Ground Penetrating Radar Survey on Portions of Lagniappe, Talbot County, Georgia

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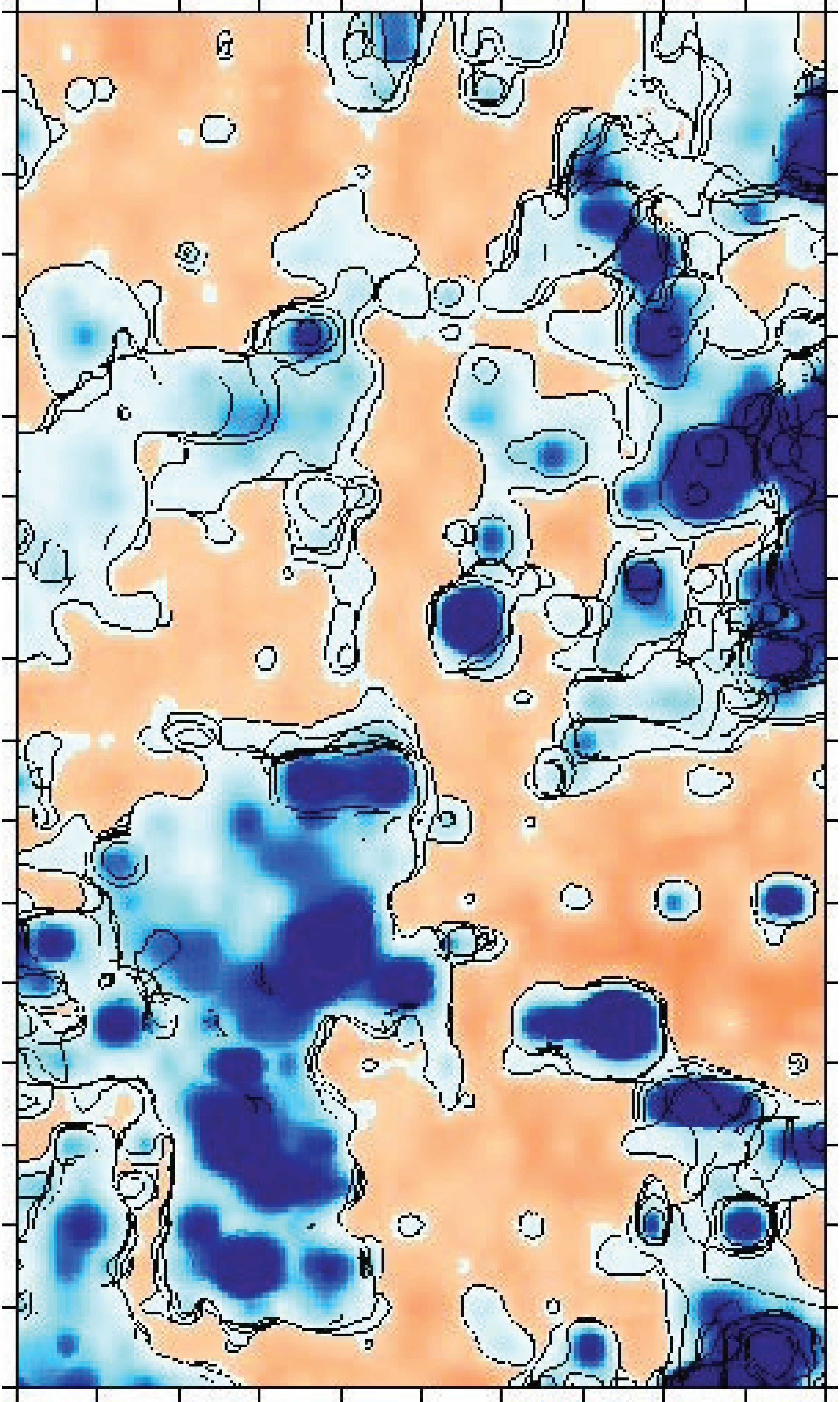

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Introduction

This report details the Ground Penetrating Radar (GPR) survey by the LAMAR Institute of a portion of Lagniappe Plantation in Talbotton, Talbot County, Georgia, USA. This survey sampled a portion of the rear and side yards of this historic plantation home. The field survey was completed in 2012 and the post-processing and reporting were completed in 2016. Chapter 2 detailes the methods used in the survey. Chapter 3 presents the results of the survey. Chapter 4 contains a brief interpretive summary. The report concludes with a bibliography of references cited.

Lagniappe Plantation, also known as the Frederick A. Bailey House, the Hill-Leonard House and the Barnard Hill House, is the current home of Glen Dean and Tracy Dean. The history of this impressive Greek Revival dwelling is addressed in published histories of Talbot County, Georgia (Davidson 1983-1988; Jordan 1996). The original dwelling on this lot was built about 1837 by F.A. and Hannah Bailey. The home was sold in a sheriff's sale to Henry I. Bailey in 1840. Henry Bailey sold the property in 1843 to Thomas A. Brown. Thomas Brown sold it in 1847 to Isham Brooks. Improvements to the house were made in 1852 by Joseph Pou, who purchased the home from Brooks' heirs. Mr. Pou sold the property in 1859 to Barnard Hill. Walter Barnard Hill, son of Barnard Hill, sold the house to Mrs. Frances B. Brown, widow of Thomas A. Brown, in 1879. The Browns conveyed the house to O.D. Gorman. In 1911 the Gormans conveyed it to Edward K. Leonard and Ida Lee Leonard. The property was acquired sometime after the death of Mr. Leonard by Mr. and Mrs. Ben G. Jordan. Mrs. Jordan conveyed the property to Clinton E. Searle in 1947. Mr. Searle conveyed the house to Edwin Page in 1948. Mr. Page conveyed the property to Joel B. Byars in 1943. Mr. Byars conveyed it to Ellis A. Hall in 1956 (Jordan 1996:189-191). The house was surveyed by the Historic American Buildings Survey (HABS) in 1936 and it was added to the National Register of Historic Places (NRHP) in 1980 (Alexander and Thomas 1980). Glen and Tracy Dean acquired the property in 2009.

Methods

The equipment used for this study 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). A 500 megahertz (MHz) shielded antenna was used for the data gathering. MALÅ GeoScience's Ground Vision software (Version 1.4.5) was used to acquire and record the radar data. 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 data was post-processed with GPR-Slice software (version 6.0). 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 2004, 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 permitivity, 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 (measured in nanoseconds, or ns), 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. This project represents the first application of GPR technology to archaeological sites in Talbot County, Georgia

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.

The time window that was selected allowed data gathering to focus on the upper 1.5 meters of soil, which was 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.

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. Equipment settings and other pertinent logistical attributes included the following:

- Time Window: 80.7 ns
- Number of Stacks: 4
- Number of Samples: 632
- Sampling Frequency: 7,462.13 MHz
- Antenna: 500 MHz shielded
- Antenna Separation: 0.18 m
- Trigger: 0.04 m
- Radargram orientation: South to North
- Radargram progress: West to East
- Radargram Spacing: 50 cm
- Total Radargrams: 34
- Coverage (m): 340 m^2

One GPR block was collected by the survey team and it was designated Block A. The survey team consisted of Daniel Elliott and Tracy Dean. The southwestern corner of GPR

Block A was located at UTM coordinate Zone 16 E731172 N3616758 (NAD27). Grid North was arbitrarily established and oriented on a compass bearing of 352 degrees. This GPR block examined an area 15.5 m East-West by 10 m North-South. Radargrams were collected from south to north and progressed from west to east. Block A covered an area of 340 m^2 (Figures 1 and 2).

Figure 1. GPR Sampled Area, Lagniappe Plantation, Facing Southwest.

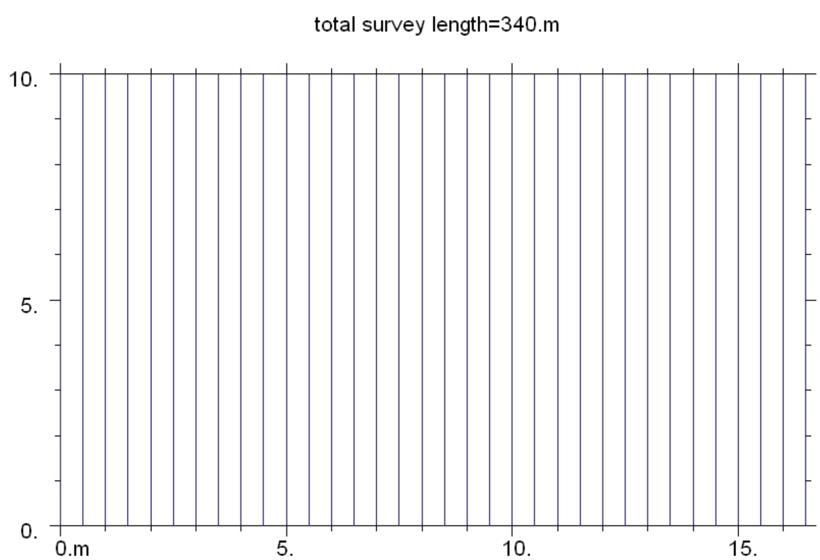

Figure 2. Radargram Plan of GPR Block A, Lagniappe Plantation.

GPR Survey Results

GPR Block A revealed several potentially cultural subsurface features that may relate to the historic occupation of the dwelling, now known as Lagniappe Plantation. Figures 3-6 show plan views and isometric views of GPR Block A. Figure 3 is a plan view at 8-11ns depth. Figure 4 is a plan view from 26-30ns depth. Figures 5 and 6 are isometric views of the GPR block. One particularly intriguing radar reflection appears in Figures 4-6 at approximately 2.5 m north and 4.5 m east of the 0,0 point. This feature does not show up well in Figure 3, which suggests that its lower depths contain material that is more reflective of the microwave beams generated by the radar.

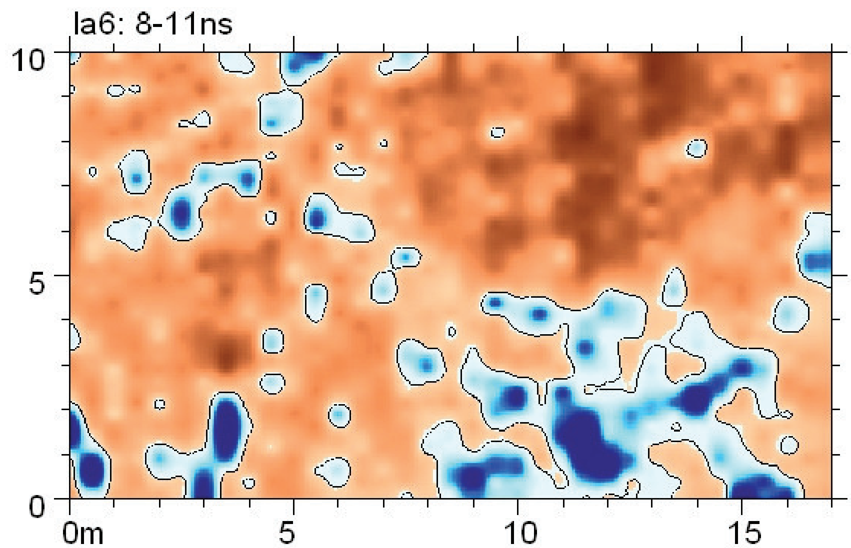

Figure 3. Plan of GPR Block A, Lagniappe Plantation, 8-11ns Depth.

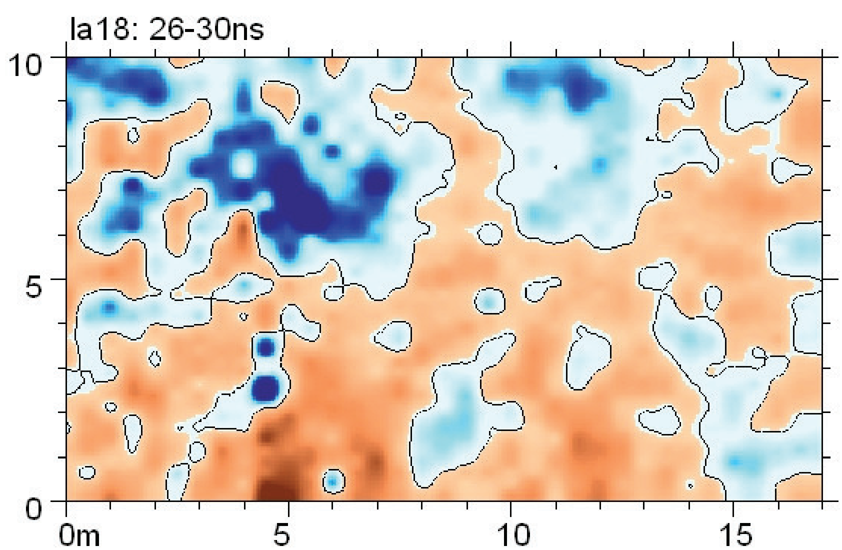

Figure 4. Plan of GPR Block A, Lagniappe Plantation, 26-30ns Depth.

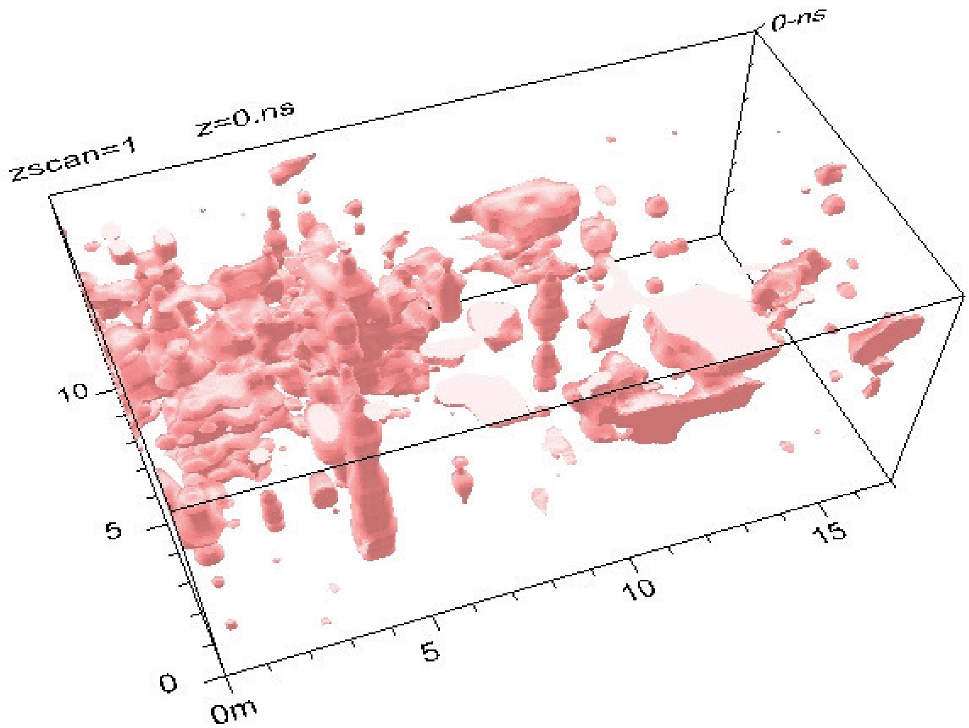

Figure 5. Isomorphic View of GPR Block A, Lagniappe Plantation.

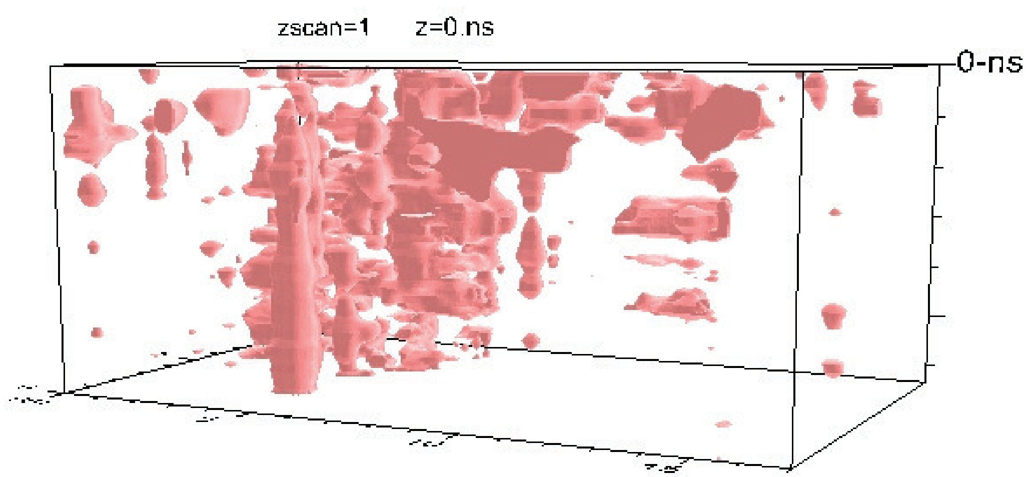

Figure 6. Isomorphic View of GPR Block A, Lagniappe Plantation.

Interpretative Summary

GPR survey was completed by the LAMAR Institute on a portion of the side yard of the Dean's Lagniappe Plantation in Talbotton, Georgia. Figure 7 shows a GPR overlay map in relation to the house and grounds. A 1936 photograph and a 1948 plat of the property shows no features in this portion of the property (Figure 8; Andrew 1936; Carter 1948). When viewed from this perspective the importance of the GPR mapping information achieves relevance. Numerous massive, strong radar reflections are visible in this image (shown in dark blue). While these do not form any obvious architectural patterning, they may represent wells, privy's, ancillary building foundations or refuse disposal pits. One particular radar anomaly, which is visible in plan and profile views in Figures 4-6, is interpreted as a well shaft. Some radar reflections in this sample block also may represent the roots of large trees. Ground truthing through archaeological excavation would be necessary to fully ascertain the function and age of these potential features. This sample survey demonstrates the utility of GPR in mapping this early historic home site. Additional GPR mapping promises to reveal other exciting secrets about Lagniappe's past.

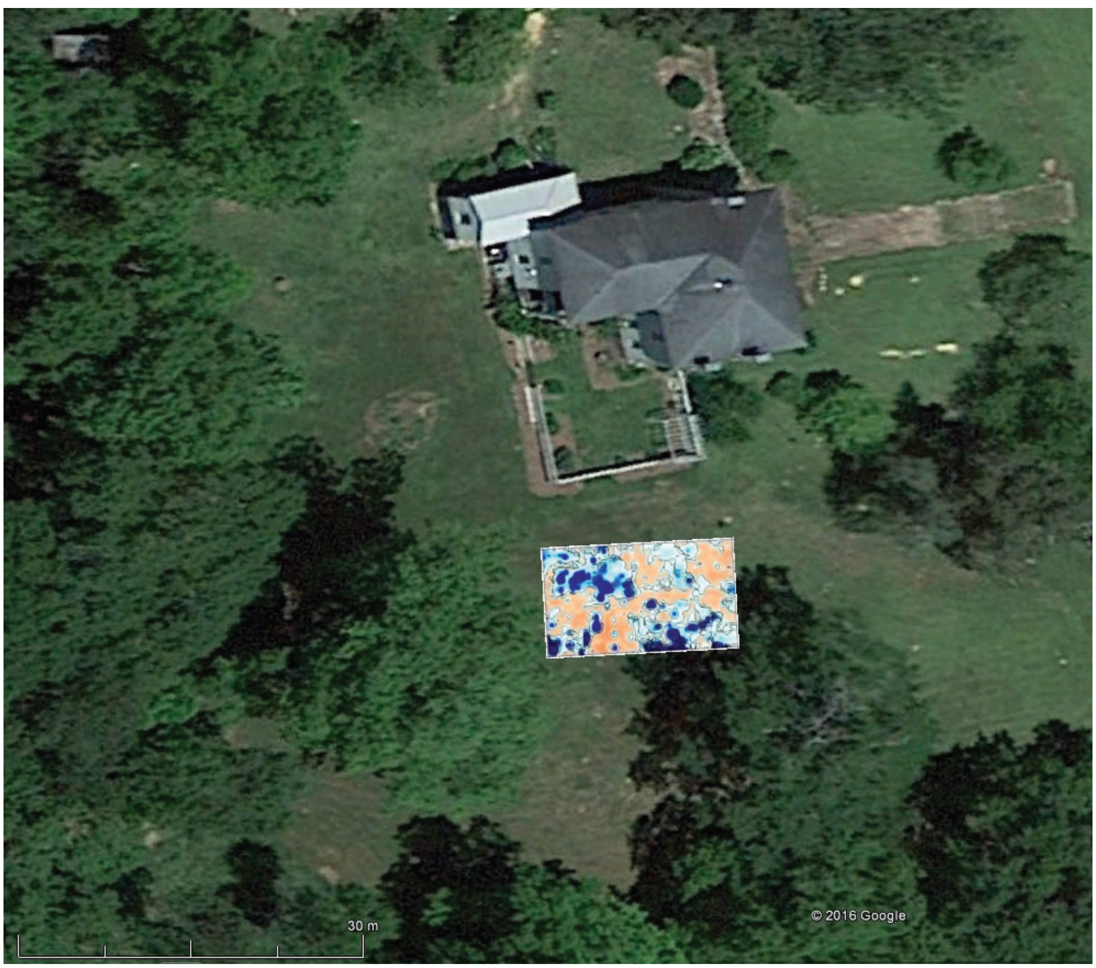

Figure 7. GPR Overlay Map on 2016 Aerial Photograph of Lagniappe.

Figure 8. HABS Photograph by Andrew (1936).

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