

***Ground Penetrating Radar Survey at Sibley Mill in
Augusta, Richmond County, Georgia***



***LAMAR Institute Publication Series,
Report Number 194***

Savannah, Georgia

2014

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The LAMAR Institute, Inc.

Savannah, Georgia

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Introduction

In May 2014, the LAMAR Institute was retained by the Augusta Canal Authority and Cardno ENTRIX, Inc. to conduct Ground Penetrating Radar (GPR) survey on portions of the historic Sibley Mill property in Augusta, Richmond County, Georgia. This report details the background, methods and results of the GPR survey.

The Sibley Mill study property is located in the Harrisburg community in northern Augusta, Richmond County, Georgia (Figure 1). It is located on the east bank of the Augusta Canal, west of the Savannah River and north of King Mill. It is flanked on the west side by Goodrich Street. River Watch Parkway bisects the tract just west of the mill complex.

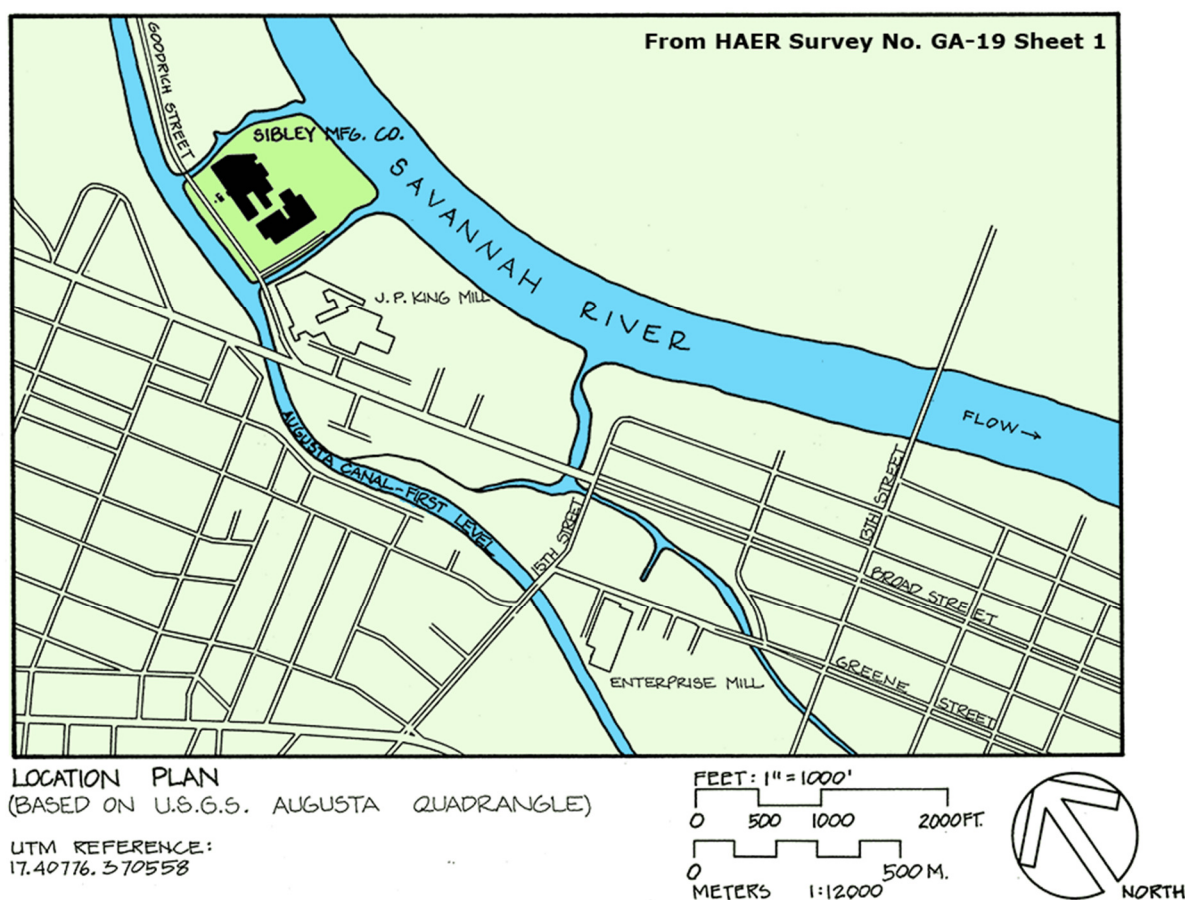


Figure 1. Project Location.

Surface conditions in the study area varied greatly. Most of the mill complex is occupied by mill buildings and no GPR survey was attempted within any buildings. Several large asphalt and concrete parking lots occupy the front of the property. A series of access roads and vacant areas within the mill complex are covered with a mix of asphalt and concrete surfaces. The front of the original mill complex is marked by narrow strand of grassy lawn.

The Augusta Canal is a prominent landscape feature in the Sibley Mill study area. The canal was built in 1845 and the first factory on the Augusta Canal was constructed in 1847. In 1872, the canal was widened and deepened. Construction began on the Sibley Mill textile complex in 1880 and it was completed in 1882. This mill, with various expansions and additions, continued in operation until 2006.

An earlier Confederate Powder Works had been constructed at the same site as Sibley Mill in 1861-1862 (Rains 1882; Bragg et al. 2007). The large chimney is the only architectural remnant of that expansive Confederate military stores factory, which stretched for two miles along the Savannah River and included 26 buildings. This chimney was part of the refinery building (Figure 2). The Confederate facility, in turn, was constructed on the site of the United States Arsenal, -which operated at this location from about 1816-1826. No remains from the United States Arsenal have been identified. The arsenal changed locations in 1826-1827 from near the Savannah River and the Augusta Canal to a more upland setting in Augusta's Summerville community.

In 1956, the Georgia Historical Commission erected a historical marker commemorating "The Augusta Arsenal" at its post-1826 location. The marker text noted that, "An 'arsenal at Augusta' to aid the state in resisting invasion was originally provided for by President George Washington in 1793" and that, "In 1816 a U.S. Arsenal was established on the Savannah River where the King Mill is now located, but the garrison having been wiped out in 1819 by 'black fever,' it was removed to this site [on Walton Way] in 1827" (Georgia Historical Commission 1956).

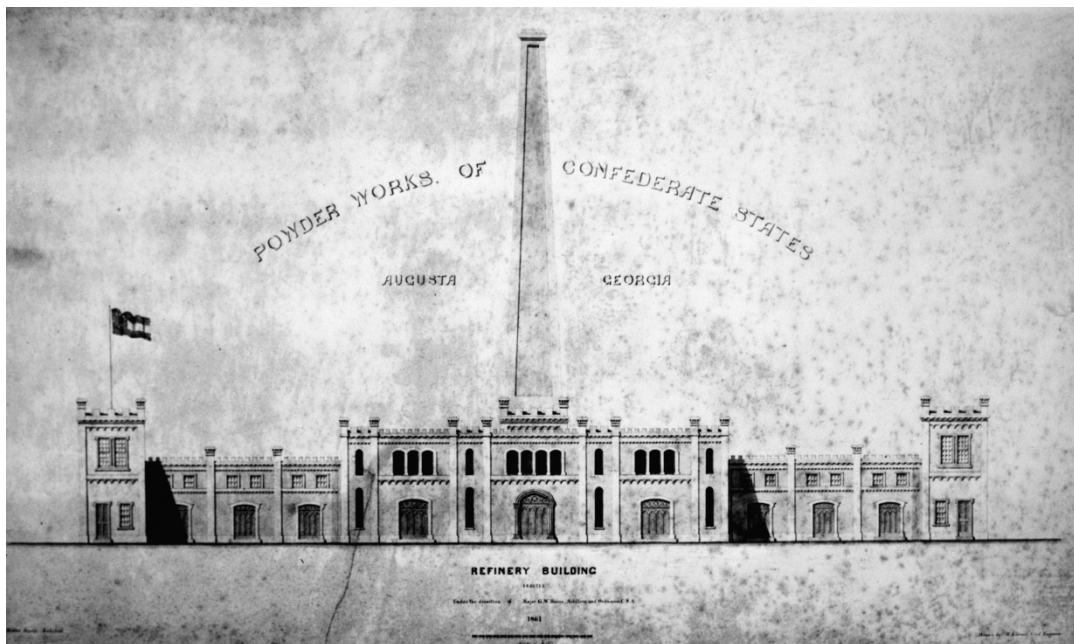


Figure 2. Confederate Powder Works, Plan of Front Facade, 1861.

Newspaper articles from 1880 attest to U.S. Army use of the Sibley Mill property in the early nineteenth century. An 1880 Columbus, Georgia newspaper provided this account of discoveries during the mill construction:

“—Augusta News: ‘Mr. Edwin Philip, one of the surveyors at the Sibley mills, and a son of the late Wm Philip, for many years city surveyor of the Augusta canal, lays upon our table several interesting relics found while digging for the foundation of the mills. In the collection are specimens of the original stone tomahawk used by the Indians, and also the iron or double bladed tomahawk furnished the Indian allies by the English government. Besides these Indian relics, and most interesting, perhaps, were found the graves, coffins and skeletons of soldiers. These remains are identified as soldiers of the American army by the buttons found among the bones in the graves. Thus, for instance, one button is marked ‘LA., 1,’ encircled with stars, denoting that the wearer of the uniform belonged to the first corps of light artillery. Another button has an artillery representation of cannon with mounted eagle, and the word ‘corps’ underneath, plainly showing the soldier, whose record is written on a brass button found with his ashes and crumbling bones, was a brave cannoneer of the revolution. Another button again is marked ‘rifle corps,’ with thirteen stars, showing the wearer to have hailed from one of the original thirteen states. Several buttons are marked in this manner, showing plainly that they were American soldiers. Several old flints and a number of bullets have been picked up underground showing that the line of fire was warm around Augusta and the old fort on the Savannah. One flattened bullet was found among the bones of one poor soldier, proving itself the instrument of death in his case. The graves of quite a number were unearthed and one of the decayed coffins was marked with brass tacks in the shape of an ‘I,’ denoting in all probability the initial letter of some officer of rank. The crumbling bones of these dead heroes were gathered together and buried by the workmen of the mill, while the souvenirs are kept in remembrance of the struggles of our ancestors for independence, and as silent echoes from the buried past to remind the present day and time that earthly work and glory is but an offering to oblivion and destined to perish in the forgetfulness of the future, leaving but footprints on the sands of time to be traced and wondered at in turn by peoples and ages to come” (Columbus Daily Enquirer 1880:3).

Another account of the same discovery from the Macon Weekly Telegraph (1880a:6) provides additional details of the discovery, “Six graves of Confederate soldiers were excavated yesterday while working on the Sibley mills foundation, at the old Powder mills site. The bones and bullets found are themselves held as souvenirs of the buried and lost cause for which these brave men died and the once world-famous walls of the Powder mills rose and fell”. From the Macon Weekly Telegraph (1880b:1) we learn additional information on this discovery: “Augusta News: Mr. E.G. Phillips brought to this office Wednesday quite a collection of Indian relics, gathered in digging about the foundation of the Sibley mills. Immediately on the river bank while digging at a depth of five feet, the workmen came upon the remains of an Indian camp fire; the charcoal from the fire was found in considerable piles. Scattered about were pieces of pottery, arrow heads, bullets, some flattened out and others round, and among them a small earthenware vial. Near the same spot were found a lot of grape and canister shots, which are supposed to have been left by the British during the revolutionary war. There were, also, several cut and hand made nails found. Mr. Phillips has now quite a museum of curiosities taken from this spot, every one of which is of more or less historical”.

Taken collectively these three newspaper accounts from 1880 indicate that the construction of the Sibley Mill foundation disturbed prehistoric and historic period archaeological deposits including stone tools, European trade materials, early U.S. Army military artifacts (including ordnance and uniform

buttons from the 1st Light Artillery Corps (ca. 1808-1821), Federal Artillery corps (ca. 1814-1821) and the Rifle Corps (date undetermined). At least six military graves (U.S. Army and possibly Confederate) were disturbed. None of the buttons described in 1880 date to the American Revolution or the American Civil War. The buttons that were described are consistent with the dates of the first United States arsenal at Augusta, ca. 1816-1826. Other than the vague locational description, “while digging for the foundation of the [Sibley] mills”, the precise location of these finds on the modern day landscape remains undetermined.

While operation of Sibley Mill ended in 2006, national recognition of the historic character of the Sibley Mill vicinity escalated as early as the 1970s. Figure 3 is an aerial view of Sibley Mill in operation in 1961 and Figure 4 shows a portion of a 1904 fire insurance map of the mill (NPS 1961; Sanborn Fire Insurance Company 1904). Sibley Mill was listed by the National Park Service in the National Register of Historic Places in 1975; registered as a National Historic Landmark in 1978, and elevated to be part of the first National Heritage Area in 1996. The architecture of Sibley Mill was documented by the Historic American Building Survey. The Sibley Mill property was purchased by the Augusta Canal Authority in 2010. - Sibley Mill and its surround landscape, however, has received no formal archaeological study with the exception of limited excavations within the powder works tower itself by archaeologist Mark Newell, which remains unreported (Tammy Herron personal communication May 29, 2014).



Figure 3. Perspective View of Sibley Mill in Operation (NPS 1961).

The GPR survey at Sibley Mill is the first documented archaeological investigation of the Sibley Mill property. Potential subsurface features in the project vicinity that were likely to be imaged by GPR survey included the following:-

- Prehistoric features and occupational layers-(The margin of the Savannah River at Augusta is rich with evidence of prehistoric life and the study area is highly likely to contain evidence of this occupation if any of those soil zones remain intact.)
- Human burials, including 19th century military graves
- Architectural remnants from the ca. 1816-1826 United States Arsenal
- Architectural remnants from the ca. 1861-1865 Confederate Powder Works
- Debris fields from after 1880 and the construction of Sibley Mill
- Modern (1880 and later) utility lines servicing the mill
- Soil deposits associated with the initial construction of the Augusta Canal in 1845 and its 1872 upgrade.

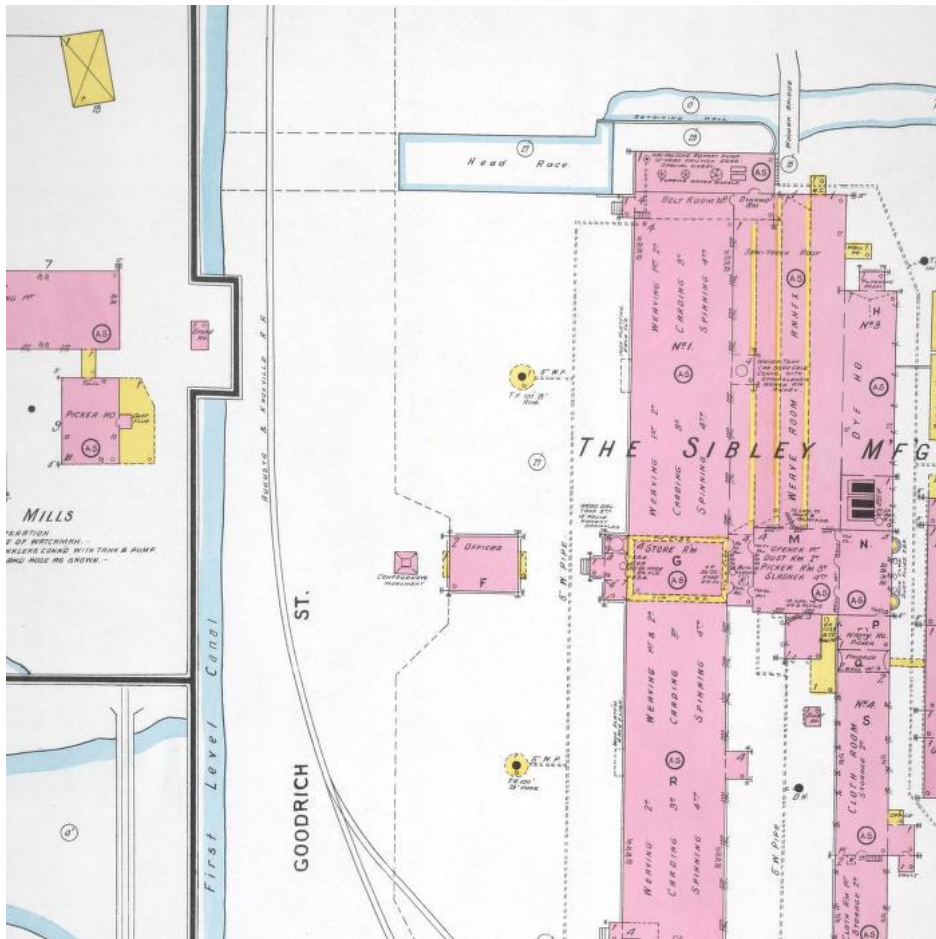


Figure 4. Portion of 1904 Sanborn Fire Insurance Map in the Vicinity of GPR Blocks A, D and E (Sanborn Fire Insurance Company 1904:Sheet 1).

Survey Methods

The LAMAR Institute's Ground Penetrating Radar (GPR) survey team examined four areas of the Sibley Mill complex on May 22 and 23, 2014. The project began with a meeting with Cardno Entrix's Senior Staff Archaeologist Garrett Silliman, Augusta Canal Authority staff Dayton Sherrouse and Billy Power, and LAMAR Institute researchers Daniel Elliott and Rita Folse Elliott. Mr. Sherrouse led the group on a tour of the building grounds and emphasized areas of concern for future development. Mr. Power provided key information on the location of buried utilities. Both men advised that no master plan of the underground utilities for the Sibley Mill complex exists. Mr. Power did provide an early fire insurance map that depicted the location of buried water lines for fire protection services.

The equipment used for the GPR survey consisted of a RAMAC/X3M Integrated Radar Control Unit, mounted on a wheeled-cart and linked to a RAMAC XV11 Monitor (Firmware, Version 3.2.36). Both 500 and 800 megahertz (MHz) shielded antenna were used for the data gathering. MALÅ GeoScience's Ground Vision software (Version 1.4.6) was used to acquire and record the radar data (MALÅ GeoScience USA 2006). The radar information was displayed as a series of radargrams. Output from the survey was first viewed using GroundVision. This provided immediate feedback about the suitability of GPR survey in the area and the effective operation of the equipment. GPR-Slice software (Version 7.0) was used in post-processing the data (Goodman 2014).

The same RAMAC X3M GPR system as that used in the present study has been used successfully by the author on numerous archaeological sites in the southeastern United States. The methods employed for the GPR survey were consistent with similar projects conducted by the LAMAR Institute.

Ground Penetrating Radar (GPR) is an important remote-sensing tool used by archaeologists (Conyers and Goodman 1997; Conyers 2012). The technology is particularly effective in mapping historic cemeteries. The technology uses high frequency electromagnetic waves (microwaves) to acquire subsurface data. The device uses a transmitter antenna and closely spaced receiver antenna to detect changes in electromagnetic properties beneath them. The antennas are suspended just above the ground surface and are shielded to eliminate interference from sources other than directly beneath the device. The transmitting antenna emits a series of electromagnetic microwaves, which are distorted by differences in soil conductivity, dielectric permittivity and magnetic permeability. The receiving antenna records the reflected waves for a specified length of time (in nanoseconds, or ns). The approximate depth of an object can be estimated with GPR, by adjusting for electromagnetic propagation conditions.

The GPR samples in this study area were composed of a series of parallel transects, or traverses, which yielded a two-dimensional cross-section or profile of the radar data. These samples are termed radargrams. This two-dimensional image is constructed from a sequence of thousands of individual radar traces. A succession of radar traces bouncing off a large buried object will produce a hyperbola, when viewed graphically in profile. Multiple large objects that are in close proximity may produce multiple, overlapping hyperbolas, which are more difficult to interpret.

The GPR signals that are captured by the receiving antenna are recorded as an array of numerals, which can be converted to gray scale (or color) pixel values. The radargrams are essentially a vertical map of

the radar reflection off objects and other soil anomalies. It is not an actual map of the objects. The radargram is produced in real time and is viewable on a computer monitor, mounted on the GPR cart.

GPR has been successfully used for archaeological and forensic anthropological applications to locate relatively shallow features, although the technique also can probe deeply into the ground. The machine is adjusted to probe to the depth of interest by the use of different frequency range antennas. Higher frequency antennas are more useful at shallow depths, which is most often the case in archaeology. Also, the longer the receiving antenna is set to receive GPR signals, the deeper the search. The effectiveness of GPR in various environments on the North American continent is widely variable and depends on solid conductivity, metallic content, and other pedo-chemical factors.

GPR signals cannot penetrate large metal objects and the signals are also significantly affected by the presence of salt water. Although radar does not penetrate metal objects, it does generate a distinctive signal that is usually recognizable, particularly for larger metal objects, such as a cast iron cannon or man-hole cover. The signal beneath these objects is often canceled out, which results in a pattern of horizontal lines on the radargram. For smaller objects, such as a scatter of nails, the signal may ricochet from the objects and produce a confusing signal. Rebar-reinforced concrete, as another example, generates an unmistakable radar pattern of rippled lines on the radargram.

Upon arrival at the site the RAMAC X3M Radar Unit was set up for the operation and calibrated. Several trial runs were made on parts of the site to test the machine's effectiveness in the site's soils. The time window that was selected allowed data gathering to focus in the soil the zone most likely to yield archaeological deposits. Additional filters were used to refine the radar information during post-processing. These include adjustments to the gain. These alterations to the data are reversible, however, and do not affect the original data that was collected.

Four areas of the Sibley Mill property were sampled by GPR survey (Figure 5). These included the main parking lot (Block A), Front lawn (Block D), Confederate Powder Factory Tower (Block E) and rear of main mill building (Block F). Plans for two additional samples (Blocks B and C) were scrapped due to lack of time. Those prospective survey areas were located south of the main mill building and west of Block F.

Block A measured 50 meters north-south by 33 meters east-west. This block was flanked on the west by Goodrich Street, on the east by a chain link fence, and separated several meters from Block D. A section of the Augusta Canal is located several meters north of the survey block. -The Sibley Mill "Smoke house", a late twentieth century building for employee congregating, helped establish the southern boundary of Block A. UTM coordinates for the southwestern corner of Block A were Zone 17, 407787.6E, 3705732.7N (NAD83). Sixty-seven radargrams, which totaled 3310.3m in length, were collected within this block. Figure 6 shows a plan of the radargram coverage in all - four GPR sample blocks.

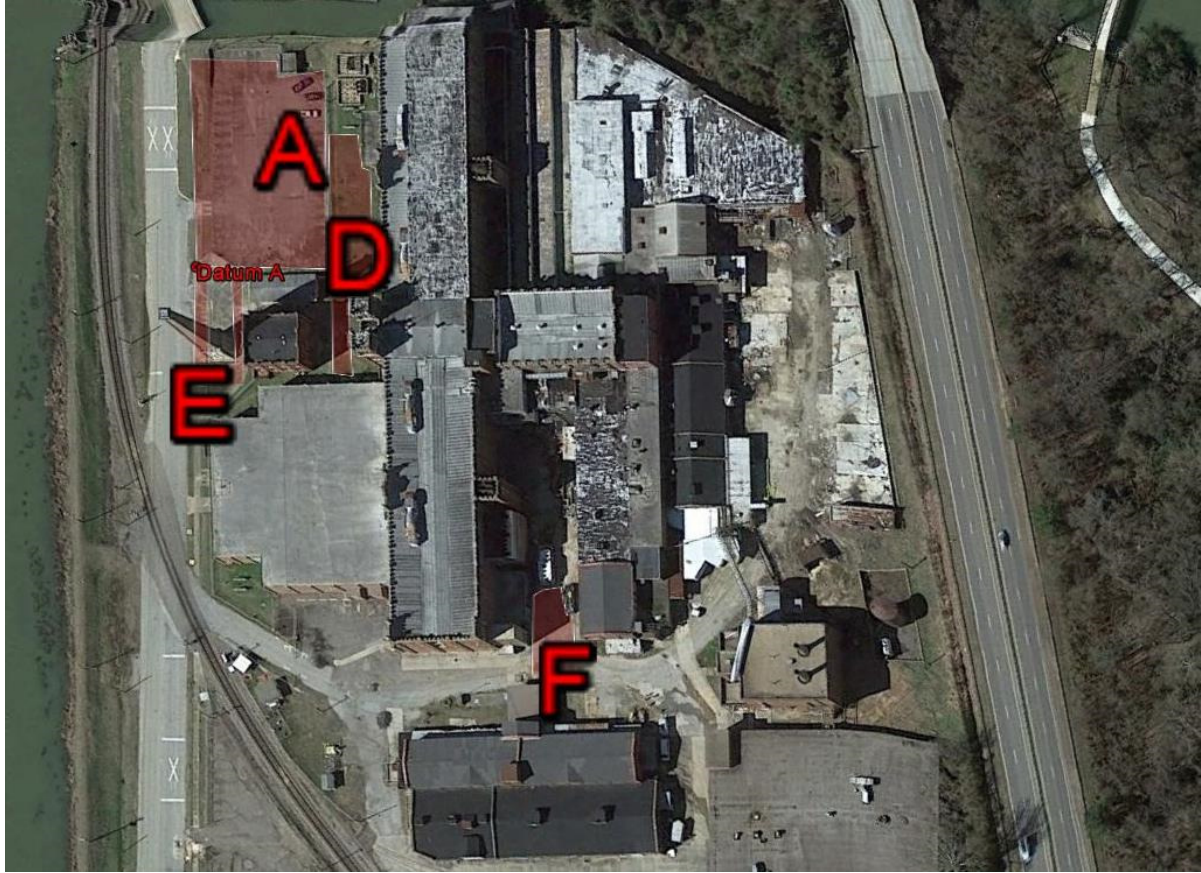
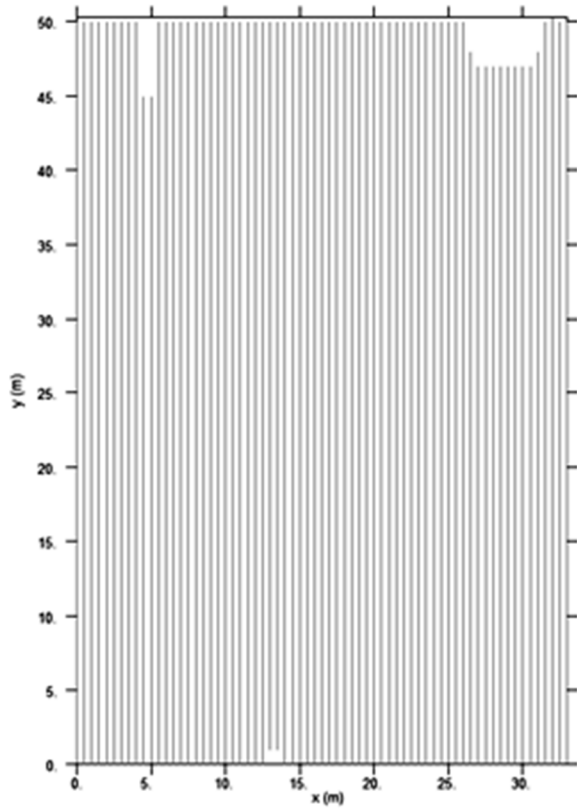


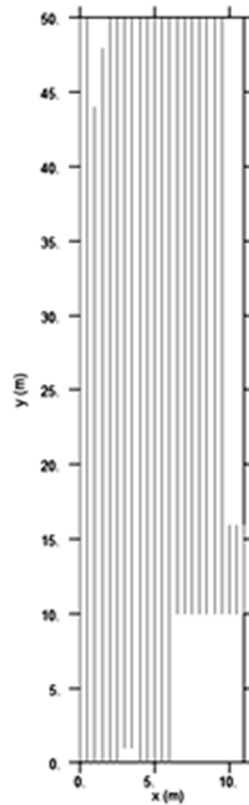
Figure 5. Sibley Mill, GPR Study Locations (Google Earth 2014).

Block D measured 50 meters north-south by 11 meters east-west. Twenty-three radargrams, which totaled 938 m in length, were collected within Block D. This sample covered the grassy lawn in front of the original Sibley Mill building. The southern part of Block D contained a wide concrete walkway leading to the front entrance of the mill. The northern end of Block D contained several large obstacles. The eastern edge of Block D was marked by a steep slope and the western side of Block D was defined by the chain link fence. Two fire hydrants were located within Block D. UTM coordinates for the southwestern corner of Block D were 407831.6E, 3705729.6N.

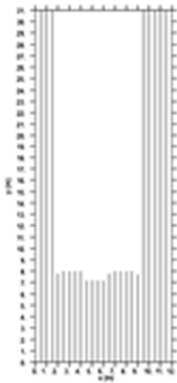
Block E measured 31 meters north-south by 12 meters east-west. Twenty-five radargrams, which totaled 426.1 m in length, were collected in Block E. It was U-shaped and surrounded three sides (west, south and east) of the Confederate Powder Factory tower. The tower is protected on its perimeter by large iron guard rails. Block E was covered by concrete pavement. UTM coordinates for the southwestern corner of Block E were 407807.2E, 3705705.3N.



Block A



Block D



Block E



Block F

Figure 6. Radargram Coverage Plan of GPR Blocks A, D, E and F, Sibley Mill.

Block F measured 21 meters north-south by 10 meters east-west. This block examined the area to the southeast of the main mill building. A large houseboat and other large pieces of metal debris limited access to this interior space for GPR survey. Approximate UTM coordinates for the southwestern corner

of Block F were 407920E, 3705698.5N. Twenty-one radargrams, which totalled 394.7 m in length, were collected in Block F.

Radar equipment settings and configurations for all four blocks were as follows:

- 50 cm spacing of radargrams
- Collection from grid south to grid north and progress from west to east
- Collection of 512 samples per trace
- 500 MHz shielded antenna
- Sampling frequency-7751.11
- Time window—62.2 ns
- Antenna separation- 0.18 m
- Trigger, ping interval- 0.02 m
- Stacks—4
- Estimated soil velocity—60 for Blocks A, E and F and 70 for Block D

Results of the GPR Survey

GPR Block A

GPR Block A was the largest sample collected by the survey team. The area is currently a large parking lot flanked by the sidewalk and Goodrich Street on the west and a chain link fence to the right. The survey block began just north of the “Smoke house” and continued to an area south of the Augusta Canal. An area of cement pavement on the southwestern side of the sample displayed sharp contrast to the rest of the parking lot, which is paved with asphalt. Mr. Power noted that, based on his observations during past utility work at Sibley Mill, this parking lot contains several layers of pavement.

An active sewer system is located in the center of the parking lot and marked by two cast iron manhole covers. Many other utilities, including water and electric lines, service the mill building and crisscross Block A. As shown in Figures 7 and 8, the sewer system has obliterated many potential buried features within its catchment basin. The areas highlighted in green have an extremely low likelihood for yielding intact archaeological resources.

In the absence of any detailed maps showing the locations of the various utility ditches and without any ground-truthing, it is difficult to determine which linear radar reflections represent utility lines and which ones may represent other cultural features. One point is clear however, surveyors mapped no east-west anomalies that would have been directly perpendicular to the Sibley Mill building.

One large radar reflection was observed on the west-central portion of Block A that may have cultural significance (Figure 9-11). This anomaly measures more than 26 meters north-south and 1-2 meters east-west and is oriented nearly parallel to Goodrich Street, Sibley Mill and the Augusta Canal. The reflection originates at a depth of approximately 15-20 centimeters and showed no indications at the

ground surface. It is a strong radar reflection that repeats multiple times with depth. It may represent a massive architectural footing for a building. Since no buildings were located in this vicinity in association with Sibley Mill, it is quite likely that this anomaly is remnant of an earlier construction, possibly the Confederate Powder Works refinery. Alternatively, it may represent a large buried utility of more recent age. Such a determination would require verification through archaeological excavation and study of the surviving historical building plans for the Powder Works facility.

Figure 10 shows a composite view of radar reflections throughout Block A. This view is useful in understanding the totality of reflected radar energy in Block A. Two large areas displaying low reflections correspond to the sewer catchment areas described earlier. Figure 8 shows one isosurface view of Block A. Isosurfaces provide helpful graphics for understanding the three-dimensional characteristics of GPR information.

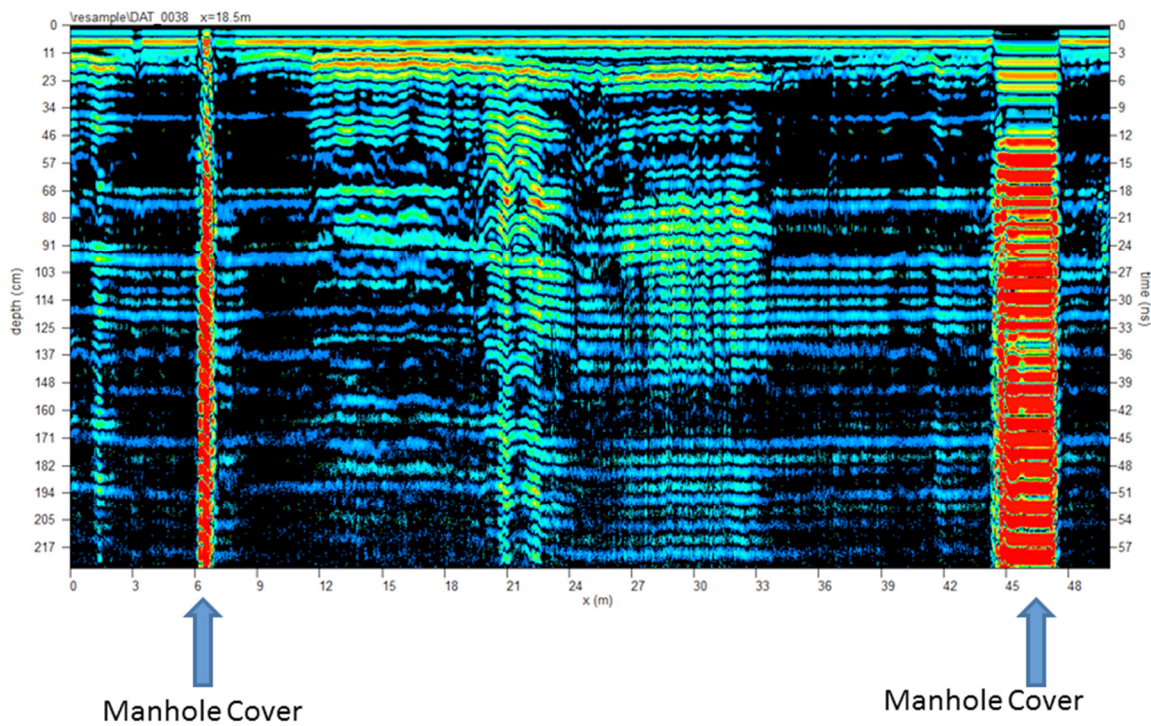


Figure 7. Radargram Showing Sewer Disturbance in Block A.

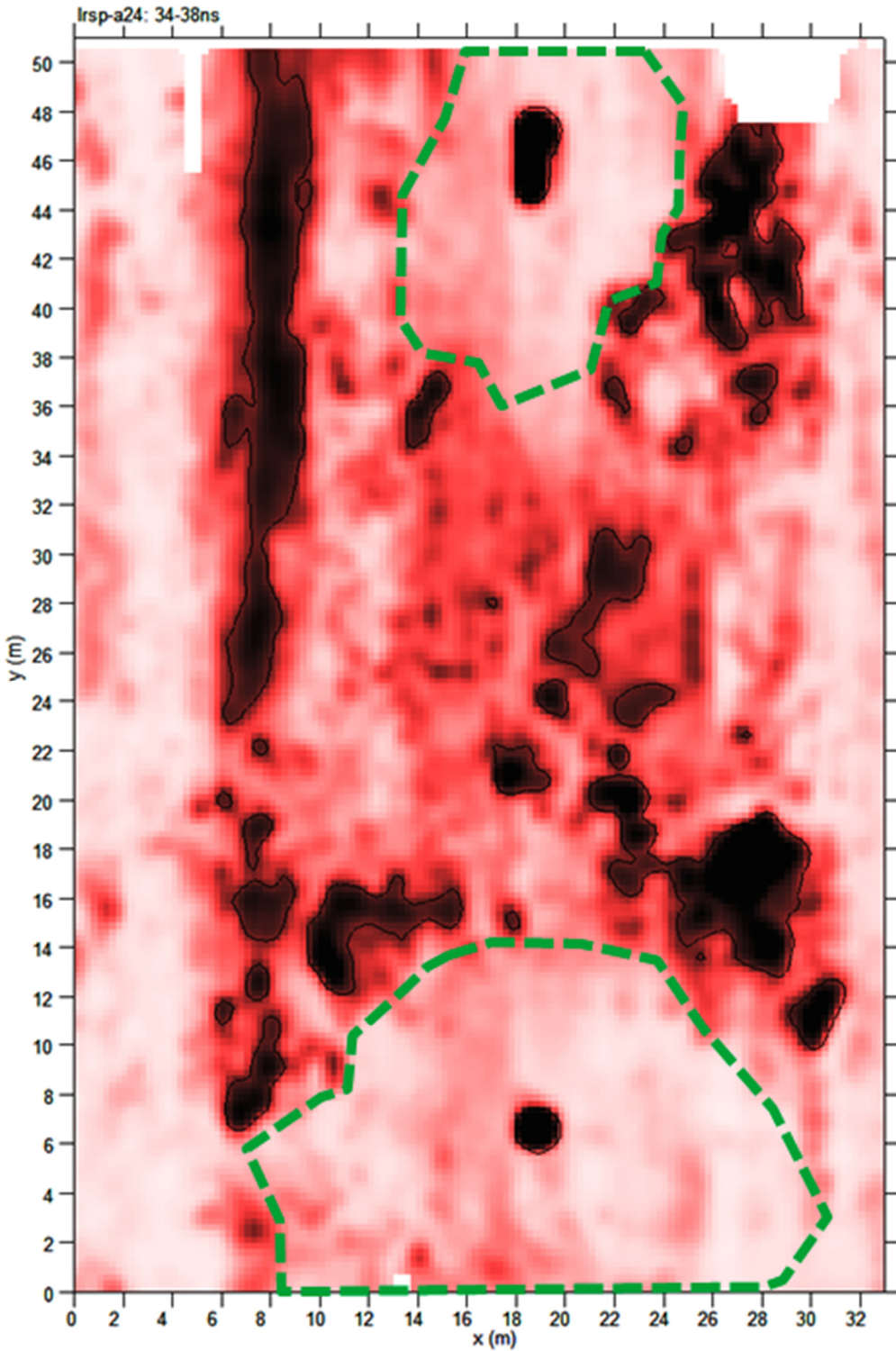


Figure 8. GPR Block A, Showing Sewer Disturbance (outlined in green).

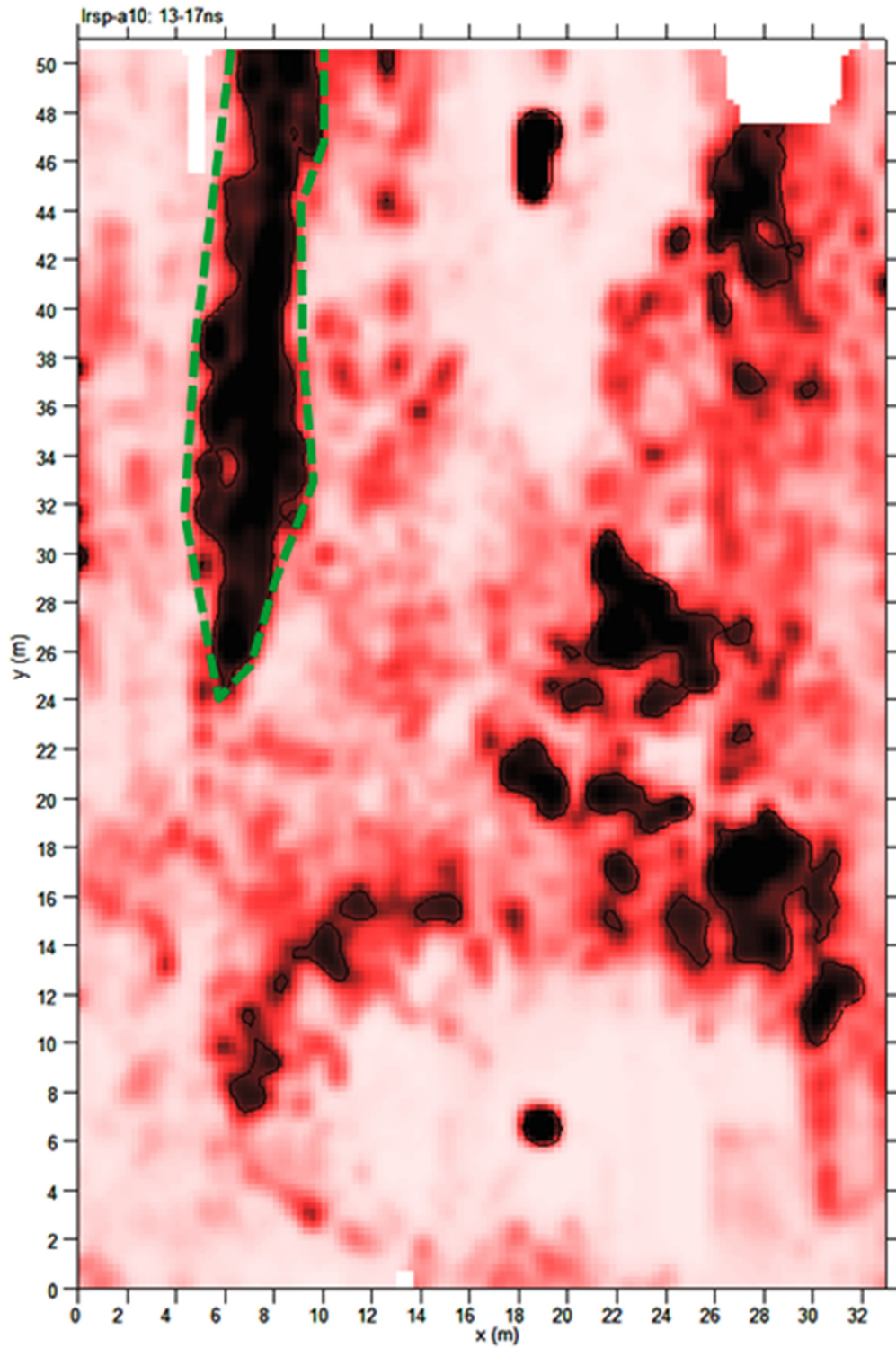


Figure 9. GPR Plan of Block A, Showing Large Linear Anomaly (outlined in green).

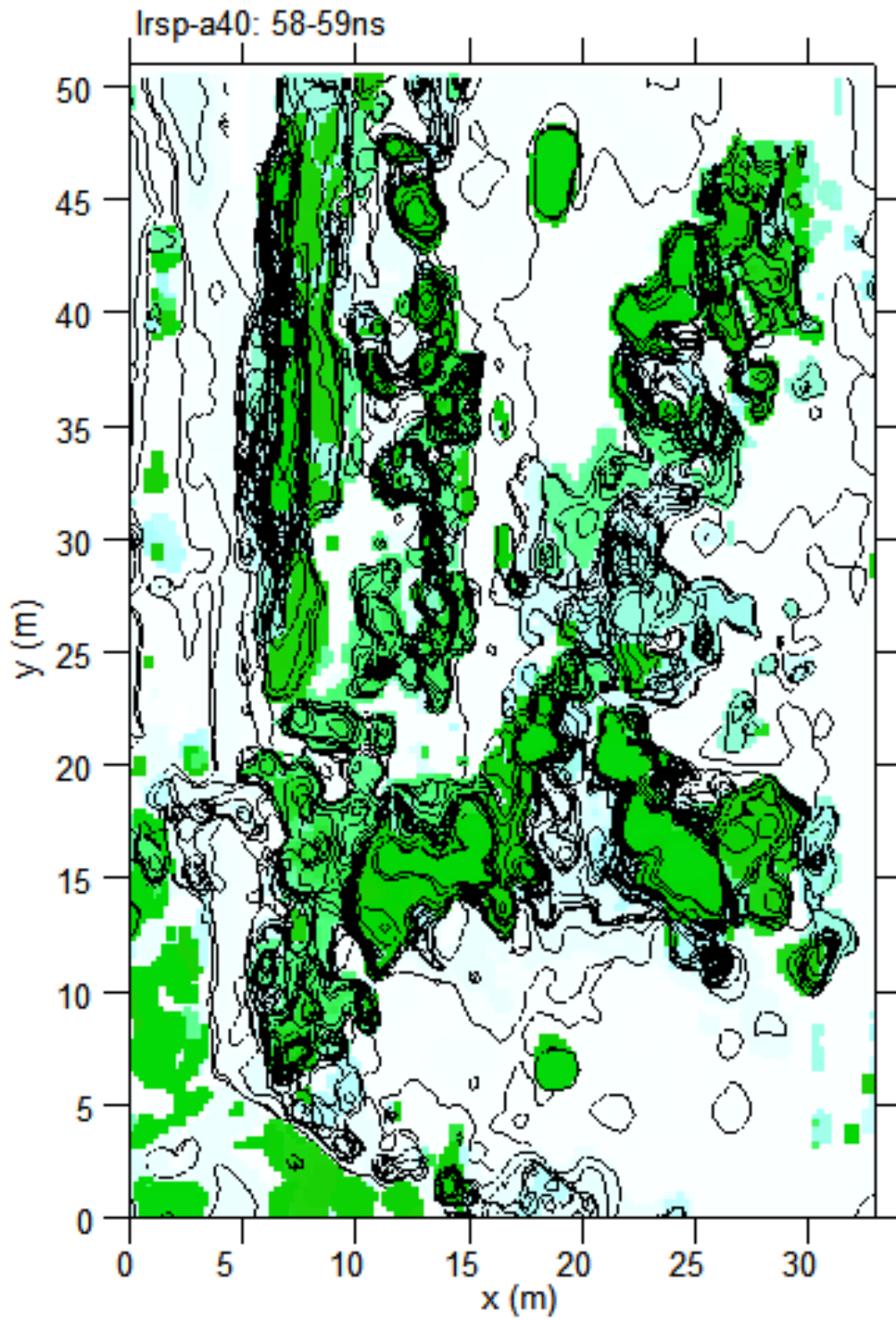


Figure 10. Composite Plan View, GPR Block A.

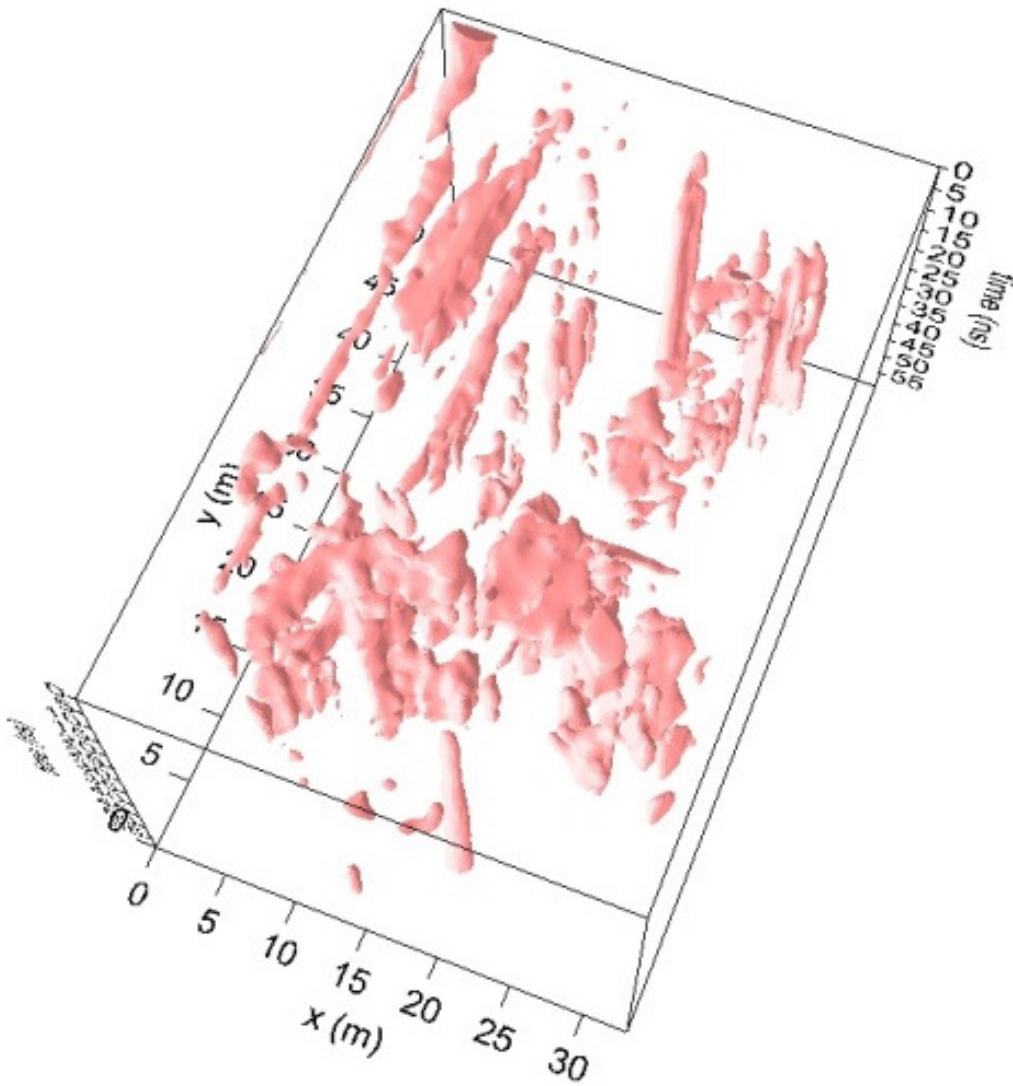


Figure 11. Isosurface View of GPR Block A.

GPR Block D

GPR Block D was the second largest sample in the survey. It was situated a short distance east of Block A and the two areas were separated by a chain link fence. Block D sampled the front lawn of the original Sibley Mill building and covered an area approximately 50 meters by 12 meters. Figures 12 and 13 show representative radargrams from the western and eastern sides of GPR Block D. Figure 14 shows four plan views of GPR Block D at increasing depths.

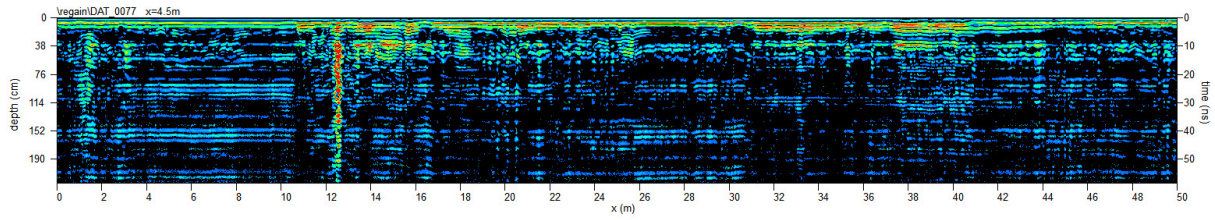


Figure 12. Radargram Example from West Portion of Block D.

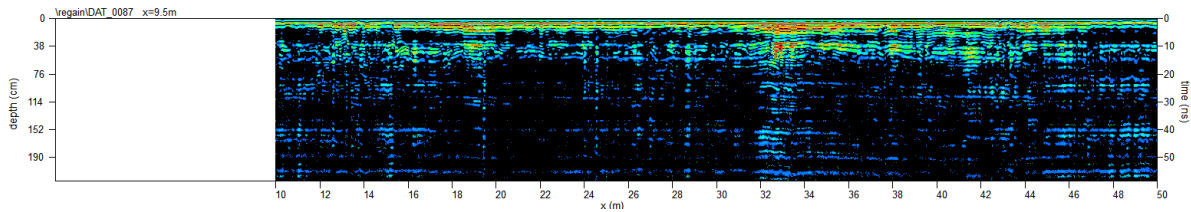


Figure 13. Radargram Example from East Portion of Block D.

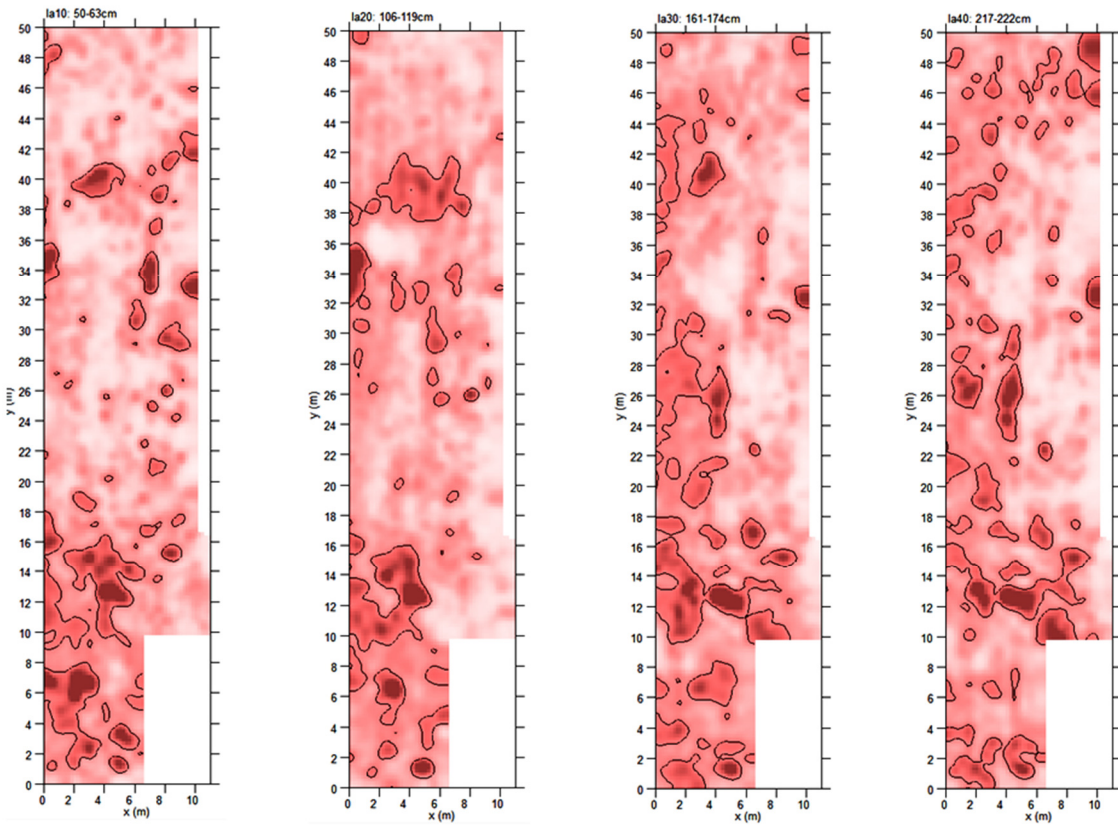


Figure 14. GPR Plan of Block D at Increasing Depths.

Figure 15 shows a composite plan view of GPR reflections in Block D and Figure 16 shows an isosurface view of the same. Both maps show that many areas contain strong radar reflections, which attests to the active use and disturbance of this portion of the property. A majority of these radar anomalies likely represent utility lines associated with the mill operation.

A concern going into this survey was the potential for a military cemetery in the vicinity of the Sibley Mill building foundation, as reported in 1880. GPR is useful in mapping historic cemeteries, particularly when graves are organized into rows or regularly spaced. Human burial radar signatures vary considerably depending on a burial's age, depth, presence/absence of a coffin, inclusion of metal objects, soils and other factors. Ideally, cemetery surveys are able to map the outline and depth of graves and determine if the burial contains large metal items, such as coffin handles or a metal vault. The grave shaft is often perceived in profile view. No clearly organized rows of graves are indicated by the Block D data. One cannot eliminate the possibility that some radar reflections within the Block D data may represent isolated graves, but these would be difficult to identify because of the extensive ground disturbances observed in the radar information.

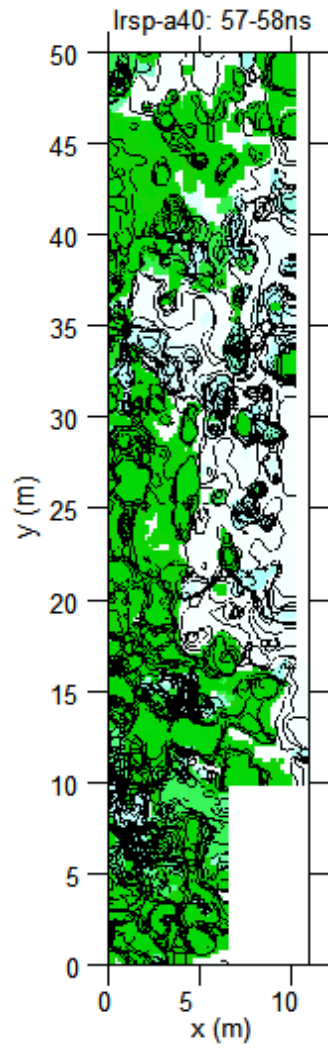


Figure 15. Composite Plan View, GPR Block D.

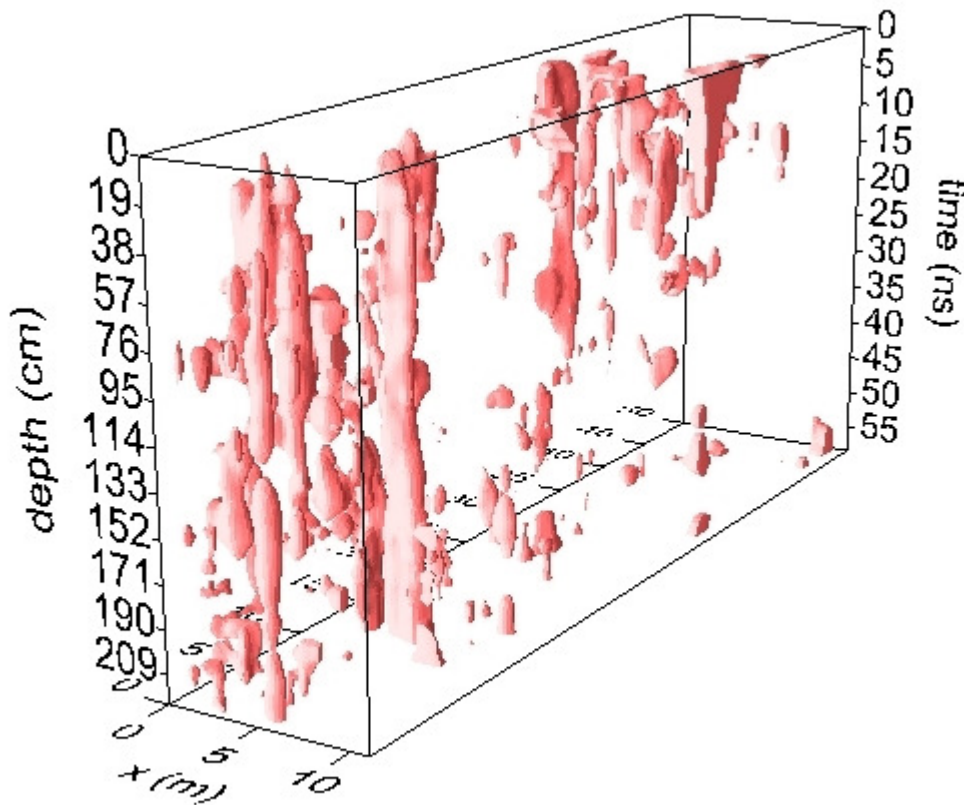


Figure 16. Isosurface View of GPR Block D.

GPR Block E

GPR Block E explored three directions surrounding the Confederate Powder Works refinery tower. Survey of this vicinity was considered a high priority because landscape work and other ground disturbing activities are planned for this portion of the Sibley Mills property and the land managers wanted to identify any sensitive subsurface cultural features in this area.

Survey coverage surrounding the refinery tower was complicated by the presence of guard rails, which protect the tower. One particular radar anomaly was recognized by the survey, as shown in Figure 17 (highlighted by the green circle). This is a oval ring-shaped reflection approximately 4-5 m in diameter located just south of the tower. This reflection is visible at several elevations within the block, which may indicate it has considerable depth. This large radar reflection is shown in profile in Figure 18. Figure 19 shows an isosurface view of Block E. Quite possibly this feature is cultural and may be associated with the Confederate Powder Works. Other features visible in Block E also may be associated with the Confederate factory but ground truthing would be necessary for a proper determination.

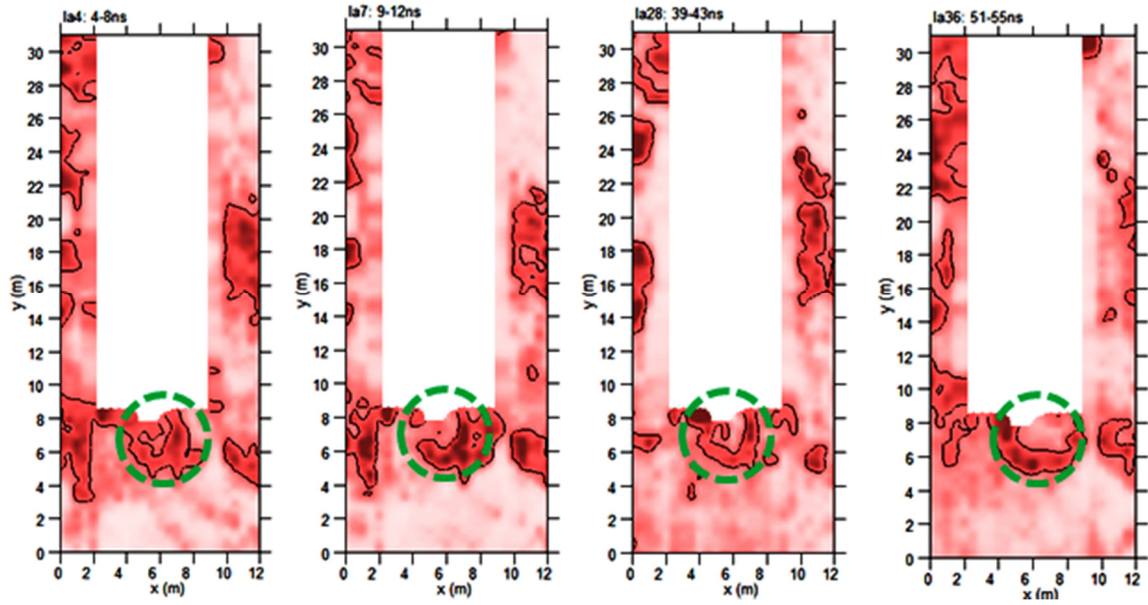


Figure 17. Circular Radar Anomaly at Varying Depths in Block E.

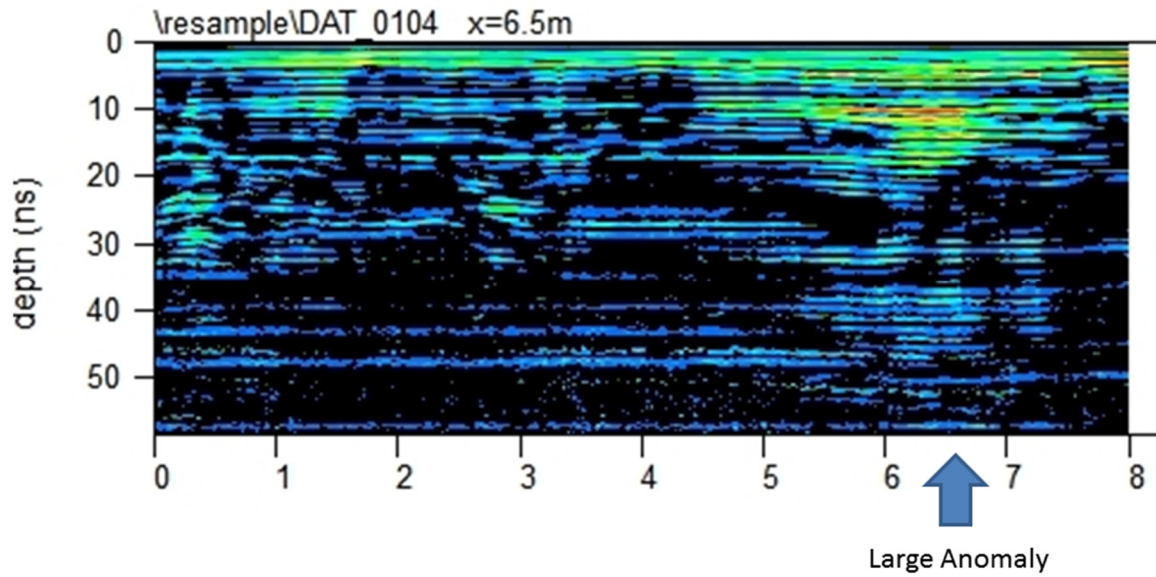


Figure 18. Radargram in GPR Block E Showing Profile View of Large Ring-Shaped Anomaly.

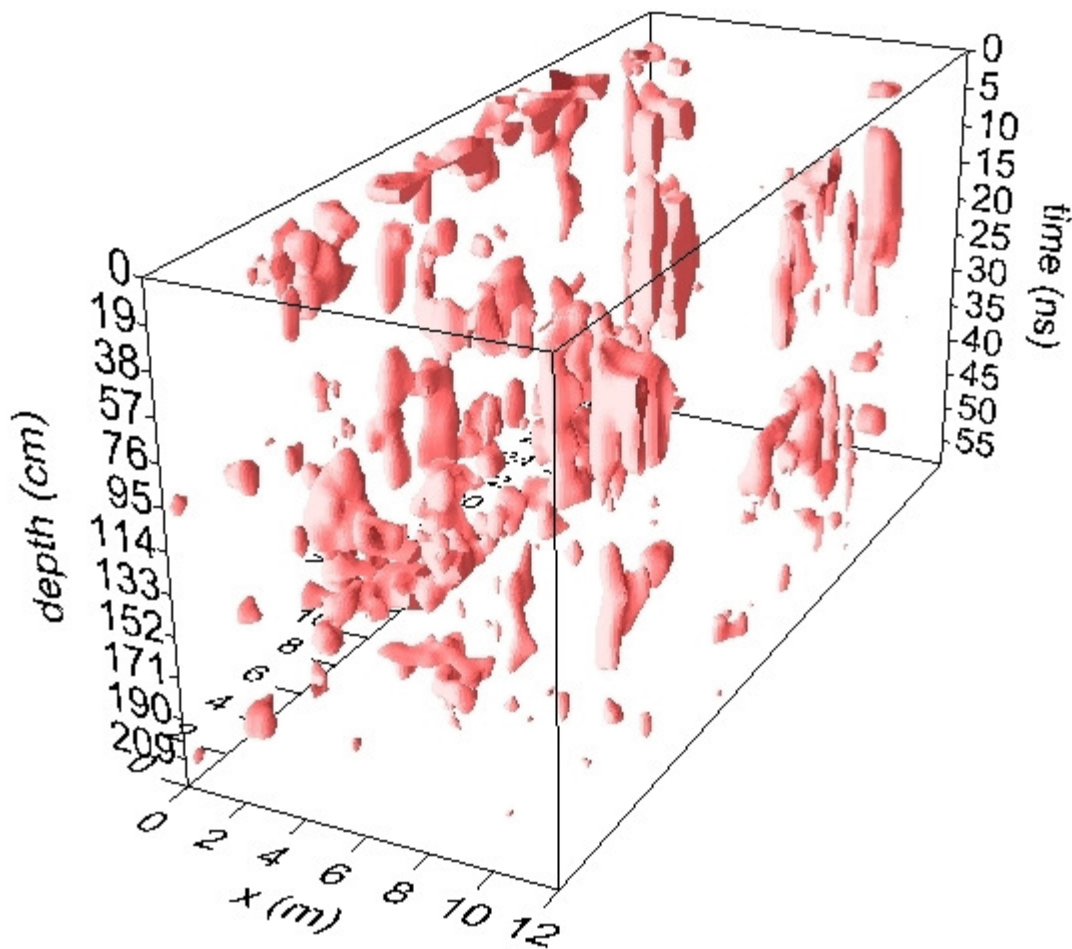


Figure 19. Isosurface View of GPR Block E.

GPR Block F

GPR Block F was the final area sampled by GPR survey. This sample was located between the two sections of the 1880 Sibley Mill complex and an area just south of the buildings. Recent water line repair work by the Augusta Canal Authority had encountered an arched brick feature, which was located just south of GPR Block F. The bricks that were used in the construction of the arched feature were post-1875 variety of marked bricks that were manufactured in Coaldale, Alabama. The Coaldale Brick & Tile Company was incorporated in 1890 and, therefore, these bricks date sometime after 1890. John W. Sibley was the Secretary and an owner of the Coaldale Brick & Tile Company, which helps to explain the presence of their brick at the Sibley Mill in Augusta--a city not lacking in local brick manufactories (Sibley 1890:60-69).

One large circular anomaly is readily apparent just below the ground surface in the southwestern corner of Block F. This feature likely corresponds to the brick arch (constructed of Coaldale bricks). This feature measures approximately 1.5 meters in diameter within the sample block and it likely continues south of GPR Block F (See anomaly in the bottom left corner of Figure 20).

A larger ring-shaped radar reflection below the ground surface was observed in the west-central portion of Block F. It is shown in plan view in Figure 20 and in profile in Figure 21. This feature measures approximately 4 meters north-south by 3 meters east-west. Its function is undermined at present, but it possibly represents a large cistern.

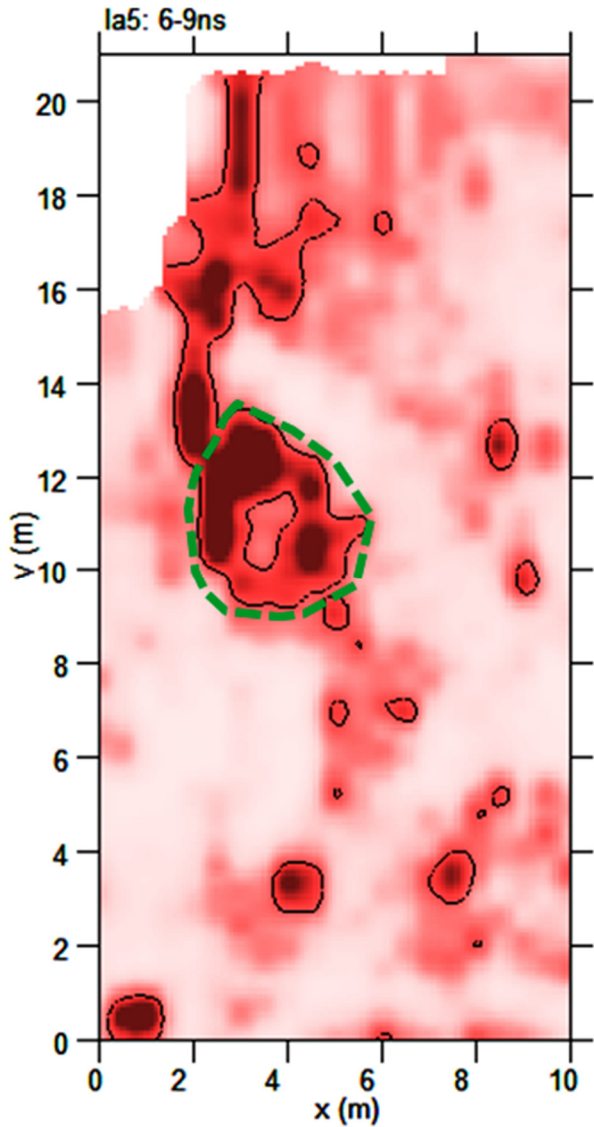


Figure 20. GPR Plan of Block F Showing Ring-Shaped Anomaly (outlined in green).

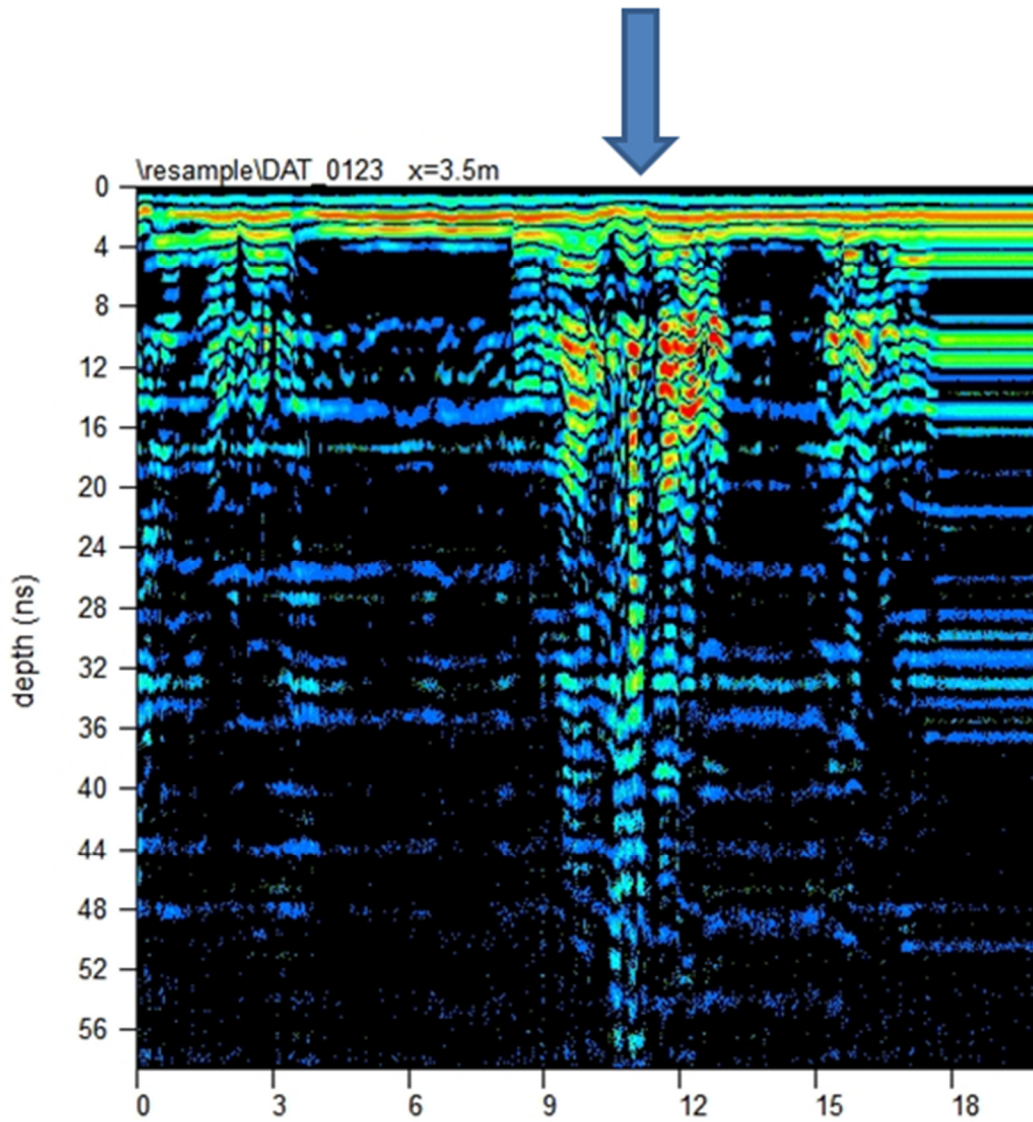


Figure 21. Radargram in Block F Showing Large Ring-Shaped Anomaly in Profile.

Figure 22 shows another anomaly. It is a deeply buried radar anomaly that is circular and measures approximately one meter in plan. This reflection originates at approximately 15 nanoseconds depth. This anomaly may represent a well or similar historic, deep cylindrical feature. The very deep point of origin may indicate a zone of debris deep within a well shaft.

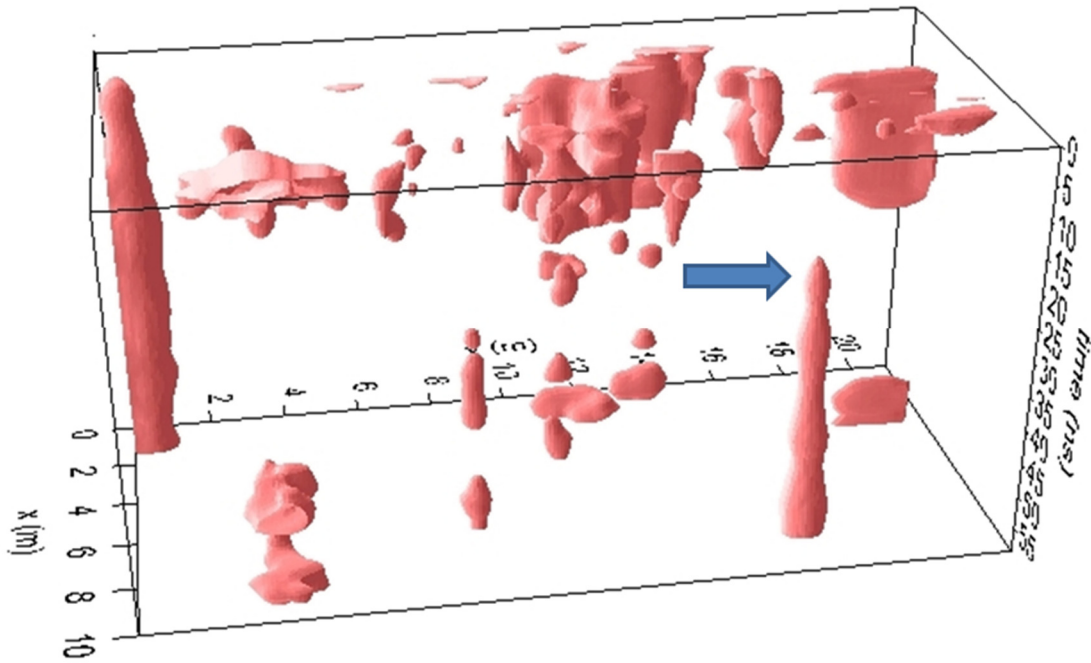


Figure 22. Isosurface View of GPR Block F Showing Deep Circular Anomaly.

Summary Interpretation

Ground Penetrating Radar (GPR) survey was conducted by the LAMAR Institute on portions of the Sibley Mill historic site. Collectively, the LAMAR Institute research team examined a total of 2535.5 m² (0.63 acres or 0.25 hectares) within four GPR sample blocks. This GPR mapping coverage represents a substantial sample of the available exterior space on the Sibley Mill context from which one may derive conclusions about the suitability and effectiveness of GPR survey for mapping cultural resources in this environment. These survey data also may serve a useful purpose for other engineering concerns, including pending soil removal of contaminated (brownfield) areas of the study property.

Past human activity in the study area resulted in a vast number of ground disturbing activities. The study property is located on ancient piedmont soils (primarily clay and decomposed bedrock), which are elevated well above the elevation of historic floods on the Savannah River. Radar propagation characteristics of piedmont clay soils are considered to be poor as the radar energy is absorbed and the return signals are attenuated. Consequently, GPR is not very effective for mapping these clay soils. Over most of the project area, GPR mapping of the clay soil matrix was ineffective below a depth of two meters. Where the clay has been intruded and the holes filled with other types of soil, however, GPR mapping was more effective.

The extent of the soil disturbance is quite apparent in the GPR mapping information. Radar information from Block A was particularly intense, as Figure 23 demonstrates. Major areas of the study property

have been used for buried utilities, including water, electric and sewer. Despite these widespread disturbances, most of which likely date after 1879, the GPR data reveals some areas of interest.

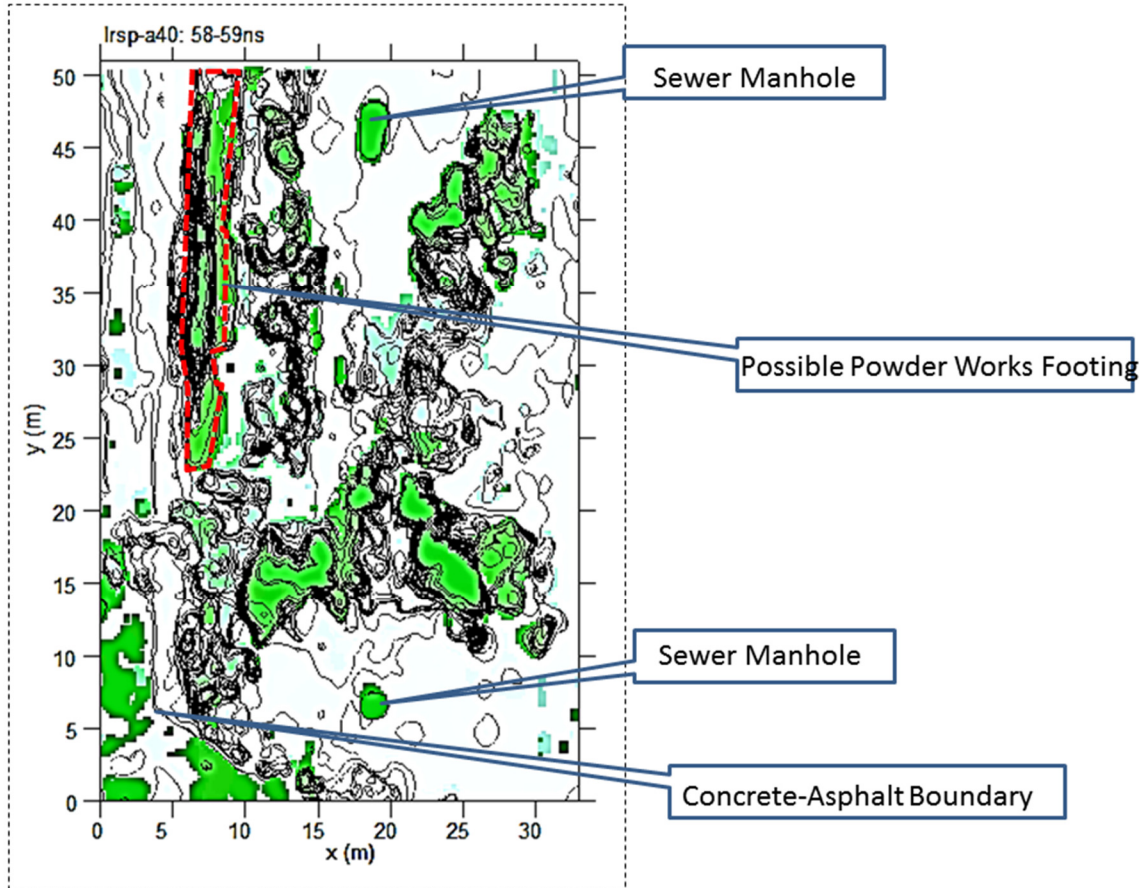


Figure 23. Complexity of Radar Information in GPR Block A.

Demand for water was intense, at both the Confederate Powder Works and the Sibley Cotton Mill. Wells and cisterns likely provided part of their pure water needs. Large ring-shaped radar anomalies in Blocks E and F may represent large cisterns. A large supply of water for fire suppression also was necessary and several water mains dating to the post-1880 period met these needs. Over the more than 125 years that Sibley Mill was in operation the mill operators made many additions, changes and repairs to the utility infrastructure.

Ground Penetrating Radar (GPR) is one remote sensing method for identifying and imaging buried cultural deposits. It has a marked advantage over other remote sensing methods by providing information in three dimensions. In many situations, however, other methods are superior for mapping deposits with concentrations of metal or in clay soils. At Sibley Mill, GPR appeared to perform effectively for imaging radar anomalies in the soil. The problem, however, was in isolated the meaningful cultural information from the massive amount of ground disturbance from the relatively recent historic period.

This more recent ground disturbing activity created strong radar reflections that likely masked the deeper, more subtle radar reflections. In many areas, it is nearly impossible to determine if important cultural deposits exist because of this masking effect. In other areas GPR imagery reveals a number of potentially important cultural features. These radar targets may be areas of interest for future investigators. No excavation was included in the current effort, so the validation and confirmation of the tentative conclusions in this report must await future investigations.

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