foundation to a metal plate located east of the foundation. It would be prudent to conduct visual inspections beneath the metal plate and along the North Boat Slip shoreline for any evidence of the storm drain pipe.

In order to determine the usefulness of GPR for deeper targets, the Malå GPR system with a 250 MHz antenna was utilized to collect the data over the known location of the storm drain. Unfortunately, the instrument was unable to detect the pipe due to poor penetration of the GPR's signal around this area. The signal penetration was estimated to be less than 3 feet. This could be caused by conductive subsurface fill materials and the probability of groundwater with elevated salinity.

5.8 Area 19

Eleven east-west transects and two north-south transects were collected within an approximately 50 by 50-foot area encompassing large metal plates, which were placed over a vault. The primary target of this area was to delineate the extent of the vault using GPR. The area of investigation was surrounded by chain-link fences, which restricted our ability to collect GPR data. The ground surface to the west side of the plates is covered with gravel. Each GPR profile was inspected for indication of suspected voids, which may intern represent the extent of the vault (see Plate 5). The map revealed that the vault was estimated to be approximately 25 by 30 feet in size. The average concrete thickness of this area is estimated to be about 8 inches.

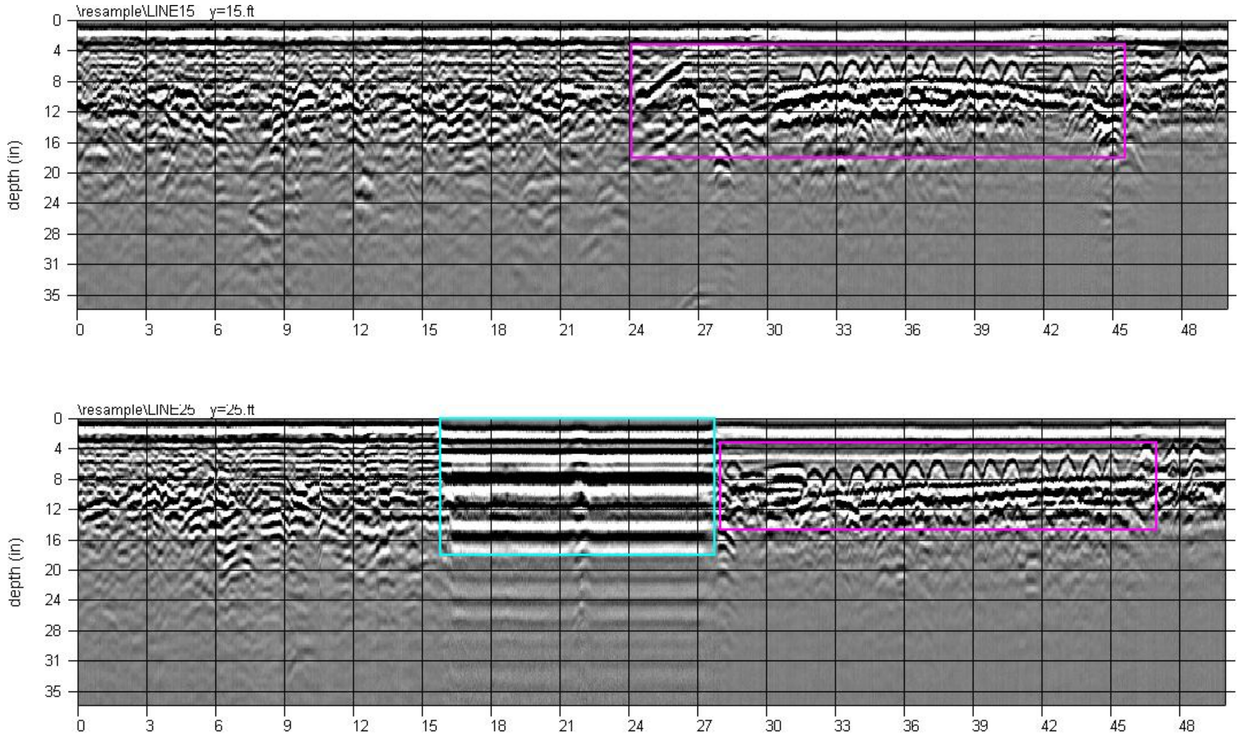


Figure 23. GPR data profiles of Line 15N (top) and 25N (bottom) collected east-west. The western ends of the lines are on the left (0 ft) and the eastern ends of the lines are on the right (50 ft). The pink rectangles indicate strong reflections that may indicate the vault. The blue rectangle is the GPR data profile collected over the metal plate.

5.9 Conclusion

For the concrete thickness investigation, the high-frequency (1,000 MHz) GPR seems to be effective in areas of smooth and clean pavement. Because of its cart-mounted configuration, the high frequency GPR data collection is not effective over areas covered by gravel, construction debris, vegetation, or loose soil. Rough surface conditions contribute to a reduction in signal strength due to poor ground coupling effect. Furthermore, when the rebar spacing is less than about 6 inches or an uneven burial depth disturbs the image beneath the rebar, it is difficult to determine the concrete thickness.

For the void investigation, we feel the results indicate that high-frequency GPR cannot be used to confidently delineate voids at this site. While large portions of the areas of investigation may contain voids, as indicated in the data profiles, there is still significant uncertainty as to whether these strong reflections are caused by voids or are coming from the bottom of concrete. It is the contrast in relative dielectric constant between adjacent layers that give rise to reflection of the GPR's signal, but considering the expected variety of subsurface fill materials emplaced at this site over its long history, the process is quite complicated. NAEVA believes that without the collection of a large number of contemporaneous concrete cores for verifications, the potential for misidentification outweighs the usefulness of this technique.

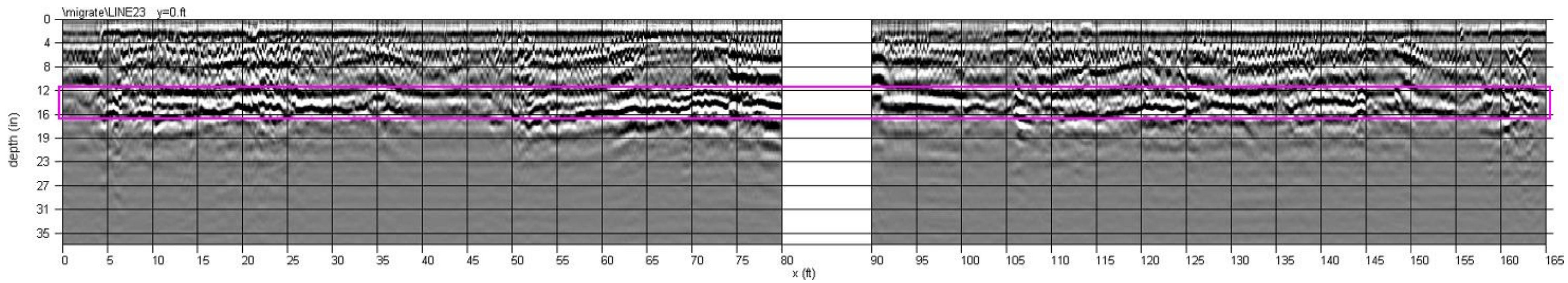
For the utility investigation, our brief usage of the lower-frequency (250 MHz) GPR in Area 15, as well as our general experiences of the GPR data over steel reinforced concrete, suggested that the instrument is likely ineffective at this site. As mentioned during the teleconference, the GPR's depth of penetration is affected by site conditions such as the near-surface soil type, ground surface material, soil conductivity, and soil moisture. In general, better results are expected in dry, resistive, sandy soils than in wet, clayey, conductive ones. The subsurface conditions at this site limited the 250 MHz antenna's depth of penetration to be roughly less than 3 feet.

Utilities that have accessible surface exposures, such as manhole access, catch basins, fire hydrants, valves, etc., can probably be delineated, at least in part, by using standard electromagnetic utility-locating instruments. It should be noted that the utility-locating instruments rely upon the detection of an induced radio-frequency signal, which can sometimes be interfered with by the steel reinforcement in concrete pavement.

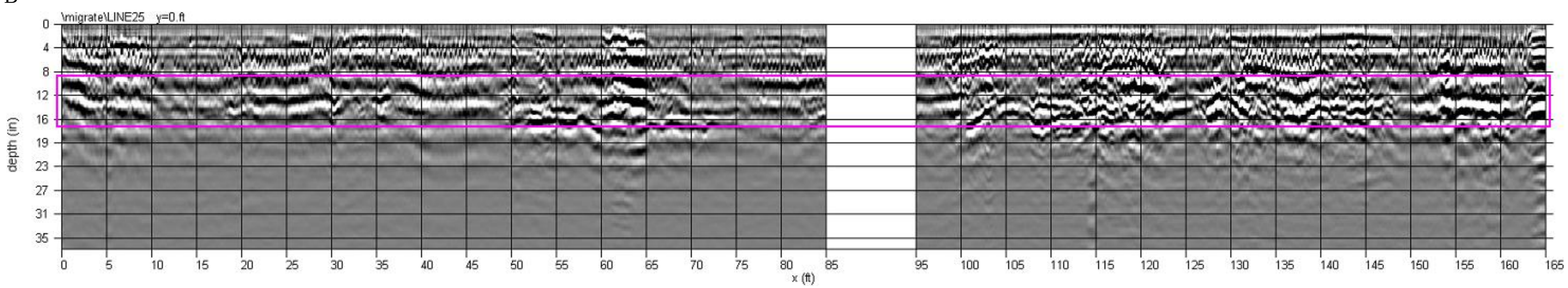
In conclusion, NAEVA is uncertain whether enough useful information is likely to be obtained to justify the expense of proceeding with the full scale survey based upon the results of this pilot program. We think that coring and video inspection, when that is allowable, may provide a sufficiently accurate and quantitative analysis of the site regarding concrete thickness, rebar spacing, and voids, particularly in areas with the potential for large and extensive voids, such as in Areas 1, 3, and 4. At this time, it may be reasonable to utilize high-frequency radar at inland locations to reduce or focus coring activities.

Appendix A: **GPR Profiles in Area 1**

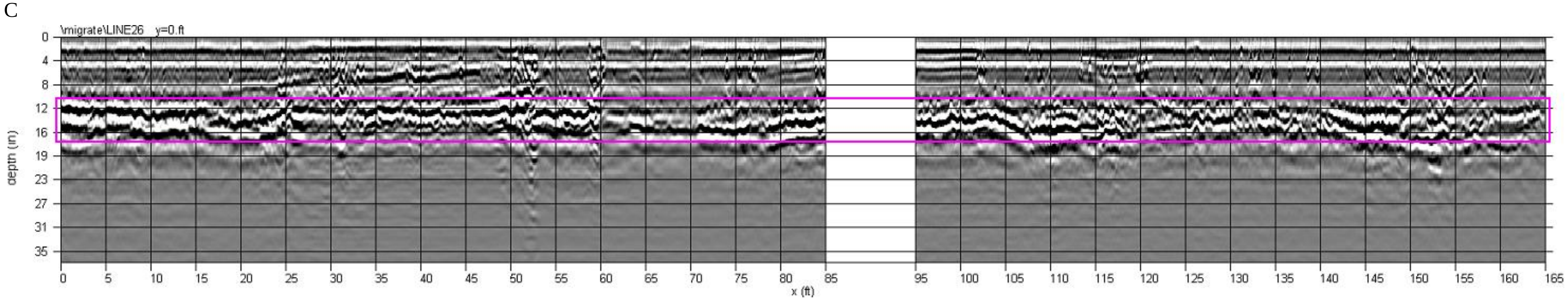
Line A



Line B



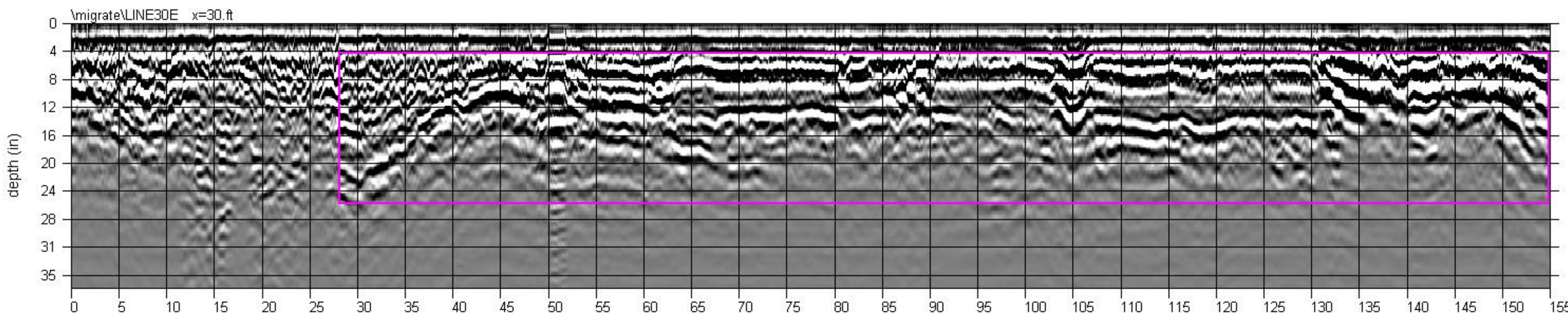
Line C



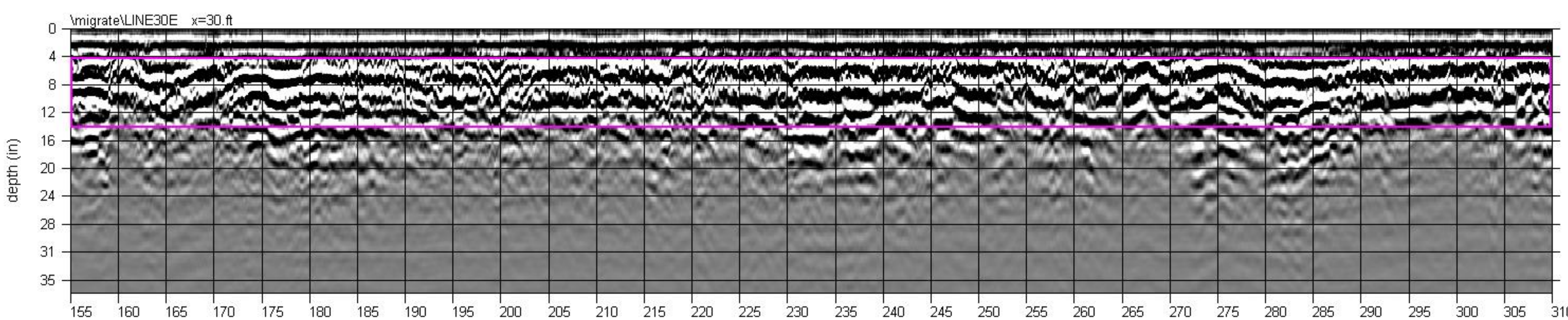
GPR data profiles collected in Area 1. The western end of each line is on the left (0 ft) and the eastern end of each line is on the right (165 ft). The pink rectangles indicate the areas of strong reflections that could be interpreted as suspected locations of voids.

Appendix B: GPR Profiles in Area 3

Line 30E 0N to 155N



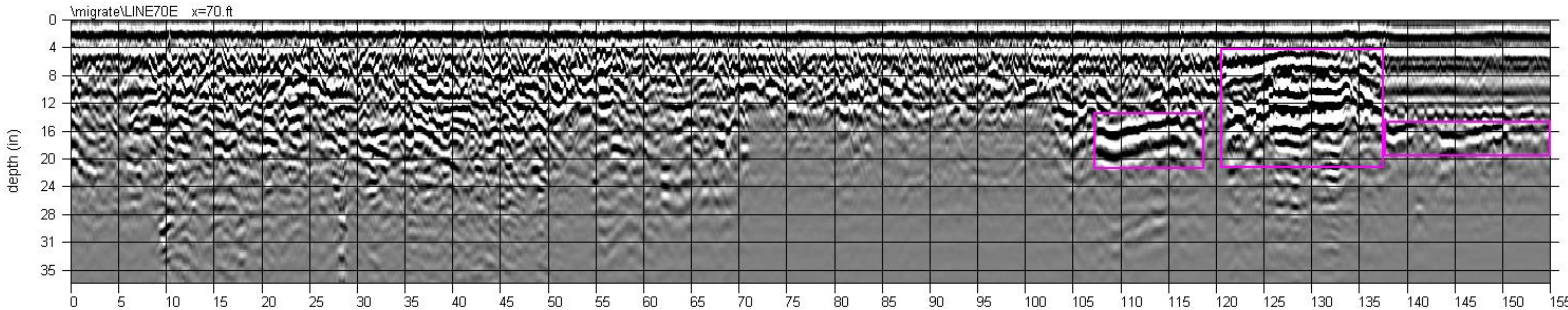
Line 30E 155N to 310N



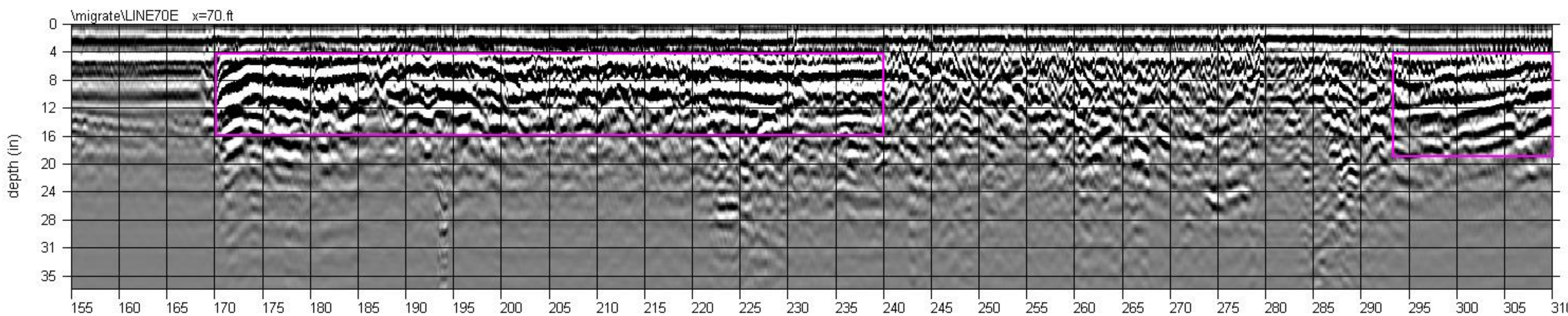
GPR data profiles collected in Area 3. The southern end of the line is 0N and the northern end of the line is 310N. The pink rectangles indicate the areas of strong reflections that could be interpreted as suspected locations of voids.

Appendix B: **Continued**

Line 70E 0N to 155N



Line 70E 155N to 310N



GPR data profiles collected in Area 3. The southern end of the line is 0N and the northern end of the line is 310N. The pink rectangles indicate the areas of strong reflections that could be interpreted as suspected locations of voids.

LEGEND

	gpr transect		fire hydrant
	suspected voids		catch basin
	suspected voids (weak reflection)		manhole cover
st	storm sewer line		catch basin
	chain-link fence		

N

30 15 0 15 30 ft

Scale: One inch equals approximately thirty feet

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Plate 1: Results of Geophysical Investigations in Area 1
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Client	Antea Group	Date of Work	April 29, 2013
Project No.	C1304291H	Map By	Alec D. Kurowski

ALL UNDERGROUND FACILITIES MAY NOT BE DEPICTED ON THIS MAP

LEGEND

gpr transect		fire hydrant	
suspected voids		catch basin	
suspected voids (weak reflection)		manhole cover	
storm sewer line (st)		catch basin	
chain-link fence			

N

20 10 0 10 20 ft

Scale: One inch equals approximately twenty feet

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(845) 268-1802 FAX

Plate 2: Results of Geophysical Investigations in Area 3 & 15
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Client	Antea Group	Date of Work	April 29, 2013
Project No.	C1304291H	Map By	Alec D. Kurowski

ALL UNDERGROUND FACILITIES MAY NOT BE DEPICTED ON THIS MAP

LEGEND

	gpr transect		fire hydrant
	suspected voids		catch basin
	suspected voids (weak reflection)		manhole cover
st	storm sewer line		catch basin
	chain-link fence		monitoring well

20 10 0 10 20 ft

Scale: One inch equals approximately twenty feet

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Plate 3: Results of Geophysical Investigations in Area 4
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Client	Antea Group	Date of Work	April 29, 2013
Project No.	C1304291H	Map By	Alec D. Kurowski

ALL UNDERGROUND FACILITIES MAY NOT BE DEPICTED ON THIS MAP

LEGEND

	gpr transect		suspected utility on gpr profile
	suspected voids		catch basin
	suspected voids (weak reflection)		manhole cover
st	storm sewer line		catch basin
	chain-link fence		monitoring well

40 20 0 20 40 ft
Scale: One inch equals approximately forty feet

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Plate 4: Results of Geophysical Investigations in Area 6 & 7
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Client	Antea Group	Date of Work	April 29, 2013
Project No.	C1304291H	Map By	Alec D. Kurowski

ALL UNDERGROUND FACILITIES MAY NOT BE DEPICTED ON THIS MAP

LEGEND

gpr transect

suspected voids

suspected voids (weak reflection)

chain-link fence

10 5 0 5 10 ft

Scale: One inch equals approximately ten feet

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Plate 5: Results of Geophysical Investigations in Area 19
Former Anaconda Wire & Cable Company
1 River Street, Hastings-on-Hudson, New York

Client	Antea Group	Date of Work	April 29, 2013
Project No.	C1304291H	Map By	Alec D. Kurowski

ALL UNDERGROUND FACILITIES MAY NOT BE DEPICTED ON THIS MAP