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# Geophysical Determination of Unmarked Graves at 41NA140 (Old Baptist Cemetery/Zion Hill Baptist Church)

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## Table of Contents

List of Figures	ii
Introduction	1
Methodology	3
Results	10
Appendix 1	11
References Cited	12

## List of Figures

Figure 1: USGS 1983 Topographic Map (1:24,000) with the location of the Zion Hill Baptist Church Cemetery (41NA140).	1
Figure 2: XY Grid used for the geophysical analysis of the Zion Hill Baptist Cemetery (41NA140).	4
Figure 3: Recording data points from the EM-31.	5
Figure 4: Surfer map of the geophysical data depicting differences in soil conductivities.	6
Figure 5: ArcGIS 3-D contour map of the EM-31 data.	7
Figure 6: Temporary marking of geophysically-detected but unmarked graves	8
Figure 7: Current marking method to indicate the location of the unmarked graves.	8
Figure 8: Location of unmarked graves and marked graves indicated by geophysical data.	9



## Introduction

The Old Baptist Cemetery (hereafter, Zion Hill Baptist Church Cemetery) is the first organized Black Baptist cemetery (and church) in Nacogdoches County (Tindall 1976:94). It is located along the current rechanneled La Nana Creek on Park Street (Figure 1). The church/cemetery site was originally a two acre plot of land, donated by Frank and Ellen Walton, that housed a brush arbor church and the cemetery to the east side of the church (Texas Historical Commission 2008). The brush arbor church was reconstructed into a frame building and then to the current Zion Hill Baptist Church (that was later moved). The cemetery was used from 1897-1945, but fell into disrepair. The City of Nacogdoches assumed custodianship of the cemetery in the early 1970s. As part of their preservation program for the Zion Hill Baptist Church Cemetery, a fence was erected around the area where headstones are present and a Texas Historical Landmark (number 12110) was designated and erected.

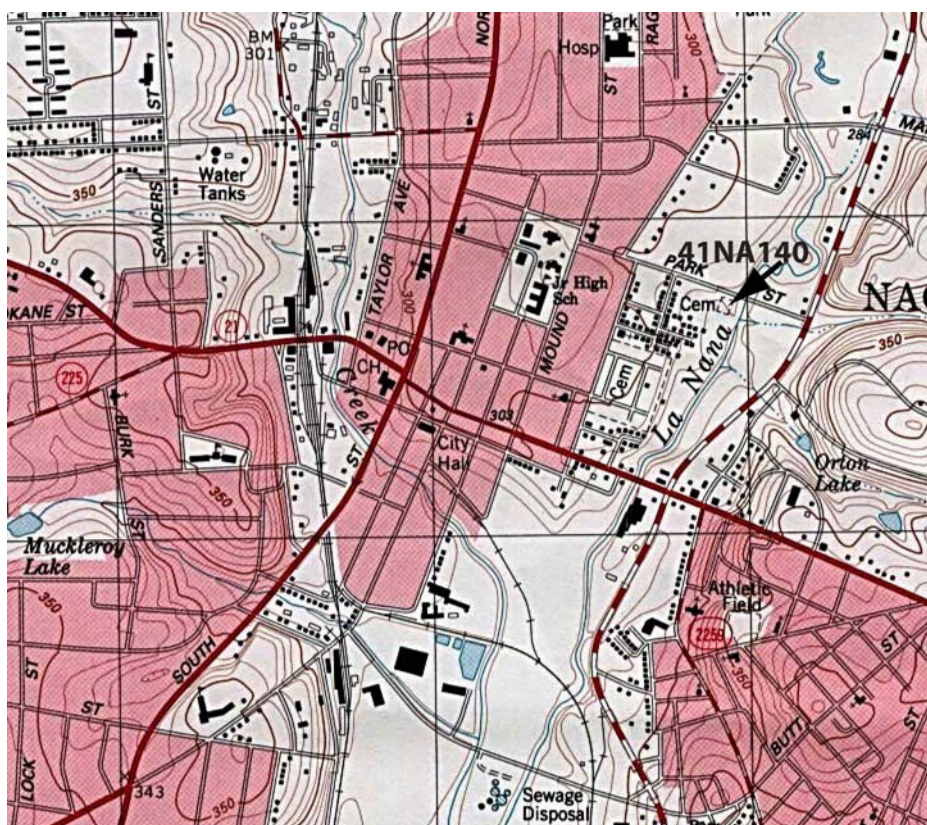


Figure 1: USGS 1983 Topographic Map (1:24,000) with the location of the Zion Hill Baptist Church Cemetery (41NA140).

In July 1980, personnel of Prewitt and Associates, Inc. surveyed above ground a 200 foot area on either side of the Banita and La Nana creeks to determine the effects of the channelization project proposed by the U.S. Army Corps of Engineers (Corbin

1980a). Ten archaeological sites were identified through this survey, one of which was Zion Hill Baptist Church Cemetery. According to Corbin (1980a:1):

Survey methods consisted of one person walking a zigzag linear pattern within the project limits along either side of the creek channels; shovel tests were attempted at each locality which appeared to be a potential site location. The normal thick summer vegetation in the project area obscured the ground surface to the extent that it was almost impossible to see the ground, and the unseasonably dry weather made shovel testing extremely difficult.

As a result of this survey methodology and the season in which it was conducted, it is entirely possible that sites and/or graves were overlooked. Although 29 headstones recording 36 individuals were recorded (dating from 1897-1945), Corbin (1980a:4) notes that there were “small mounds and rock- and/or cement-outlined areas” that may indicate additional graves in the cemetery. Mrs. Ernestine McNeil told Corbin that the cemetery was filled to capacity (*ibid*).

Attached to Corbin’s original survey report that included the Zion Hill Baptist Church Cemetery (1980a), is a working document (Corbin 1980b) that alludes to the presence of many unmarked graves. He was concerned with the impact of the chanelization project and the mitigation of the impact on the site. He stated (Corbin 1980b:3) that if the site were to be subject to adverse impacts, that the following mitigation efforts should be conducted: “archaeological work to determine [the] extent of cemetery and [the] number of unmarked graves. . . .” Thus, there is reason to believe that there are unmarked graves in the cemetery.

In November 2007, Dr. Leslie G. Cecil and Dr. Jeffery E. Roth conducted an above ground survey of the cemetery grounds and noted that there were large open areas (areas without marked graves) within the fenced area. If as Mrs. McNeil states is true and the graveyard was filled to capacity, then these open areas could hold the unmarked graves of those individuals. The only way to determine if there were unmarked graves without conducting shovel tests or excavations was through the use of geophysical surveying methodologies. We obtained a permit from the Texas Historical Commission (#4825) to conduct a below ground survey using electromagnetic technology (EM-31).

## Methodology

Geophysical analysis was conducted using a Geonics® EM-31 Terrain Resistivity/Conductivity Meter. This technology detects variations in the subsurface soils through an electromagnetic inductive technology (Geonics 2009). The EM-31 is composed of three distinct areas: 1) the transmitter coil; 2) the receiver coil; and 3) the data logger. The electromagnetic pulse produced by the transmitter coil penetrates two meters in the horizontal position and three meters in the vertical position. For this project the two meter depth was sufficient to obtain relevant data. After penetrating the soils, conductivity (related to soil density) is recorded by the receiver coil and displayed in the data logger. The data logger numbers were recorded by hand and entered into an Excel spreadsheet for additional analyses.

The quality of the results can be affected by salinity, clay content, moisture, and temperature (Kinal et al. 2006:79; Whittaker 2005). For this project, the only variables that could be controlled for were moisture and temperature. Therefore, if it had rained more than .25 inches within two days of gathering data, research was not conducted. The field days were short (four hours) and the ambient temperatures ranged from 86-55°F. While the temperature differences did not seem to make quantifiable differences, the amount of soil moisture did affect these data and, as discussed above, field work was not conducted on days after it had rained. Additionally, while this technology does indicate the presence of differences of soil conductivity, it does not guarantee a one-to-one ratio of graves with geophysical readings. The only way to ground truth the results would be to shovel test and that was not feasible for this project.

Below ground survey began on October 10, 2008 and was completed on December 5, 2008. The final placement of the unmarked graves occurred on February 6, 2009. A north-east grid was established with the datum point one meter to the west of the northern-most Lawson Reed headstone and flush with the northern-most edge of that headstone. The area mapped was 58 meters (west-east) x 51 meters (north-south) for a total area of 2958 m<sup>2</sup> (Figure 2). An area of 399 m<sup>2</sup> in the northeast corner was not mapped because it served as a parking area and the ground was so disturbed that geophysical readings were not possible.

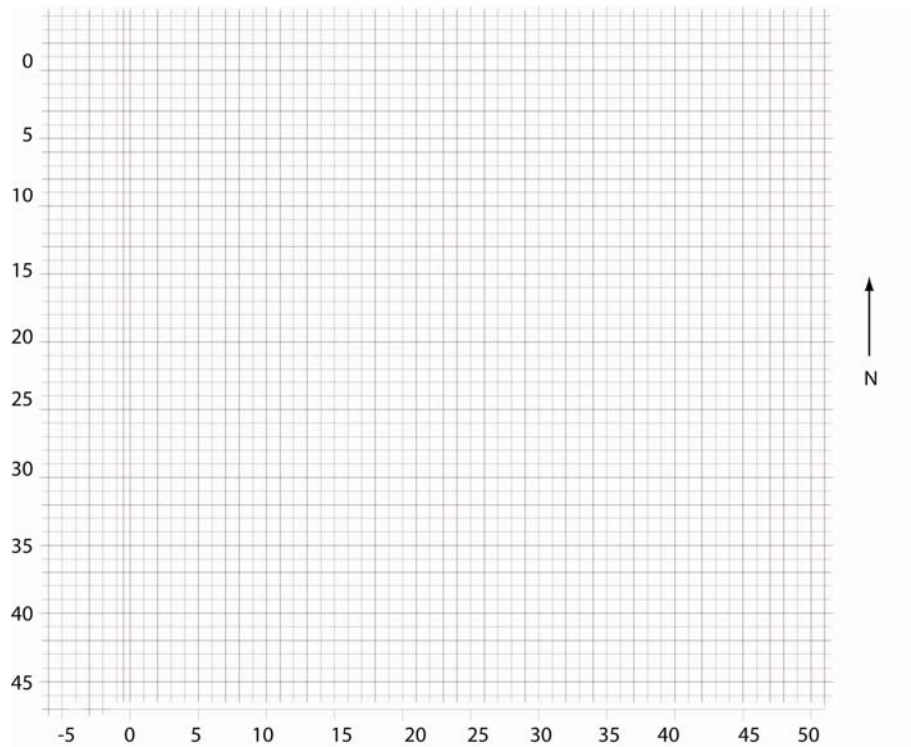


Figure 2: XY grid used for the geophysical analysis of the Zion Hill Baptist Cemetery (41NA140).

Once the grid was established using two-60 meter tapes, measurements of conductivity were taken every meter at a depth of two meters. A section of ground was tested at a depth of three meters and no differences in soil densities were determined. Therefore, it was determined that testing at a depth of two meters was sufficient given that graves are/were typically dug to a depth of 6 feet (1.83 meters). One student carried the EM-31 and sent electromagnetic pulses through the ground. A second student recorded the soil conductivity measurements (Figure 3). These data were then entered into an Excel database.





Figure 3: Matthew Worrell (left) recording data points from the EM-31 held by Zachary Overfield (right).

Data maps of the area were produced using Surfer 8.0 (Figure 4) and ArcGIS 9.2 (Figure 5). Using a Surfer shaded relief map, Cecil was able to interpret different areas of soil conductivity that represented disturbances in the soils. These areas were marked with orange survey flags as we progressed with the geophysical survey (Figure 6). The final step in this project was to establish the exact XY coordinates. To that end an ArcGIS map with contours was produced. The orange survey flags were replaced with red pieces of plastic nailed flush to the ground (Figure 7). This was done because mowing of the grass would begin before stone or cross markers are to be permanently set. A map (Figure 8) and a list of the coordinates of known and unknown graves were also produced (see Appendix 1). GPS coordinates were also obtained to integrate into a larger Preserve America project (Community-Based Cemetery Interpretation: Linking Heritage, Preservation, GIS, Curriculum & Web Services).

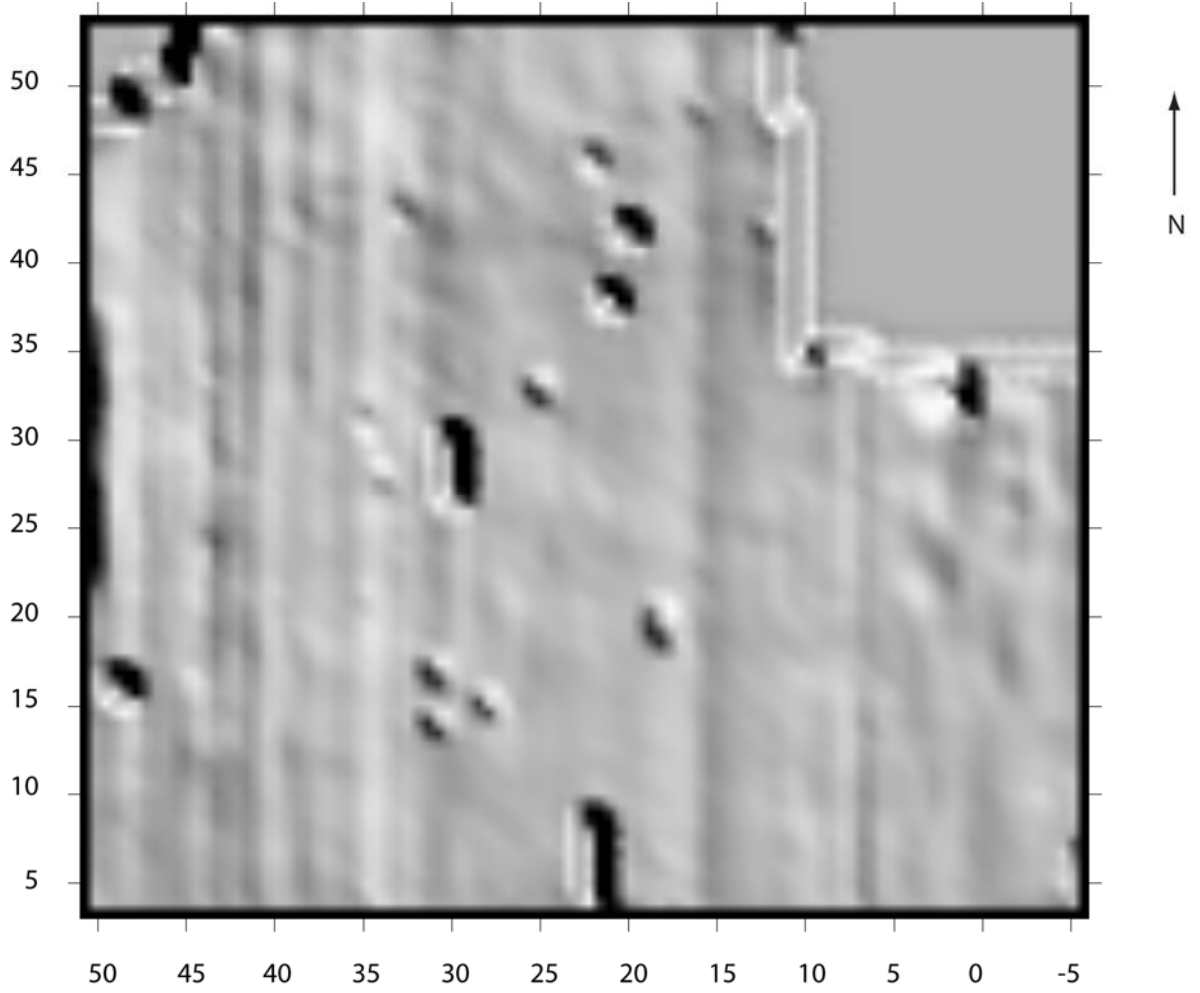


Figure 4: Surfer map of the geophysical data depicting differences in soil densities and conductivities.

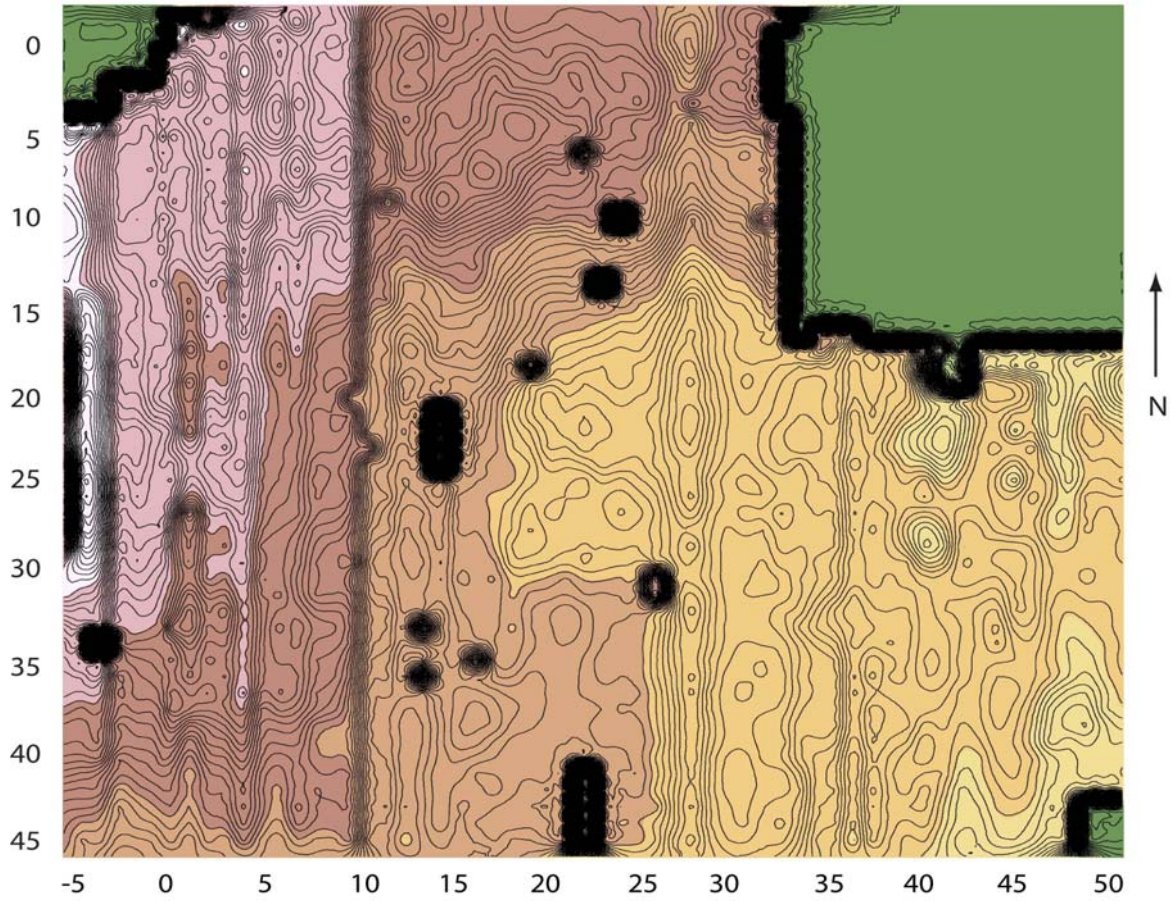


Figure 5: ArcGIS 3-D contour map of the EM-31 data.





Figure 6: Temporary marking of geophysically-detected but unmarked graves with orange survey flags.

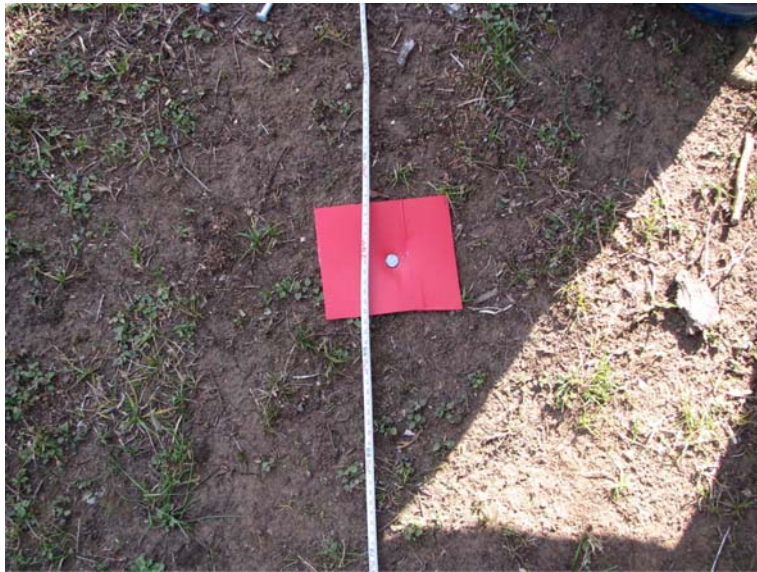


Figure 7: Current marking method to indicate the location of the unmarked graves.

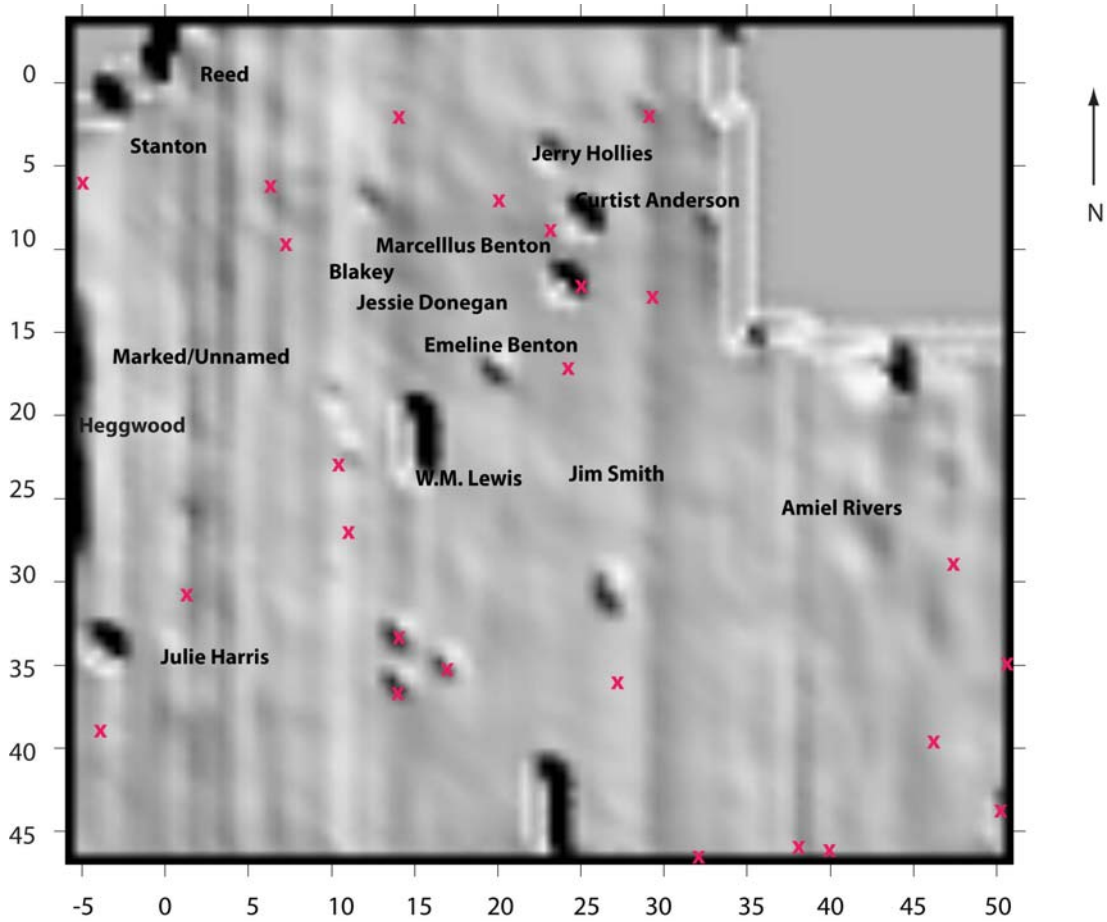


Figure 8: Location of unmarked graves (red x) and marked graves (family names) that were indicated with geophysical data. Areas of dark depressions that are neither marked with a red x or a family name are the result of tree roots and a water fountain.

## Results

As a result of our geophysical analysis of the Zion Hill Baptist Church Cemetery grounds, our analysis detected 25 unmarked graves. From the soil conductivity data, it appears that two different kinds of graves occur in the Zion Hill Baptist Church Cemetery: those made out of a durable hard material (perhaps a metal casket or stone grave lining) and those made out of a more perishable material (such as wood). For example, the cluster of three unmarked graves at 38,14, 40,14, and 40,17 have a much different density than the majority of the other unmarked (and marked) graves.

County death records indicate there are many more unmarked graves within what is now recorded as the Zion Hill Baptist Church Cemetery. Geophysical analysis also indicates the possibility of additional unmarked graves because there are many quiet geophysical spots with less activity. This could result from limitations of the technology and/or the kind of burial. Obviously, no attempts will be made to ground truth these results or to determine the cause of the quiet spots.

We would like to mark those graves that may have been lost to history and we are in contact with the Zion Hill Baptist Church to determine how they would like their ancestor's graves to be marked. The two methods of marking the graves that are being discussed are marking them with small, simple wooden crosses that will not disturb the historic grounds. Another idea is to mark the graves with flat, simple stones and erect a larger monument with the names of the dead (obtained through examination of the county death records) buried within the cemetery's grounds. Finally, since the La Nana Creek Trail runs through the cemetery (and over some of the unmarked graves), it may be appropriate to erect a metal arch with the name of the cemetery on trail within the bounds of the cemetery. This would bring the past to the present when people pass on the trail through the cemetery.

### *Acknowledgments:*

We would like to thank Brian Bray and Kathy Joslyn for their support as well as the City of Nacogdoches' support for this project. Dr. Wesley Brown and the Geology Department at Stephen F. Austin State University loaned the EM-31 to the Anthropology and Geography students. We would also like to thank Dr. Jerry Williams, Chair of the Department of Sociology, for facilitating the discussion of the final marking of the unmarked graves with the Zion Hill Baptist Church. Finally, a number of Anthropology, Archaeology, and Geography students volunteered their time on Friday afternoons. Without their time and interest, this project would not have succeeded. The Anthropology/Archaeology students were Natalie Arriola, Zacheryadam Collins, Carlos Cooper II, Florencia de la Cruz, Heather Merchant, Beth Morgan, Zachary Overfield, Joshua Pace, Katherine Robinson, Robert Z. Selden, Emily Williams, and Matthew Worrell. The Geography students were Carlus Anders, Cassie Bennett, Amy Blankenship, Mark Hammett, Stephen Hogue, Ryan Ihrig, Arika Kulhavy, Joyce Preston, Jenna Smith, Aaron Williamson, and Lauren Wright.

**Appendix I**  
Coordinates for Detected Unmarked Graves

<b>North</b>	<b>East</b>	<b>Comments</b>
6	-5	Unmarked Grave
29	-5	Unmarked Grave
31	1	Unmarked Grave
6	6	Unmarked Grave
10	7	Unmarked Grave
24	10	Unmarked Grave
27	11	Unmarked Grave
2	14	Unmarked Grave
38	14	Unmarked Grave
40	17	Unmarked Grave
7	20	Unmarked Grave
9	23	Unmarked Grave
17	24	Unmarked Grave
13	25	Unmarked Grave
36	27	Unmarked Grave
3	29	Unmarked Grave
13	29	Unmarked Grave
48	32	Unmarked Grave
49	38	Unmarked Grave
49	39	Unmarked Grave
38	46	Unmarked Grave
29	47	Unmarked Grave
44	50	Unmarked Grave
35	51	Unmarked Grave

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**Geophysical Determination of Unmarked Graves at 41NA140  
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Final Report  
Permit #4825**

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