Ground Penetrating Radar (GPR) Investigations at the Jimmy Carter National Historic Site, Sumter County, Georgia

Prepared for:

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ACKNOWLEDGEMENTS

The opportunity to perform Ground Penetrating Radar at the Jimmy Carter National Historic Site (JICA) was a wonderful experience for the archaeologists from the Georgia Department of Transportation (GDOT). The project would have never been realized if it was not for the cooperative relationship between our agency and the staff of both the JICA and the Southeast Archeological Center (SEAC). I would like to express my sincere appreciation to the following individuals: Annette Wise and Alan Marsh of JICA and John Cornelison and Chuck Lawson of SEAC. The enthusiasm and knowledge of these individuals was both encouraging and invaluable. I would also like to thank Jim Pomfret and Shawn Patch, my colleagues at the GDOT, who are always interested in helping, learning, and sharing all of their knowledge and experiences in archaeology. Eric Duff, Archaeology Unit Supervisor at the GDOT, has always provided us with guidance and latitude. Lastly, I would like to thank Dr. Rowe Bowen and Dr. Gail D'Avino for taking an interest in what we do for the Department.

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INTRODUCTION

On April 18, 2005 staff from the Georgia Department of Transportation (GDOT) conducted a series of ground penetrating radar (GPR) assessments of a portion of the Jimmy Carter National Historic Site (JICA) in Sumter County, Georgia. This project was part of a cooperative agreement between GDOT and the National Park Service (NPS). GDOT personnel included Teresa Lotti, Jim Pomfret, and Shawn Patch. All of the work was performed under the supervision of Ms. Annette Wise and Mr. Alan Marsh of JICA and John Cornelison and Charles Lawson with NPS' Southeast Archeological Center based in Tallahassee, Florida.

The GPR investigations were within an area south of the Jimmy Carter boyhood home (Figure 1). The intent of the survey was to identify cultural anomalies that may be identified as outbuildings that were once part of the Carter farm. In particular, the park would like to reconstruct the chicken coop and car garage that were removed sometime in the 1940's. The position of the grids was based upon the recollection of former President Jimmy Carter, who had placed a stake in the approximate location of the chicken coop.

METHODS

The GPR data were collected using the GSSI SIR-3000 unit with an attached 400 MHz antenna. While in the field, the files collected were downloaded onto a laptop computer and post processed using RADAN 5.0 (a program designed by GSSI for analyzing GPR linescans and creating 3D images of the GPR data). In field processing helps to assess the quality of the data, look for any errors in the data collected, adjust settings affected by sub-surface conditions and identify potential targets (Figure 2). In-depth post-processing occurs once all the data is collected and brought back to the office.

Afterwards, the files, broken down into individual time slices, were brought into Surfer, a program that assists with grid amplification and mapping. In Surfer, time slices were assigned arbitrary color values to differentiate between the levels of reflectivity collected by the SIR-3000. Color values assigned to GPR projects are not uniform. In most cases, because soil conditions and material signatures vary, different color schemes work better from project to project. Color values, then, are assigned to grid slices to maximize their interpretive value on an individual basis.

Table 1. Summary of GPR Grids.

Grid Number	X-length (m)	Y-length (m)	Area (m^2)
1	14	13	182
2	7	20	140
Total			322

Figure 1. Map showing locations of GPR surveys at Jimmy Carter National Historic Site (source: 1993 Sumter County MrSID image).

Figure 2. Post-processing Grids 1 and 2.

Grid placements or target areas were chosen by JICA staff based on the recollections of former President Carter. Generally, baselines are established with arbitrary coordinates (0, 0 in the southwest corner). RADAN is a flexible processing program that allows for custom sized grids. The grids were oriented grid north (338^0); with the grid sizes dictated by major topographic features such as sidewalks and fence lines. For both grids the data were collected in the X direction (east-west) beginning in the southwest corner of each. The GPR transects were spaced 50cm apart in order to maximize detection of anomalies. A rebar stake was placed in the northwest corner of Grid 1 in order to locate our grids in the event that further work is performed at the site.

RESULTS

Grid 1

Two grids were collected at the JICA with a combined area of 322 m^2. Grid 1 (Figure 3) was located north of the Carter boyhood home, adjacent to the outhouse. This area was identified by former President Carter as the location for his family chicken coop. Presently, the area is a grassed lawn outside of the home. The grid size and orientation was dictated by the amount of available space, with an attempt to cover as much area as possible, using the pathway leading to the house as the baseline.

Figure 3. Grid 1 survey.

Figure 4 represents a raw data linescan of Grid 1 collected at 10 meters north of the datum in the southwest corner, while Figure 5 depicts a composite image of the radar data from Grid 1 at different depths, ranging from 60 to 140 centimeters below the surface (cmbs). In the northwest corner of the grid, a circular anomaly begins to reflect with higher amplitude around 60 cmbs. This is a 2 x 2 meter feature adjacent to a reconstructed privy that may represent the original location of the Carter outhouse. The hyperbola for the privy is also visible on the linescan in Figure 5.

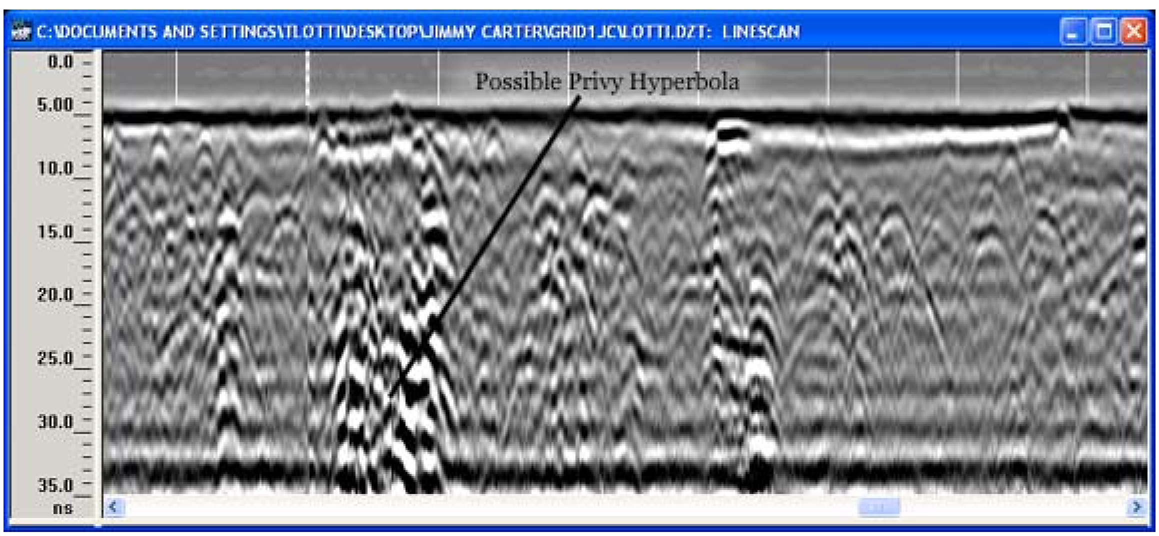

Figure 4. GPR linescan for Grid 1.

The signature becomes slightly more amorphous as the time slices get deeper. However, it retains a strong reflectivity well beyond a meter in depth. In addition to the circular anomaly, a linear set of anomalies begin to reflect in the 80-100 cmbs timeslice in the northern half of the grid. They strengthen in amplitude at a meter in depth. These signatures appear to be 50 x 50 centimeters in diameter. Given their linear pattern and circular appearance these anomalies could represent post features.

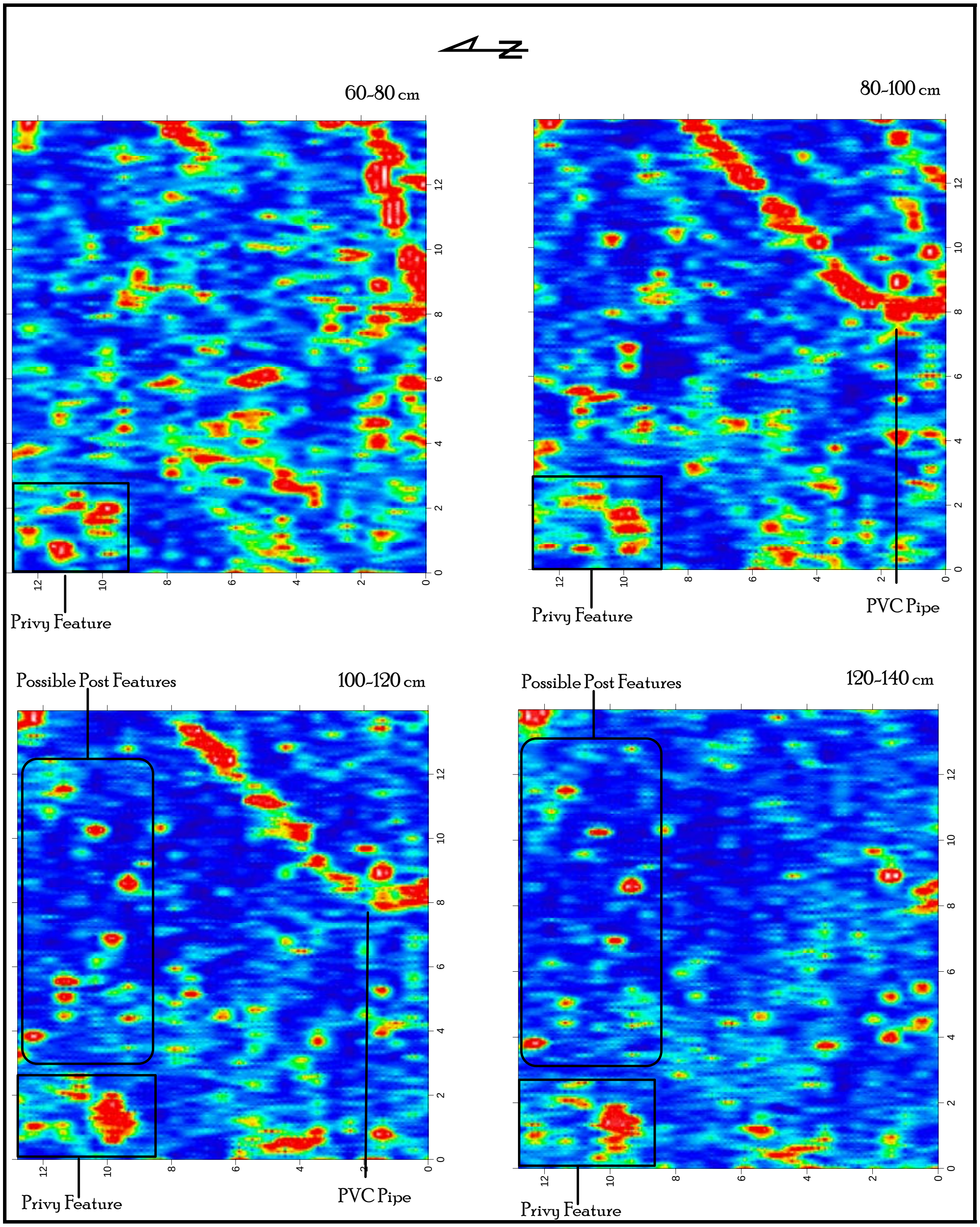

Figure 5. Composite radar image of Grid 1.

In addition to the potential cultural features, a PVC pipe appears in the southeast corner of the grid beginning in the 60-80 cmbs timeslice. The PVC pipe was buried by JICA staff to supply water to the reconstructed well outside of the Carter boyhood home. A second set of round anomalies appear throughout the Grid 1 radar composites in the southern part of the grid. These anomalies are also associated with the extensive utility work performed at the site, becoming apparent when Grids 1 and 2 are put together in a Super 3D image.

Grid 2

Grid 2 was placed adjacent to Grid 1 to the south and north of the well reconstruction (Figure 6). This grid measured approximately 140 m^2. The grid size and orientation was dictated by the amount of space, with an attempt to cover as much ground as possible. JICA staff believed this area to be the location of the Carter family car garage.

Figure 6. Grid 2 survey.

Figure 7 shows a composite image of the radar data from Grid 2 at different depths ranging from 60-140 cmbs. All of the anomalies within this grid appear to be associated with the reconstruction of the well and other utilities. The large circular anomaly in the northeast corner is an underground water tank that feeds water into the reconstructed well. The water tank hyperbola is also visible in the raw data linescan captured at 6.5

meters from the grid's datum in the southeast corner (Figure 8). Linear features are also present in Grid 2 and they begin to reflect in the 60-80 cmbs timeslice, cutting through the western half of the grid. Though amorphous in the first timeslice, their sizes and

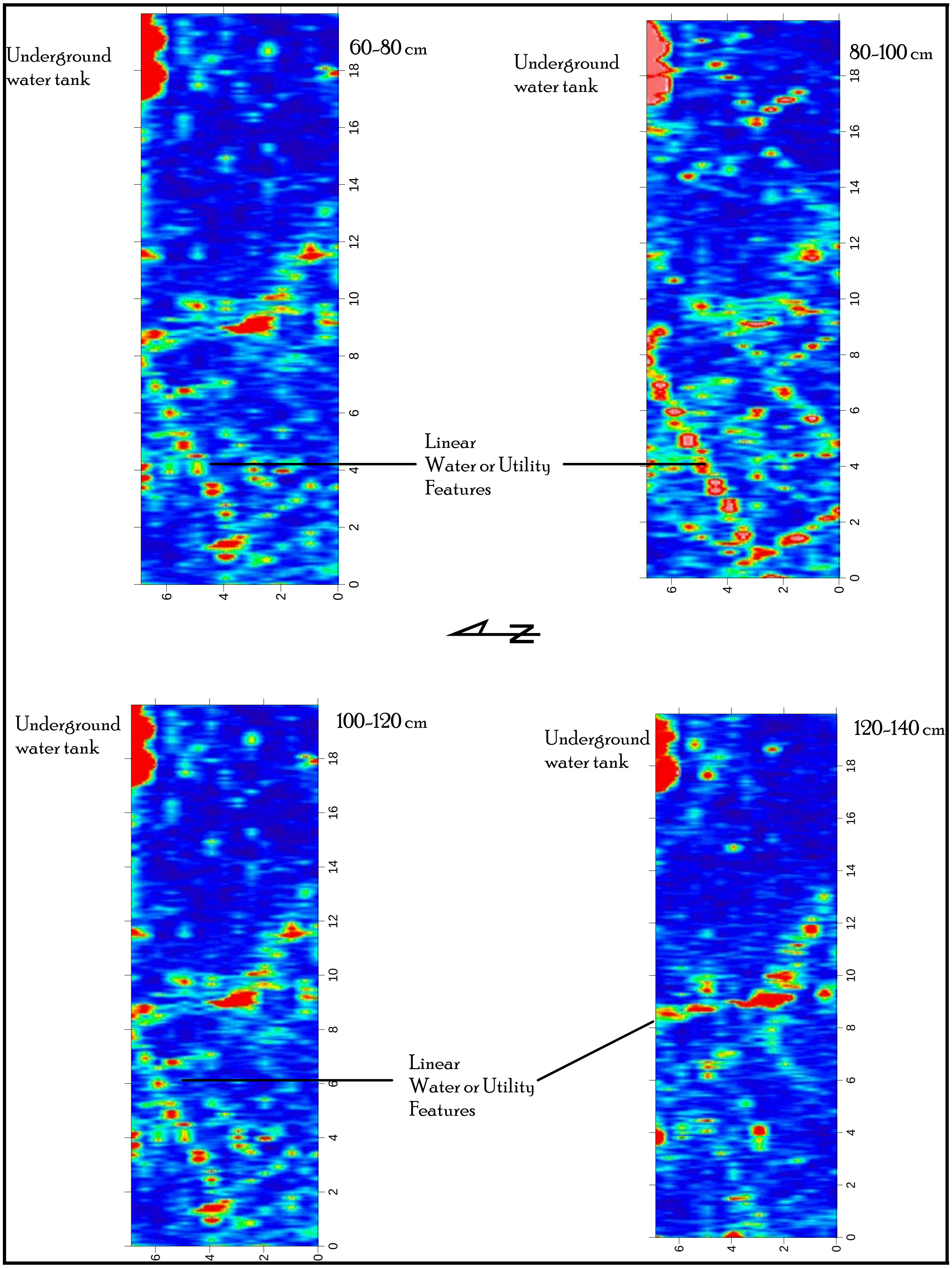

Figure 7. Composite radar image of Grid 2.

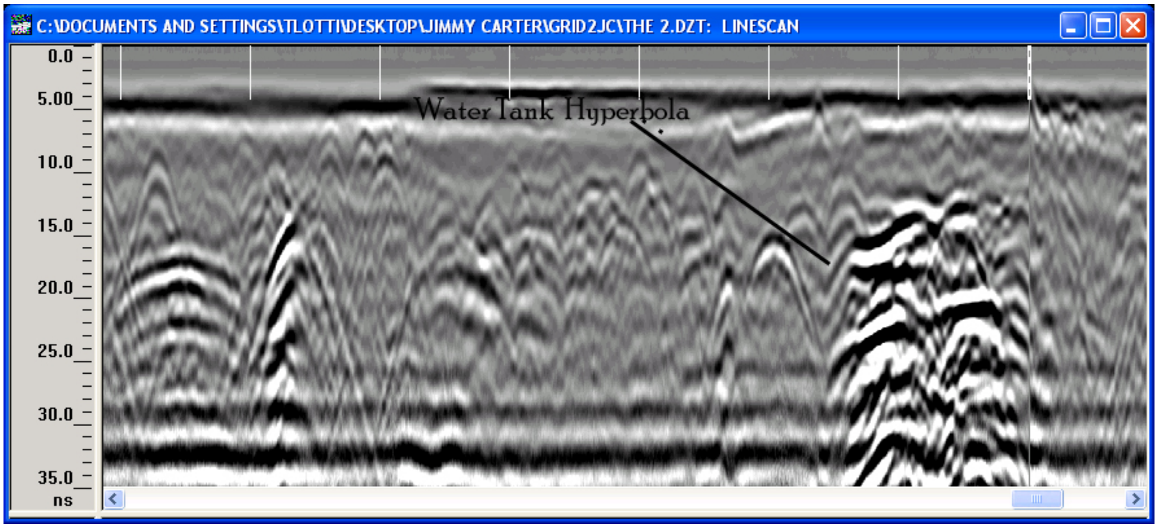

Figure 8. GPR linescan for Grid 2.

shapes appear more regular in the 80-100 cmbs timeslice. These linear features, at first glance, could be interpreted as a foundation. However, as Grids 1 and 2 are put together in a Super 3D image it becomes apparent that these features are associated with utility work.

In the case of the data collected at the JICA, the Super 3D RADAN 5.0 function proved extremely useful. Super 3D allows two or more grids to be combined. Once the grids have been merged, RADAN 5.0 reassigns grid coordinates to reflect the correct position of each grid in reference to the others. By combining Grids 1 and 2, the Super 3D image from Figure 9 helps distinguish those anomalies associated with modern intrusions, in this case utilities reported to us by JICA staff, from ones that appear to be cultural subsurface features. Most of the linear lines that begin in the eastern half of Grid 1, already identified as a PVC pipe and utilities for the well, tie into the linear anomalies in the western half of Grid 2. The circular features, which may represent post holes in the northern portion of Grid 1, do not appear to be linked to the extensive utility work near the home. In addition, the larger circular anomaly in the northwest corner of Grid 1, the privy feature, does not appear to be part of the recent utility work at the farm.

CONCLUSIONS AND RECOMMENDATIONS

Our GPR collection strategies were focused on identifying subsurface archaeological features associated with historic structures (e.g. chicken coop, car garage). Our selections for grid locations were based on former President Carter's recollections and JICA' research and documentation. The environmental settings, sand and cut grass, are optimal conditions for GPR data collecting. Prior to the survey, we were unsure if the structures would provide a detectable signature, and we were unaware of the previous disturbance. The GPR worked extremely well in these conditions and collected positive data approximately 1 ½ meters below the surface. The coupling for the GPR was easily maintained on the manicured grass surface and sand swept yard, allowing the GPR antenna to maintain good surface contact.

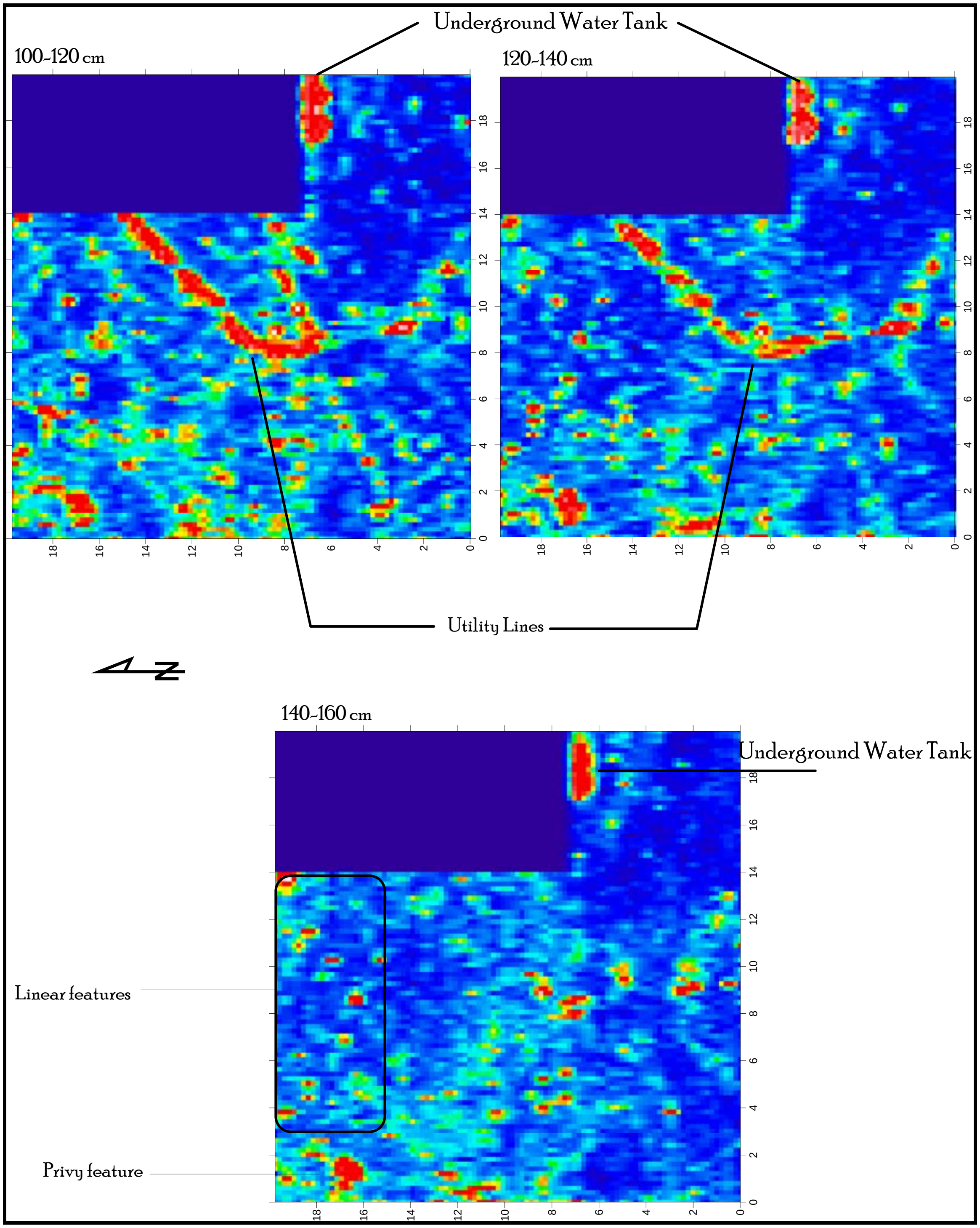

Figure 9. Super 3D composite radar image of Grids 1 and 2.

Of the two areas sampled, Grid 1 has the highest potential for buried archaeological features. Grid 1 has high reflections that were not identified as modern intrusions, such as the reflections in Grid 2. The anomalies identified during the GPR survey in Grid 1 may or may not be archaeological. However, anomalies inconsistent with modern intrusions are clearly visible, such as the circular anomaly in the northwest corner of

Grid 1, which may represent features associated with the Carter farm. Also, despite the modern intrusions identified in Grid 2, it is possible that the linear features are from an older series of utilities or possibly from a previous foundation.

The identification of any anomaly identified by the GPR requires some level of ground truthing such as archaeological excavations. The GPR investigations have identified areas of interest in both grids where subsurface archaeological features may exist. The results also reflect the level of disturbance created by modern intrusions such as utility lines and water well reconstruction. When used in optimal conditions and with the correct settings, the GPR has the ability to identify archaeological features in a non-invasive manner. The GPR investigations performed at the JICA were extremely successful, and have provided the park with valuable information for future work and research at their site.

APPENDIX A:

VITA OF PRINCIPAL INVESTIGATOR

CURRICULUM VITAE

Teresa A. Lotti
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Education

MA, 2005, History/Public History, University of West Georgia, Carrollton, GA

BA, 1994, Art History, University of Alabama, Tuscaloosa, GA

Professional Experience

2000 - Present — Senior Transportation Planner – Archaeologist, Georgia Department of Transportation, Atlanta, GA

1998 - 2000 — Crew Chief, Panamerican Consultants, Inc., Ft Stewart, GA

1996 - 1998 — Senior Laboratory Technician/Curation Supervisor, Panamerican Consultants, Inc., Tuscaloosa, AL

1995 - 1996 — Archaeology Technician/Small Survey Supervisor, Panamerican Consultants, Inc., Tuscaloosa, AL

Publications and Technical Reports

2001 — *An Archaeological Survey of County Road 201 in Treutlen County, Georgia*. Georgia Department of Transportation, Atlanta.

2001 — *An Archaeological Survey of County Road 82 in Treutlen County, Georgia.* Georgia Department of Transportation, Atlanta.

2001 — *An Archaeological Survey of County Road 169 and County Road 63 in Treutlen County, Georgia.* Georgia Department of Transportation, Atlanta

1999 — *Archaeological Investigations of Four Sites Situated Along the Cahaba River Jefferson County, Alabama.* Prepared for F.W. Dougherty Engineering & Associates, Inc. Birmingham, Alabama. Prepared by Panamerican Consultants, Inc., Tuscaloosa, AL (co-authored with Keith Little, Greg Hendryx, Paul D. Jackson, and Meghan LaGraff Ambrosino).

1998 — *Problems in Sorting: Typology for South Carolina Coastal Ceramics.* Paper presented at the Alabama Academy of Science.

1998 — *A Phase I Cultural Resources Survey of the Proposed Caney Branch Bridge (Bridge #1132) Replacement, County Road 90, Franklin County, Alabama.* Prepared for the Franklin County Engineers Office, Russellville, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama.

1998 — *Phase II Archaeological Testing of Six Sites at Parris Island, South Carolina.* Prepared for the U.S. Corps of Engineers, Savannah District.

1999	Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Kristen Zschomler, Daniel Pratt, Jennifer Grover, and Mark Steinback).
2000	*Phase II Testing of a Portion of Site 38BU927, The Track Site, Marine Corps Air Station, Beaufort, South Carolina.* Prepared for the U.S. Corps of Engineers, Savannah District. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Kristen Zschomler, Jennifer Grover, and Keith Little).
1998	*A Cultural Resources Survey of MR Pratt One, L.L.C., Pratt Mine and Road Corridor Jefferson County, Alabama.* Prepared for MR Pratt, L.L.C., Birmingham, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Kristen Zschomler, Jennifer Grover, and Keith Little).
1998	*Cultural Resources Assessment of the Smith Creek Bridge Replacement and Realignment of the Approaching Roadway in Colbert, County, Alabama.* Prepared for Colbert County Engineering Department, Tuscumbia, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama.
1999	1998 *Phase IB Cultural Resources Survey of Selected Sites on Lovango Cay, USVI.* Prepared for Estate Lovango, St. John, U.S. Virgin Islands. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Jennifer Grover, Kelly Nolte, and George Tyson).
1998	*Phase I Cultural Resources Survey of Selected Areas at Marine Corps Air Station, Beaufort, South Carolina.* Prepared for the U.S. Army Corps of Engineers, Savannah District. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Jennifer Grover).
1998	*Cultural Resources Assessment of the Proposed Extension of the Flat Creek Mine, Walker County, Alabama.* Prepared for Laguna Resources, Birmingham, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Daniel Pratt).
1998	*Cultural Resources Assessment of the Proposed Union Chapel Mine, Walker County, Alabama.* Prepared for Perc Engineering Co., Inc., Jasper, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama.
1998	*Archaeological Mitigation of Site 1WA128, Walker County, Alabama*. Prepared for Drummond Company, Inc., Jasper, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Paul D. Jackson, Patrick Smith, Keith Little, and James Ambrosino).
1998	*A Phase I Cultural Resource Survey of the Proposed Spring Branch Mine, Marion, Walker, and Winston Counties, Alabama.* Prepared for Perc Engineering Co., Inc., Jasper, Alabama. Panamerican Consultants, Inc., Tuscaloosa, Alabama (co-authored with Ryan Crutchfield).

Honors and Professional Associations

2004	Phi Alpha Theta, History Honors Society
2000	Society for American Archaeology (GDOT Group Member)

2000	Society for Historical Archaeology (GDOT Group Member)
2000	Society for Georgia Archaeology (GDOT Group Member)
1999	Southeastern Archaeological Conference (GDOT Group Member)

Training Courses

2005	Federal Highway Administration Training Course “Fundamentals of NEPA and Environmental Documentation”.
2004	Geophysical Survey Systems, Inc Training Course “Theory and Practice of Applying Subsurface Interface Radar in Engineering and Geophysical Investigations”.
2004	Georgia Department of Transportation Training Course “Ground Penetrating Radar: An Introduction for Archaeologists” with Dr. Larry Conyers.
2004	Federal Highway Administration, Georgia Department of Transportation, and the Antonio J. Waring Archaeological Laboratory “Archaeological Curation Seminar & Workshop”.
2004	Georgia Department of Transportation Training Course “Plan Development Process Training”.
2003	SRI Foundation Training Course “Section 106: Principles & Practice”.
2001	University of Nevad, Reno Heritage Resources Management Program Training Course “Introduction to Section 106 Review”.