Ground Penetrating Radar Survey on Portions of Four Aboriginal Sites, Genesis Point, Bryan County, Georgia

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Ground Penetrating Radar Survey on Portions of Four Aboriginal Sites, Genesis Point, Bryan County, Georgia

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By Daniel T. Elliott

The LAMAR Institute, Inc.
Savannah, Georgia
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<td>Block D Overlay, 30-39 ns</td>
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Introduction

This report and its accompanying appendix CD-Rom presents the findings of a Ground Penetrating Radar survey on portions of four aboriginal sites in Bryan County, Georgia (Figure 1). These archaeological sites are located within the Genesis Point development project, which has been the subject of archaeological study by Environmental Services, Inc. (ESI). The ESI research team has studied the project area over the past two years and the entire area was covered by an intensive archaeological survey with Phase II testing at a number of these sites (Hendryx et al. 2006; Hendryx and Sawyer 2007a). The Phase II sites included Sites 9Bn11, 9Bn104, 9Bn887, and 9Bn909, which were the subjects of this initial GPR study. The LAMAR Institute was retained by ESI in 2007 to conduct GPR survey on sample portions of these four sites.

![Figure 1. Project Location (Study Sites Shown in Red).](image)

GPR data was collected from 15 sample blocks on these sites and these data represent the basis of this report. Table 1 contains a summary of the locations and spatial attributes of the study blocks. This effort is the initial study of the GPR application potential on aboriginal sites in coastal Bryan County.

The main purpose of the GPR study is to generate data that would, “help guide the placement of formal excavation units, which will focus on identifying the areas with the most and largest anomalies (features) identified during geophysical imaging” (Hendryx and Sipe 2007a:9). Areas for GPR survey were carefully selected by Hendryx and his colleagues based on the results from Phases I and II investigations.
Table 1. Locations and Attributes of GPR Blocks, Genesis Point, Bryan County, Georgia.

<table>
<thead>
<tr>
<th>Site</th>
<th>GPR Datum</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
<th>Grid North</th>
<th>Dimensions (m)</th>
<th>Direction</th>
<th>Comments</th>
<th>Approx. Area m²</th>
<th>Total Length (m)</th>
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Note: UTMs are NAD 27 taken with Gamin V GPS Receiver at Southwest corner of GPR Block, November 2007, The LAMAR Institute.
Methods

Ground Penetrating Radar, or GPR, uses high frequency electromagnetic waves 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 the antennas are shielded to eliminate interference from sources other than directly beneath the device. The transmitting antenna emits a series of electromagnetic waves, 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 sample blocks 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. For example, an isolated historic grave may produce a clear signal, represented by a well-defined hyperbola. A cluster of graves, however, may produce a more garbled signal that is less apparent.

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 best 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 soil conductivity, metallic content, and other pedo-chemical factors. Generally, Georgia’s coastal soils have moderately good properties for its application.

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, underground storage tanks or man-hole covers. 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. Larry Conyers notes:

“Ground-penetrating radar works best in sandy and silty soils and sediments that are not saturated with water. The method does not work at all in areas where soils are saturated with salt water because this media is electrically conductive and ‘conducts away’ the radar energy before it can be reflected in the ground” (Conyers 2002).

GPR has been used to a limited extent on archaeological sites in Georgia yielding mixed results. Thomas and his colleagues employed GPR technology in his study of the Guale Spanish mission on St. Catherines Island, Georgia in the early 1980s (Royce Hayes personal communication May 31, 2006). More recently, the LAMAR Institute team has conducted GPR survey with good results on several of Georgia’s barrier islands, including Jekyll, Ossabaw, Sapelo, St. Catherines and St. Simons islands. In the period since the
early GPR work at St. Catherines Island, advances in software imaging have substantially increased the value of this technology in identifying subsurface features.

GPR is particularly well suited for the delineation of historic cemeteries. Historic graves are often easy to recognize in radargrams, as evidenced by a pronounced hyperbola. When 3-D slices intersect these hyperbolas the graves are usually clearly evident in plan view. When a series of graves are closely spaced, however, the grave radar “signature” is less clear-cut. By slicing the radar data at various depths along the hyperbola, the aerial perspective can be refined for optimal viewing and recognition. Since not all graves were dug to the same depth, 3-D slices at different depths can often yield very different views of graves in plan by varying the slice only a few centimeters. The GPR signature for aboriginal features on the Georgia coast has not been fully established. The current work is an important attempt towards characterizing aboriginal features with GPR technology.

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. Figure 2 shows the GPR survey in progress and a representative view of the field conditions.

Using the same RAMAC X3M GPR system as that used in the present study, Elliott has conducted several GPR studies of 18th and 19th century archaeological sites in coastal Georgia. The first study was at the New Ebenezer town site in Effingham County, Georgia (Elliott 2003a). The results of the GPR work at New Ebenezer were quite exciting and included the delineation of a large portion of a British redoubt palisade ditch and the discovery of several dozen previously unidentified human graves (both within and beyond the known limits of the Jerusalem Lutheran Church cemetery). More recently, GPR survey was conducted by Elliott and his colleagues, at Fort Morris and Sunbury Cemetery (Liberty County), Sansavilla Bluff (Wayne County), Woodbine Plantation cemetery (Camden County), and Garden Homes [Waldburg Street, Savannah] (Chatham County), the Gould-Bethel Cemetery (Chatham County), Bullhead Bluff Cemetery (Camden County), Fort Saint Andrews (Camden County) and numerous other sites with satisfactory results (Elliott 2003b; 2004; 2006).

MALÅ GeoScience’s Ground Vision (Version 1.4.5) software was used to acquire and record the radar data (MALÅ GeoScience USA 2006a). The radar information was displayed as a series of radargrams. Easy 3D software (Version 1.3.3), which was developed by MALÅ GeoScience (2006b), was used in post-processing the radar data and 3-D imaging. This entailed merging the data from the series of radargrams for each block. Once this was accomplished, horizontal slices of the data were examined for important anomalies and patterns of anomalies, which were likely of cultural relevance. These data were displayed as aerial plan maps of the sample areas at varying depths below ground surface. These horizontal views, or time-slices, display the radar information at a set time depth in nanoseconds. Time-depth can be roughly equated to depth below ground. An estimated soil velocity of 98 (an approximate value for dry sand) was used to generate the GPR maps in this report.

Output from the survey was viewed using the GroundVision and Easy 3D software, which provided preliminary information about the suitability of GPR survey in the area and the effective operation of the equipment. An example of a GPR plan map of Block E generated by the Easy 3D program is shown in Figure 3.

The GPR data from the present study was further processed with more robust imaging software, which was developed by Dean Goodman, called GPR-Slice (Version 5.0). Goodman’s GPR-Slice program is recognized as the world leader in GPR imaging (Goodman 2006). The output from Goodman’s software, which is superior to that generated by Easy 3D, forms the bulk of the results presented in this report.
Various adjustments to the GPR equipment were made in the field during the data collection phase. 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. Machinery settings and other pertinent logistical attributes included the following:

**Machine Settings**
- Time Window: ranged from 74.4-80 ns
- Number of Stacks: 4
- Number of Samples: 400
- Sampling Frequency: 4974.75 MHz
- Antenna: 500 MHz shielded
- Antenna Separation: 0.18 m
- Trigger: 0.02 m
- Radargram orientation: South-North (except where noted)
- Radargram progress: West to East (except where noted)
- Radargram Spacing: 50 cm

Grid North for these GPR blocks was Magnetic North, except where noted. The GPR grids were established by using a hand held compass and a fiberglass metric tape, which reduced the accuracy for the site map somewhat. This factor should be considered by archaeologists returning to the site to investigate any of the GPR anomalies that were identified. The locations of each GPR block were located in the field using a Garmin V GPS handheld receiver. The Southwest corner of each block was designated as a datum and UTM Coordinates for each location were recorded and calibrated to the North American Datum (1927), or NAD27. ESI archaeologists revisited the GPR study areas after the survey was completed and they gathered more accurate locations using a Trimble GPS receiver with sub-meter accuracy.
Results and Interpretation

Fifteen sample blocks of GPR data were collected by the survey team at four aboriginal sites in the Genesis Point development site in Bryan County, Georgia. The archaeological sites that were sampled were: 9BN11, 9BN104, 9BN887, and 9BN909. These sites contain a variety of aboriginal components. The details of the GPR samples at each of these sites are presented below. Appendix 1 is a CD-Rom disc that contains electronic versions of additional GPR images from the survey. These images are organized into folders by sample block. Each folder contains two sets of animated .jpeg files. The first set (labeled A) are GPR overlay maps. The second set (labeled Blk(A through O) are GPR time slice maps. These may be accessed by clicking the animations icon. The animations are based on sets of 20 time slice and overlay maps. The jpeg GPR maps also may be viewed and printed as individual images. Additional instructions for viewing these animations are included on this disc. Appendix 1 also contains electronic versions of the figures shown in this report text.

Site 9BN887

Site 9BN887 is a multi-component aboriginal site that is dominated by the Late Mississippian Irene occupation. The site contains approximately 20 elevated shell middens, which are thought to date to the Irene Phase, and a procurement midden. The site also contains a generous deposit of Savannah Phase pottery. Lesser amounts of earlier pottery also are present at 9BN887. This includes Late Woodland Wilmington, Middle Woodland Deptford and Archaic St. Simons phase artifacts. A research design for Phase III investigations of 9BN887 was recently prepared and the present GPR study is consistent with that design (Hendryx and Sipe 2007a). Three of four potential GPR target areas were examined by the GPR survey. Each of the three surveyed areas contains elevated shell mounds.

Block A

Block A at 9BN887 was an L-shaped block that was placed on the northern part of Site 9BN887. The sampled area measured approximately 43.5 m East-West by 38 m North-South. The approximate UTM location of the southwestern corner of Block A was established with a Garmin V GPS receiver at Easting 483784, Northing 3524905 (NAD 27). Grid North for this GPR block was Magnetic North. A low shell and sand mound, which had been sampled by a single 1 m by 1 m test unit, was visible on the ground surface within the northeastern part of the block. Block A consisted of 88 radargrams that varied in length from 10 m to 38 m. Radargrams 1 to 52 averaged 12 m in length, while Radargrams 53 to 84 measured 38 m in length. Radargrams 85 to 88 ranged in length from 14 m to 21.5 m. The total length of radargrams in Block A was 1,907.2 m.

One radargram profile from Block A is illustrated in Figure 4. This profile of Radargram 65 traversed the crest of the low mound at approximately 28.4 m from its southern begin point. It also crossed an area where oyster shell was scattered on the ground surface at approximately 6.1 m out. These locations are indicated by small white triangular markers on the radargram. The mound feature is not readily apparent in this radargram, although numerous hyperbolas are present in that vicinity. Quite a few of the radar reflections in this radargram occur at depths greater than 50 cm, although none are greater than 1 m depth.

Figures 5-8 show time slice plan views of Block A at increasing depths. Figure 5 is a view from 2-12 ns.; Figure 6 shows from 7-17 ns; Figure 7 is a view from 25-35 ns; and Figure 8 shows Block A at 32-42 ns.

Overlay analysis of GPR data is an important method for visualizing a composite GPR map. Two overlay images of Block A are shown at increasing time depths in Figures 9 and 10. Figure 9 shows an overlay from 2-12 ns time depth. This map illustrates the concentrations of radar reflections just beneath the ground surface and in the upper topsoil zone. Figure 10 shows an overlay from 33-43 ns. The woods road is apparent in this view. This composite view, which is at the base of most cultural activity, provides a view of the overall soil disturbances in the sample block. The shell mound in the northeastern portion of the sample block is clearly evident in both of these views.
Many smaller radar reflections are found throughout the sample block and many of these may represent cultural features.

Figure 4. Block A, Radargram 65.

Figure 5. Block A Time slice, 2-12 ns.
Figure 6. Block A Time slice, 7-17 ns.

Figure 7. Block A Time slice, 25-35 ns.

Figure 8. Block A Time slice, 32-42 ns.

Figure 9. Block A Overlay, 2-12 ns.

Figure 10. Block A Overlay, 33-43 ns.
**Block B**

Block B was placed southwest of Block A on Site 9Bn887. The sampled area was rectangular and measured 29.5 m East-West by 44 m North-South. Datum B was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 483782, Northing 3524847. Sixty radargrams were recorded in this block. The total length of radargrams in Block B was 2,640 m.

One representative radargram profile from Block B is illustrated in Figure 11. This profile of Radargram 35 traversed a probable low shell mound at approximately 4.6 m from its southern begin point. That location is indicated by a white triangular marker (left side) on this image.

Two time slices of Block B are shown at increasing time depths in Figures 12 and 13. Figure 12 shows Block B at 2-12 ns time depth. At this depth the western side of the sample block contains a high concentration of radar reflections compared with the eastern side. Figure 13 shows Block B at 22-32 ns time depth. In this plan map the western side of the sample block still contains more strong radar reflections but they are considerably diminished from the previous map.

Overlay analysis of GPR data is an important method for visualizing a composite GPR map. Two overlay images of Block B are shown at increasing time depths in Figures 14 and 15. Figure 14 shows an overlay from 2-12 ns time depth. Figure 15 shows an overlay from 32-42 ns.

The shell mound on the south side of Block B is not obvious on any of these plan views. A large area in the north-central part of Block B contains a strong cluster of radar anomalies, which is most apparent in Figure 14. This cluster, which is considerably larger than the signal produced by a single large tree, may represent cultural activity.

![Figure 11. Block B, Radargram 35.](image-url)
Figure 12. Block B Time slice, 2-12 ns.

Figure 13. Block B Time slice, 22-32 ns.

Figure 14. Block B Overlay, 2-12 ns.

Figure 15. Block B Overlay, 32-42 ns.
Block C

Block C was placed in an area southeast of Block A on Site 9Bn887. The sampled area was rectangular and measured 38 m East-West by 13.5 m North-South. Grid North for this block was adjusted to 335 degrees North-Northwest to align the block with the landform edge. Datum C was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 489898, Northing 3524862. Twenty-eight radargrams were recorded in this block. The total length of radargrams in Block C was 1,015.3 m.

One representative radargram profile from Block C is illustrated in Figure 16. This profile of Radargram 67 traversed two elevated shell mounds; one at approximately 0 m and another at 14 m from its southern begin point. These locations are indicated by white triangular markers on this image. A number of radar reflections, seen as hyperbolas, are visible in the latter vicinity. These appear to be mostly shallow (<50 cm depth). Numerous other hyperbolas are contained in this image, which attests to many natural or cultural objects in the upper soil stratum.

![Figure 16. Block C, Radargram 67](image)

Two time slices of Block C are shown in Figures 17 and 18. The upper view shows Block C from 8-18 ns time depth and the lower view is from 22-32 ns. Both of these images reveal a concentration of strong radar reflections in the northeastern portion of the sample block. Interestingly, this area is not where the most obvious shell mounds and shell scatters are evident.

Two overlay images of Block C are shown at increasing time depths in Figures 19 and 20. Figure 19 shows a composite view of the upper soil zones from 2-12 ns time depth. Figure 20 is a composite view from 32-42 ns, which is indicative of the overall radar reflections within the sample block.

Interestingly, the GPR plan maps of Block C do not clearly depict the low mounds that are obvious on the surface at the southern end of the sample block. The reasons why this is the case remain a puzzle. These data demonstrate, however, that GPR application for the identification of low sand and shell mounds on the Georgia coast remains problematic. The survey of 9Bn887 yielded widely varying results with clear mound definition in Block A, versus mixed results in Block C. Many factors may be at play to obscure the patterning in Blocks B and C, including close proximity to salt water, extensive tree root systems, and an abundance of other cultural deposits that mask the mound's GPR signatures.
Figure 17. Block C Time slice, 8-18 ns.
Figure 18. Block C Time slice, 22-32 ns.
Figure 19. Block C Overlay, 2-12 ns.
9BN909

Site 9BN909 is a multi-component aboriginal site. The primary occupation of this site was during the Late Woodland Wilmington and Late Mississippian Irene phases. Limited occupation occurred during the Savannah, Deptford, and St. Simons phases (Hendryx 2007:1). This site differed from the other three study sites by the strong Wilmington Phase presence in addition to the Irene Phase. Site 9BN909 was sampled by three GPR blocks (Blocks D, E, and F).

Block D

Block D was placed on the western part of Site 9BN909. Although a few scattered oyster shells were noted on the surface in this area, no shell mounds are apparent. Any surface evidence of these mounds was probably erased as a result of historic-era farming. The sampled area measured 17.5 m East-West by 14 m North-South. Grid North for this block was adjusted to 330 degrees North-Northwest in order to align the block with preexisting agricultural rows. Datum D was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 480620, Northing 3525390. Thirty-six radargrams were recorded in this block. The total length of radargrams in Block D was 503.5 m.

One time slice of Block D at 23-33 ns time depth is shown in Figure 21. This map reveals a number of medium to large radar reflections. Whether these signals represent cultural features or natural phenomena remains unclear.

Two overlay images of Block D are shown at increasing time depths in Figures 22 and 23. The upper view in Figure 22 is an overlay from 3-12 ns time depth and the lower map is from 30-39 ns. The upper map shows few radar reflections, while the lower map (Figure 23) shows a concentration of moderate to strong reflections on the northwestern side of the sample block.

Figure 21. Block D Time slice, 23-33 ns.
Figure 22. Block D Overlay, 3-12 ns.

Figure 23. Block D Overlay, 30-39 ns.
**Block E**

Block E was placed northeast of Block D on Site 9Bn909. The sampled area was rectangular and measured 18.5 m East-West by 18 m North-South. Grid North for this block was aligned with Magnetic North, since no agricultural rows were apparent in this area of the site. Datum E was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 480624, Northing 325414. Thirty-eight radargrams were recorded in this block. The total length of radargrams in Block E was 683.5 m. An open 2 m by 1 m test unit was positioned near the center of Block E. This excavation unit remained open and the backfill was piled immediately to its north. A dense shell midden deposit was visible in the profile of this test unit.

One radargram profile from Block E is illustrated in Figure 24. This profile of Radargram 67 traversed the open test unit at 10 m from its southern begin point. The test unit location is indicated by the left white triangular marker on this image. Several radar reflections are visible in this radargram, particularly to the north of the test unit. Some of these undoubtedly are indicative of the excavation itself, while other are deeply buried and probably represent large, undisturbed objects at depths greater than 50 cm.

Four time slices of Block E are shown at increasing time depths in Figures 25-28. Two overlay images of Block E are shown at increasing time depths in Figures 29 and 30. Figure 29 is an overlay map from 2-12 ns time depth. A large anomaly on this map corresponds to the location of the back dirt pile associated with the open test unit. Figure 30 is an overlay map from 30-39 ns time depth. A large anomaly appears (in blue) on this map, which corresponds to the location of the open test unit.

**Figure 24. Block E, Radargram 54**
Figure 25. Block E Time slice, 1-11 ns.

Figure 26. Block E Time slice, 17-26 ns.
Figure 27. Block E Time slice, 23-33 ns.

Figure 28. Block E Time slice, 30-39 ns.

Figure 29. Block E Overlay, 3-12 ns.

Figure 30. Block E Overlay, 30-39 ns.
**Block F**

Block F was placed southeast of Block D on Site 9Bn909. The sampled area was rectangular and measured 15.5 m by 16 m. Grid North for this block was adjusted to 340 degrees (North-Northwest) in order to align the block with preexisting agricultural rows. Datum F was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 480637, Northing 3525371. Thirty-two radargrams were recorded in this block. The total length of radargrams in Block F was 469 m.

One time slice of Block F from 7-16 ns depth is shown in Figure 31. This map reveals a concentration of radar reflections along the western side of the sample block. Two overlay images of Block F are shown at increasing time depths in Figures 32 and 33.

The southwestern side of Block F contains more radar anomalies than the rest of the block. This is true at various depths. Another large anomaly, which originates near the ground surface, is located along the north-central part of the block. The series of linear anomalies at the lowest depths of Block F may represent machine line noise or they may be associated with deep plowing at the site.

![Figure 31. Block F Time slice, 7-16 ns.](image-url)
Figure 32. Block F Overlay, 3-13 ns.

Figure 33. Block F Overlay, 32-41 ns.
**9BN104**

Site 9Bn104 is a large, multi-component aboriginal site in the northeastern part of the study tract (Hendryx and Sawyer 2007). Soils on the site include Chipley fine sand for the northeastern exterior portions of the site and Lakeland sand for the site’s interior. The site contains Irene, Savannah, Wilmington, Swift Creek, Deptford, Refuge, and St. Simons components. Most of the occupational debris at the site is probably associated with the Late Mississippian Irene Phase. Site 9Bn104 was sampled by six GPR blocks (Blocks G, H, I, J, K, and L).

**Block G**

Block G was a rectangular sample that measured 19 m East-West by 10 m North-South. Datum G was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 483297, Northing 3526476. Thirty-nine radargrams were recorded in this block. The total length of radargrams in Block G was 389 m.

One radargram profile from Block G is illustrated in Figure 34. This profile of Radargram 6 traversed a surface scatter of oyster shell near its southern begin point. The shell vicinity is indicated by a white triangular marker in this image. Several hyperbolas are clustered in the area immediately north of the oyster shell scatter. The objects represented by these hyperbolas are shallow deposited (<50 cm depth).

One time slice of Block G from 14-23 ns time depth is shown in Figure 35. Two overlay images of Block G are shown at increasing time depths in Figures 36 and 37. Figure 36 shows a composite view of radar reflections from 3-12 ns, or the upper soil zones. Figure 37 shows a composite view at 29-39 ns. Comparison of these two images reveals that most of the radar reflections in Block G originate near the ground surface.

The western one-third of Block G contains a concentration of radar anomalies. These reflections originate near the ground surface, which may indicate concentrations of tree roots or shallow cultural features (or both).

![Figure 34. Block G, Radargram 6.](image)
Figure 35. Block G Time slice, 14-23 ns.

Figure 36. Block G Overlay, 3-12 ns.

Figure 37. Block G Overlay, 29-39 ns.
Block H

Block H was square and measured 10 m East-West by 10 m North-South. Datum H was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 483279, Northing 3526416. Twenty-one radargrams were recorded in this block. The total length of radargrams in Block H was 209 m. A woods road cuts across the southeastern corner of this sample block and shallow wheel ruts are associated with it. One radargram profile from Block H is illustrated in Figure 38. This profile of Radargram 56 crosses a curious radar reflection, which is discussed below.

A time slice of Block H from 3-12 ns time depth is shown in Figure 39. Several connecting lines of radar anomalies, which appear to have a Northeast-Southwest and Northwest-Southeast orientation, are apparent in this image.

Two overlay images of Block H are shown at increasing time depths in Figures 40 and 41. The three maps shown in Figures 39-41 reveal a particularly intriguing anomaly pattern. A large (roughly) rectangular outline, which is oriented diagonal to the GPR grid, appears on the east-central part of Block H. This outline is best defined at about 12 ns depth, although it originates near the ground surface. The suspicious rectangular outline measures approximately 7 m Northeast-Southwest by 5 m Northwest-Southeast. One possible interpretation for this anomaly pattern is that it represents a concentration of daub along the walls of a rectangular wattle and daub building ruin. This hypothesis is tenuous at present, but it bears testing by archaeological excavation. An alternative hypothesis is that the southeastern alignment of this radar reflection is associated with the woods road that passes just southeast of it.

Figure 38. Block H, Radargram 56.
Figure 39. Block H Time slice, 3-12 ns.

Figure 40. Block H Overlay, 3-12 ns.
Block I

Block I was placed on Site 9Bn104. The sampled area was rectangular and measured 10.5 m East-West by 10 m North-South. Datum I was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 483330, Northing 3526389. Twenty-two radargrams were recorded in this block. The total length of radargrams in Block I was 219.5 m.

One time slice of Block I from 26-35 ns is shown in Figure 42. Two overlay images of Block I are shown at increasing time depths in Figures 43 and 44.
Block J

Block J was placed 1.6 m south of Block G on Site 9Bn104. The sampled area was rectangular and measured 2.5 m North-South by 30 m East-West. This long, narrow sample was positioned parallel with the slope break on this site. Datum J was established in the southwestern corner of the GPR block at UTM,
NAD27, Zone 17, Easting 483279, Northing 3526460. Seven radargrams were recorded in this block. The total length of radargrams in Block J was 210 m.

One radargram profile from Block J is illustrated in Figure 45. This profile of Radargram 86 crosses several strong radar reflections.

One time slice of Block J from 16-25 ns is shown in Figure 46. Two overlay images of Block J are shown at increasing time depths in Figures 47 and 48.

Figure 45. Block J, Radargram 86.

Figure 46. Block J Time slice, 16-25 ns.

Figure 47. Block J Overlay, 3-12 ns.
Block K

Block K was placed to completely surround a low mound, which had been recently sampled by a test excavation unit on its summit. Block K was rectangular and measured 13.5 m East-West by 15 m North-South. Datum K was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 483351, Northing 3526197. Twenty-eight radargrams were recorded in this block. The total length of radargrams in Block K was 418.5 m.

One radargram from Block K is shown in Figure 49. This radargram traverses the low mound and test excavation unit. These areas are bounded by the white triangular markers shown in this figure. Many strong radar reflections are exhibited in this portion of the sample block. These anomalies are mostly contained in the upper 50 cm soil zone.

One time slice of Block K from 5-14 ns is shown in Figure 50. Two overlay images of Block K are shown at increasing time depths in Figures 51 and 52.
Figure 50. Block K Timeslice, 5-14 ns.

Figure 51. Block K Overlay, 3-12 ns.
Figure 52. Block K Overlay, 29-39 ns.
Site 9Bn11 is a multi-component site located on a bluff at Redbird Creek. The primary occupation at this site dates to the Late Mississippian Irene Phase, although Late Archaic St. Simons and Middle Mississippian Savannah Phase artifacts are present (Sawyer and Hendryx 2007). Site 9Bn11 was sampled by four GPR blocks (Blocks L, M, N and O).

**Block L**

Block L was rectangular and measured 10.5 m East-West by 11 m North-South. Datum L was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 481522, Northing 3525861. Twenty-two radargrams were recorded in this block. The total length of radargrams in Block L was 241.3 m. One radargram from Block L is shown in Figure 53. Numerous objects are reflected in this radargram, including several at depths greater than 50 cm.

Two time slices of Block L are shown in Figures 54 and 55. Two overlay images of Block L are shown at increasing time depths in Figures 56 and 57.

![Figure 53. Block L, Radargram 13.](image-url)
Figure 54. Block L Time slice, 8-17 ns.

Figure 55. Block L Time slice, 26-36 ns.

Figure 56. Block L Overlay, 3-12 ns.

Figure 57. Block L Overlay, 29-39 ns
Block M

Block M was rectangular and measured 10.5 m East-West by 12 m North-South. Datum M was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 481568, Northing 3525818. Twenty-two radargrams were recorded in this block. The total length of radargrams in Block M was 263.5 m.

One time slice of Block M from 3-12 ns is shown in Figure 58. Two overlay images of Block M are shown at increasing time depths in Figures 59 and 60. Figure 59 shows the composite radar reflections from 3-12 ns. Figure 60 is an overlay of radar reflections to 39 ns.

All three of the maps shown in Figures 58-60 reveal a strong area of radar reflection in the east central portion of the sample block. These may indicate a prehistoric habitation area.

Figure 58. Block M Time slice, 3-12 ns.
Block N

Block N was rectangular and measured 10.5 m East-West by 11 m North-South. Datum N was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 481505, Northing 3525929. Twenty-two radargrams were recorded in this block. The total length of radargrams in Block N was 241.5 m. Two radargrams from Block N are shown in Figure 61. Radargram 49 (shown on the left) runs parallel to a linear radar pattern that appears in plan view. Radargram 63 traverses several strong radar reflections on the east side of the sample block.

One time slice from Block N at 15-25 ns depth is shown in Figure 62. This map shows a cluster of strong radar reflections in the northeastern part of the sample block. Two overlay images of Block N are shown at increasing time depths in Figures 63 and 64. Figure 63 shows a composite view of the block from 3-12 ns. A pronounced North-South anomaly is visible on the western side of the sample block. This linear pattern originates near the ground surface and is evidenced in many of the subsequent radar maps. Figure 64 shows a composite view of Block N at 38 ns depth. The previously described North-South anomaly remains visible in this view. This linear pattern may signify groundwater reflection, possibly associated with an agricultural ditch. The strongest radar reflections are concentrated on the northern one-half of the sample block in this composite view.
Figure 61. Block N, Radargrams 49 and 63.

Figure 62. Block N Time slice, 15-25 ns.
Block O

Block O was placed in a cleared area at the Redbird Creek bluff on Site 9Bn11. This barren area is a modern-day informal parking and camp site. This area was selected for GPR survey by the LAMAR Institute team. The sampled area was rectangular and measured 12 m East-West by 7 m North-South. Datum O was established in the southwestern corner of the GPR block at UTM, NAD27, Zone 17, Easting 481513, Northing 3525848. Twenty-five radargrams were recorded in this block. The total length of radargrams in Block O was 175 m. One radargram from Block O is shown in Figure 65. Several strong radar reflections are apparent in this radargram. These range in depth from near the ground surface to about 75 cm below ground. The deeper reflections that are visible at about 1.5 m depth probably represent harmonic reflections and are not cultural features.

Two time slices of Block O are shown at increasing time depths in Figures 66 and 67. Figure 66 is a map from 6-15 ns time depth. Figure 67 shows the sample block from 28-37 ns depth. Two overlay images of Block O are shown at increasing time depths in Figures 68 and 69. Figure 68 is a composite view from 3-12 ns. Figure 67 shows a composite view of Block O to a depth of 39 ns. Large areas of strong radar reflection are manifested in two areas of Block O in the southwest and northeast.

Figure 65. Block O, Radargram 80.
Figure 69. Block O Overlay, 29-39 ns.
Summary

Ground Penetrating Radar (GPR) was employed by the LAMAR Institute team at four aboriginal sites in the Genesis Point development tract. This represents a survey coverage of 5,408.5 m² distributed across the four archaeological sites. Three GPR sample blocks at 9Bn887 covered approximately 3,464 m²; Three GPR blocks at 9Bn909 covered approximately 826 m²; five GPR blocks at 9Bn104 examined about 677.5 m²; and four GPR blocks at 9Bn11 explored 441 m². The GPR equipment functioned favorably at all four locations. Field survey conditions also were favorable for survey so that a greater than expected coverage was performed.

This GPR survey of four late prehistoric sites in Bryan County represents an important in-road to remote sensing application in the coastal Georgia. Most GPR studies, with a few notable exceptions, that have been undertaken in the region were historic period sites. The present study should allow the archaeologist to make informed decisions regarding the placement of test excavation units or block excavation units, particularly when combined with other survey information and detailed topographic mapping.

The areas selected for GPR survey were chosen by ESI staff archaeologists, with one single exception. GPR Block O on site 9Bn11 was chosen by the LAMAR Institute field team. In every sample block favorable GPR signals were obtained. None of these study blocks were devoid of substantial radar reflections.

In several instances, the GPR coverage included obvious surface features of prehistoric significance, such as oyster shell midden deposits and shell and sand intentionally mounded areas. The age and function of these mounds awaits further exploration. GPR surveys of these locales presents a layer of information that should reduce the level of effort required to fully understand these cultural features.

Natural versus Cultural Anomalies

The heavily wooded environment that was characteristic of each of the four study sites presented some hindrance for the study. While the problem of under story growth was minimized by advanced clearing of the ground surface, the subsurface root system of the large hardwood trees in these areas create GPR anomalies that are difficult to distinguish from cultural features.

Tree stumps and tap roots generate a GPR anomaly pattern quite similar to an aboriginal storage pit or refuse pit. Large tree roots that spread out in a dendritic pattern from the tree base may create GPR anomaly patterns that are similar to those that would result form a circular or oval building wall or a short palisade line. Even when these “tree” GPR signals are recognized for what they represent, they often mask the “real” cultural GPR signals that may lie in close proximity. At present, GPR interpretation does not include any algorithms that would allow the tree GPR signals to be filtered out from those that are cultural ones.

Groundwater

Groundwater has a significant affect on the GPR signals. Several examples where groundwater reflection affected the GPR signals were observed in the present survey. Block B on Site 9Bn887, where the radar reflections are concentrated along the western margin of the sample block, may be one such example (see Figure 15). That edge of the block is closest to the marsh and groundwater may be more concentrated in this vicinity than on the eastern 2/3 of the block. In some cases groundwater reflections may be indicative of cultural features, particularly in situations where the soils in the cultural feature retain water at a differential rate from the surrounding soil matrix.

Soil compaction is one soil characteristic that is indicated on the GPR plan maps. The most obvious case was observed in Block A where a field road traversed the sample block and is clearly visible as a broad
linear radar anomaly in several of the plan maps of that block. Soil compaction from prehistoric times also may be visible in several of these maps.

**Cultural Features**

The series of GPR plan maps presented in the previous chapter and greater detail and abundance in Appendix 1 contain many dozens of potential cultural features, as indicated by the blue-to-red color gradation. While the colors used in the mapping palette were arbitrary, they illustrate contrasts in radar signals across the 15 sample blocks.

Small pit features and shallow (near surface) features may escape detection at the level of sampling and mapping that was utilized. Small features, if they are clustered, may appear on the GPR plan maps as an irregularly-shaped zone. Likewise, dense areas of artifacts may also create a “debris field” pattern in the GPR plan maps. In these cases the areas of radar reflection (shown as red or orange) may correspond to these debris fields. Areas with fewer anomalous radar reflections (shown in the blue range) are less likely to contain any substantial feature or artifact deposits.

Larger pit features and features with substantial thickness may appear in the GPR maps as distinct anomalies. Dozens, if not hundreds, of such features are illustrated by this GPR study. The problem lies in isolated the individual features from the mass of radar reflections.

Small earthen and oyster shell mounds dot the landscape at the Genesis Point. On the better preserved sites, where the leveling effects of agriculture have been minimal, these mounds are recognizable as low oval to sub-rectangular mounds. GPR survey provides for better definition of these features. An excellent example is shown by the mound in Block A on 9Bn887. This apparently small mound is visible on the surface and it was sampled by a small test unit. The GPR survey demonstrates that this mound is considerably larger than surface evidence suggests. Its outer dimensions are approximately 17 m North-South by 14 m East-West, as shown by the black outline in Figure 70. It has a core area that measures approximately 6 m North-South by 5 m East-West.

Another interesting example is shown by the low mound in Block K. That mound also had been sampled by a small test unit. The GPR survey did not provide good definition of the mound’s outline, as with Block A, but it did reveal some other intriguing aspects. The GPR map, as shown in Figure 71, reveals some linear patterning of radar reflections, which may indicate the remains of a building on, or beneath, the mound. This hypothesized building’s existence remains to be verified by excavation. On other sampled areas with mounds the GPR survey did not yield definitive results.

**Conclusions**

This project represents an important test application of GPR technology on four aboriginal sites in coastal Georgia. The four sites that were selected for GPR survey share many characteristics in terms of their multi-component occupations, presence of cultural features, depth of cultural deposit, soil types, and their maritime forest environment.

GPR survey is a non-destructive technique that it allows the archaeologist to have some prior knowledge of the subsurface before beginning excavation. This knowledge is important for properly excavating and interpreting the cultural remains.

GPR proved effective at mapping the subsurface on all four sites, particularly the upper 1.5 m soil zone. Mapping below 1.5 m was problematic as the GPR signals quickly dissipated below that depth. Since most cultural activity fell in the upper range, the weak signals at greater depth did not present a significant problem. As expected, the large tree root systems in the maritime forest made distinguishing between tree roots and cultural features quite difficult. We were able to distinguish some cultural features with the GPR data, but it was more effective at defining gross areas of radar activity versus areas with minimal radar reflection. This “hot vs. cold” radar map probably has important meaning in mapping and defining the
cultural landscape on these sites. The hot areas probably contain a higher concentration of subsurface artifacts and features than areas with few radar reflections.

Future archaeological excavations during Phase III efforts on these sites will allow for verification of many of the findings from the GPR survey. For practical applications, GPR survey prior to Phase III excavations should decrease the level of effort and sampling necessary compared to traditional excavation strategies. Once the Phase III results are returned, ESI archaeologists will be able to assess the cost-effectiveness and accuracy of GPR application to this class of multi-component aboriginal archaeological sites. The Georgia coast abounds with thousands of similar sites and a post-excavation assessment of these results will help determine if GPR survey is a vital tool for planning excavations on similar sites.
Figure 71. Possible Building, Block K, 9Bn104.
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