United States Department of the Army
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Report to the Cultural Resources Manager, Picatinny Arsenal, New Jersey
Remote Sensing Archaeological Survey at Walton Cemetery

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Management Summary:

On June 26 – 30 2005, Dr. Laurie Rush and Amy Wood conducted a remote sensing survey at the Walton Cemetery, Picatinny Arsenal. The field team also included Kelly Ridgel, Cultural Resources Manager for the Arsenal, and Elizabeth Rush, volunteer crew member. The investigation included detailed GPS mapping of surface features and completion of nine remote sensing grids. Instrumentation included metal detection, ground penetrating radar, and an electrical resistance meter. The investigation did result in the discovery of anomalies that may be associated with interments and with recommendations for a provisional boundary.

Picatinny Arsenal, Walton-Faesch Cemetery

Purpose:

The primary purpose of this project was to establish a boundary for the Walton-Faesch Cemetery . Secondary purposes for the project included providing estimates for the potential numbers of people buried at this location and to establish remote sensing signatures for anomalies indicative of unmarked burials. It is critical for Picatinny Arsenal to have an accurate boundary for this cemetery property in order to manage and protect this asset as part of the Installation's Master Plan.

Background:

The Walton-Faesch Cemetery is a late eighteenth and nineteenth century cemetery property currently located within the training area of Picatinny Arsenal in Rockaway, New Jersey. Historic records indicate the local area surrounding the cemetery was devoid of additional community cemeteries. This fact, when combined with the cemetery's location in close proximity to an important historic cross roads, implies that the Walton-Faesch cemetery held a place of importance within the community and may have served as a primary cemetery for the area for over one hundred years.

Documentation and oral history combine to establish a firm possibility that Prisoner of War Hessian Soldiers from the Revolutionary War who were detailed to work in the nearby Faesch Iron Works may have been buried at this location as well. Additional burials of Soldiers from the Civil War era are also suspected to exist in this cemetery. Detailed histories of the cemetery property can be found in previous reports and were carefully analyzed in preparation for this investigation.

One of the primary challenges in documenting this cemetery property is the fact that native stones and boulders with minimal or no modification are used as headstones and footstones. The vast majority of these stones have no inscriptions. The most notable type of native stone used in this fashion is called a "Puddingstone." These stones are natural conglomerates stone most often reddish in color or with red inclusions. The absence of regular headstones and no known regular layout of burials create severe difficulties in terms of cemetery management. Some of the stones are easily distinguishable as grave markers while others are questionable. The purpose of the remote sensing survey was to investigate the questionable indicators without ground disturbance.

In the 1970's, in honor of the National Bicentennial, a fence was placed to commemorate those buried in the cemetery and help to define the area of burial activity. At that point, modern head stones were placed to commemorate a small number of individuals who were known through written documentation to be buried somewhere within the property. Unfortunately, the fence only offers an approximation of the actual cemetery boundaries.

Phase 1B – Remote Sensing Investigation:

Initially, the survey strategy was to test the boundary of the established fenced area by placing separate grids along each of the four currently accepted cemetery boundaries. The goal was to position the grids so that the recorded anomalies would be likely to reveal the presence and absence of interments. After the first grid was completed, it was apparent to the investigators from the data collected that significant activity was present outside the fenced area. In other words, it was clear that the currently accepted boundaries were not necessarily valid indicators of potential accurate boundaries. After this discovery, the remaining grids were placed at varying distances from the documented interment area in an effort to try and determine the actual extent of the burial activity.

Seven 10 x 10 meter grids and two 20 x 20 meter grids were completed at the cemetery. With the exception of grid number four, all grids were placed in areas of undetermined burial activity. Grid number four was placed within the cemetery proper and used as a control for analyzing the data in the unknown areas. Two types of remote sensing equipment were used; a Geoscan Research RM15 Resistance Meter, and GSSI's SIR-20 Ground Penetrating Radar System (GPR) with model 5103 antenna (400MHz). The resistance meter surveyed all nine grids, however, due to time constraints GPR was completed only on grid numbers two, four, and five. Grids were marked using tape measures and a rope marked at meter and half meter intervals.

It is important to note that Fort Drum's FM 36 Fluxgate Magnetic Gradiometer was not employed for this survey. There were two reasons for this decision. The first is that the geology of the area consists of bedrock and glacial deposits of rock with high iron content that affects magnetic readings. The second reason was the potential for features like the metal fence, the adjacent high tension electricity corridor, and the bordering metal steam pipe system to confound magnetic readings as well.

All GPR and resistance meter grids were performed at one meter transect intervals. In addition, grids nine and eight were surveyed at half meter transect intervals with the resistance meter. A metal detector was used to get a basic idea of possible metal anomalies in association with headstones or probably headstones. Two participants, Elizabeth Rush and Kelly Ridgel, systematically walked the cemetery and surrounding area with the metal detector. When the metal detector indicated a positive reading a flag was placed on the location. A general systematic survey was also performed with the intent of identifying surface indicators of graves. For example, several notable depressions were visible on the surface, these were flagged and recorded. Other surface indications were recorded such as possible headstones and puddingstones. A global positioning system (GPS) was used to collect coordinate data on these cemetery features as well as other pertinent information. Data points included the permanent survey monument placed at the cemetery from the previous remote sensing survey and the four corners of all remote sensing grids completed for the current survey.

Features where GPS data was collected included; metal anomalies, depressions, depressions with metal, headstones, probable headstones, probable headstones with a puddingstone adjacent, puddingstones, puddingstones with metal, and the survey monument.

Analysis of the GPS data demonstrates several possible conclusions. Significant absences of graves through the approximate middle of the fenced cemetery area may represent the historic road that was indicated on an historic map sketched in 1940. In addition, possible patterns in burial activity began to emerge when the maps were analyzed. Areas within the fence seem to show localized burial activity possibly due to either family burial plots or representing different temporal burial episodes. Certain areas exhibit linear burial patterns. For example, the eastern portion of the cemetery has successive burials in an east to west orientation while the western portion of the cemetery exhibit north to south patterns. These differences would indicate either separate burial episodes or isolated family or community plots.

Survey Methodology:

- **Resistance Meter**

  The Resistance Meter instrumentation is a Geoscan Research RM15 Resistance Meter. The sample interval was one meter and transect intervals were one and half meter as indicated earlier. The prospecting depth for this instrument was one to two meters. All grids were surveyed with the first transverse moving toward the west in a zig-zag pattern.

- **Ground Penetrating Radar**

  The instrument used to complete the GPR survey was a GSSI SIR-20 System with model 5103 antenna (400MHz). The sampling interval was 1 meter with a prospection depth of 4.4m. All grids were surveyed both east west and north-south in order to create a 3D view of the surveyed area.

Lessons Learned:

In the future, we would recommend that project proponents not assume that remote sensing is the immediate investigation solution for a specific archeological problem. The initial approach to the Walton Cemetery should have been removal of shrubby vegetation, very detailed walkover survey with flagging of surface features, and detailed mapping of these features using sub-meter accuracy GPS or a laser total station. Detailed analysis of a map of this nature should then be used to establish the most useful locations for completing remote sensing data collection grids.

Results:

Controlled Grid 4 – The Known Cemetery Grid:

This grid was purposely placed over known graves with definitive headstones in order to use the signature from the remote sensing equipment to possibly identify other graves. The majority of the known graves were located in the southeast section of the grid, with a single grave located in the northwestern

corner and one just outside the grid on the southwestern corner. There was a cluster of three low resistance anomalies recorded which corresponded to the burial activity (see figure 4). One locus was located in the southeastern corner and appears to extend further to the southeast. In association with this low resistance cluster was a high resistance pocket within the cluster attributed to a grave marker. This high resistance pocket lies at grid 10,8. The next low resistance cluster was focused around grids 6,7 and 7,7 and was approximately two meters in width and three meters in height. The third cluster of low resistance data centers over grid 1,4 (located in the northwestern quadrant) and was approximately two meters in width and three meters in length. This anomaly also appears to extend further than the grid. Another high resistance anomaly was located at grid 3,2 , again in the northwest quadrant, and was attributed to the grave marker at this location. The low resistance anomalies correspond to grave shafts while the high resistance anomaly corresponds to the headstone and possibly additional stone markers beneath the surface. Locating similar data in the other resistance meter grids can be used to recognize areas with possible burial activity within the cemetery.

Results for Grid 1:

This grid was placed just to the west of the fenced area (see map 1). Results from the resistance meter show three high resistance anomalies in this grid and one low resistance anomaly (see figure 1). The high resistance anomalies may indicate the likelihood of a large stone near the surface. Since the material type for headstones in this cemetery is exclusively native stone, the high resistance anomalies may serve as a potential indicator of headstone locations and subsequent graves when tree disturbance can be ruled out. The low resistance anomaly is localized at grids: 1,12; 1,13;and 1,14 and is indicative of a possible grave.

Grid 1 produced a significant number of results with the metal detector survey. The results from the metal detector tended to cluster in a linear fashion which led the investigators to believe the hits could represent metal buttons or coffin nails. There are several instances where the metal hits corresponded to low resistance anomalies, however, metal hits were also detected with a few high resistance anomalies. The concentration of metal hits in this area caused the investigators to wonder if perhaps the Hessians said in the oral histories to be buried at Walton Cemetery could be buried together in this particular vicinity. Given the metal buttons and decorations on traditional Hessian uniforms, it would be reasonable to expect increased indications of metal at the site of their burials.

Results for Grid 2:

The results for grid two show two very interesting low resistance anomalies. One low resistance anomaly surrounds a localized area of very high resistance (see figure 2). Both anomalies are located on the eastern edge of the grid and look to extend further east. The second anomaly is adjacent to a puddingstone that could be a burial marker. Similar data was recovered from grid four over a section of known graves. The similarity in headstone type used

throughout the cemetery increases the likelihood that this particular anomaly is a grave.

The second anomaly was also first noted as a substantial depression that was visually recorded in this section of the grid. This anomaly was also reflected in the GPR survey.

Results for Grid 3:

Grid 3 was purposely placed in an area adjacent to known graves in order to help discern the cemetery's northeast boundary. This grid was placed northeast of the existing fence and was directly adjacent to grid 4, the controlled grid (see map 1). An area of low resistance was located in the northeast portion of the grid and was roughly linear in shape (see figure 3). This anomaly was oriented northeast to southwest and measures approximately 2.7 meters in length. Three areas with high resistance anomalies were recorded in the northwest and southeast corners. The highest resistance anomaly was found along the western edge of the grid. This anomaly is most likely associated with the tree that was nearest to the grid.

Results for Grid 5:

Grid 5 was a 20 x 20 meter grid located along the northeast section of the fence line and was centered over the fence in order to capture data on either side. The fence ran roughly west to southeast. This grid contained more surface vegetation in the form of briars and brush than any of the other grid locations. In addition a downed tree was running through the grid area and served as a hindrance to the GPR survey.

Results from Grid 5 show an interesting low resistance linear feature running almost directly north-south spans the entire length of the grid and continues beyond the grid (see figure 5). Reviewing the anomaly in gray scale also demonstrates a different view of the linear anomaly The approximate width of the linear feature varies from 1-1.5 meters throughout, making the width of the anomaly less than five feet. The placement of this linear feature is inconsistent with the fence location. In addition, the low resistance nature of the anomaly also indicates that the data is not illustrating the current or any previous fence line. Possible causes of the linear feature include a buried path. Several fragments of the degrading fence were visible on the surface and are also exhibited in the resistance meter data as high resistance anomalies.

Results for Grid 6:

Grid 6 was placed in the southwest corner of the survey area in an effort to try and determine an extent for the cemetery boundary. The grid was 10 x 10 meters and exhibited low resistance anomalies in the northwest and southwest corners (see figure 7). The anomaly in the northwest section was approximately six meters in length and three and half meters in width, at most. The anomaly in the southwest corner was much smaller and measures two meters in length and three meters in width. These two anomalies were separated by an area of average resistance. An area of higher resistance was recorded along the

eastern wall in roughly a linear feature running toward the northwest. No depressions or possible headstones were recorded in this survey area. In the field, we did notice a relationship between high resistance numerical values in the resistance data and the presence of large, living trees.

Results for Grid 7:

Grid 7 was located in the northwest section of the survey. One substantial low resistance anomaly was recovered along the southern edge of the grid and ran roughly northwest to southeast (see figure 8). The anomaly is roughly five and half meters in width and approximately three and half meters in length. No depressions or possible headstones were recorded in this survey area. One high resistance anomaly was recorded in the very northwest corner of the survey. It was localized within one square meter and most likely corresponds to the location of a tree.

Results for Grid 8:

Grid 8 was located directly approximately 10 meters east of Grid 6 and 12 meters west of the fenced area. A very interesting low resistance anomaly that may be attributed to a grave location was recorded in the south west corner at grid locations 2,8 thought 4,8 and 2,9 through 4,9 and measured three meters in width by 2 meters in height (see figure 9). Another low resistance anomaly was detected along the east boundary of the grid at grids 10,8 to 10,6. and measures approximately 3 meters in height by one meter in width. A high resistance anomaly was recorded at grid locations 7,4 and 7,5 and is consistent with the signature of a tree disturbance noted in other locations throughout the survey.

Results for Grid 9:

Grid 9 was centered along the southern boundary of the fence line in an attempt to determine the presence or absence of any possible outlying graves to the south. Several possible headstones or grave markers were present on the surface in the area making the survey suspect for positive indication of graves. The data collected with the resistance meters was inconclusive showing only two small moderately low anomalies compared to the other data collected on the survey(see figure 10). These anomalies were located at grids 1,7 to 4,7 and 4,6; and were approximately one meter in length. The other anomaly was located at grids 8,1 to 10,1 and were one meter in length. Two small high resistant anomalies were also recorded at grids 3,2 to 3,4 and 8,5 to 8,5. The former was approximately three meters in length and one meter in width while the latter was two meters in length and one meter in width. These anomalies are consistent with tree disturbance already recorded on this survey. The average data in numerical values collected for this grid were considerably lower than the other grids. This could be attributed to a recent rainfall and thus generally increased moisture content of the soil.

Summary:

There is no question that the rocky hillside where the Walton Cemetery is

located is a challenging landform for remote sensing. The use of naturally occurring stone as markers complicates analysis as well. However, the combination of mapping and remote sensing did yield additional information about the pattern of burial activity and potential boundaries for the Walton Cemetery.

Findings:

- In our opinion, the combination of high resistance anomalies surrounded by areas of low resistance may be the best signature for identifying additional interments. The high resistance would correspond to the use of a stone marker, and the low resistance corresponds to the previous excavation for interment.
- The area of grid 1 where high and low resistance anomalies overlap with indication of metal may indicate the presence of Hessian burials.
- The high resistance anomaly surrounded by low resistance in grid 2 is very likely to be an additional interment as well as the low resistance anomaly adjacent to a puddingstone.
- The combination of depressions and low and high resistance anomalies in and in the vicinity of grid 8 may be indicative of additional interments.
- The combination of low and high resistance anomalies as well as probable head stones in and in the vicinity of grid 9 may be indicative of additional interments.
- There appears to be at least two distinct burial patterns within the Walton Cemetery. The burials appear to run in a linear fashion along a NE to SW axis in the eastern portion of the cemetery. The burials appear to run in linear fashions in the northern portion of the cemetery near grid 4.
- The low resistance void in grid 5 may be indicative of an historic road or a buried path. There is a void in surface features and a relatively regular row of puddingstones in the central section of the known cemetery. This void also appears to divide the burial pattern areas. This void could also be indicative of the historic road.
- The neutral area of grid 5 may be indicative of the eastern boundary of the cemetery.
- The radar failed to provide any consistent results in this environment.

Recommendations:

The management boundaries that we would recommend at this point would be the power line right of way as the south boundary, a line running NE to SW 50m east of grid 9, a line running NW to SE 20m north of grid 5 and 10m north of grid 3 and a line running along the western boundary of grids 2 and 7. For further study, we would recommend vegetation clearance, more detailed mapping of surface features, especially away from the known cemetery area, and completion of additional remote sensing grids in the vicinity of grid 9. Results of the detailed mapping could be used to determine placement of additional electrical resistance grids along the provisional northern and western boundaries.

Resistance grids at .5m intervals could provide more detailed information about individual interments as well.

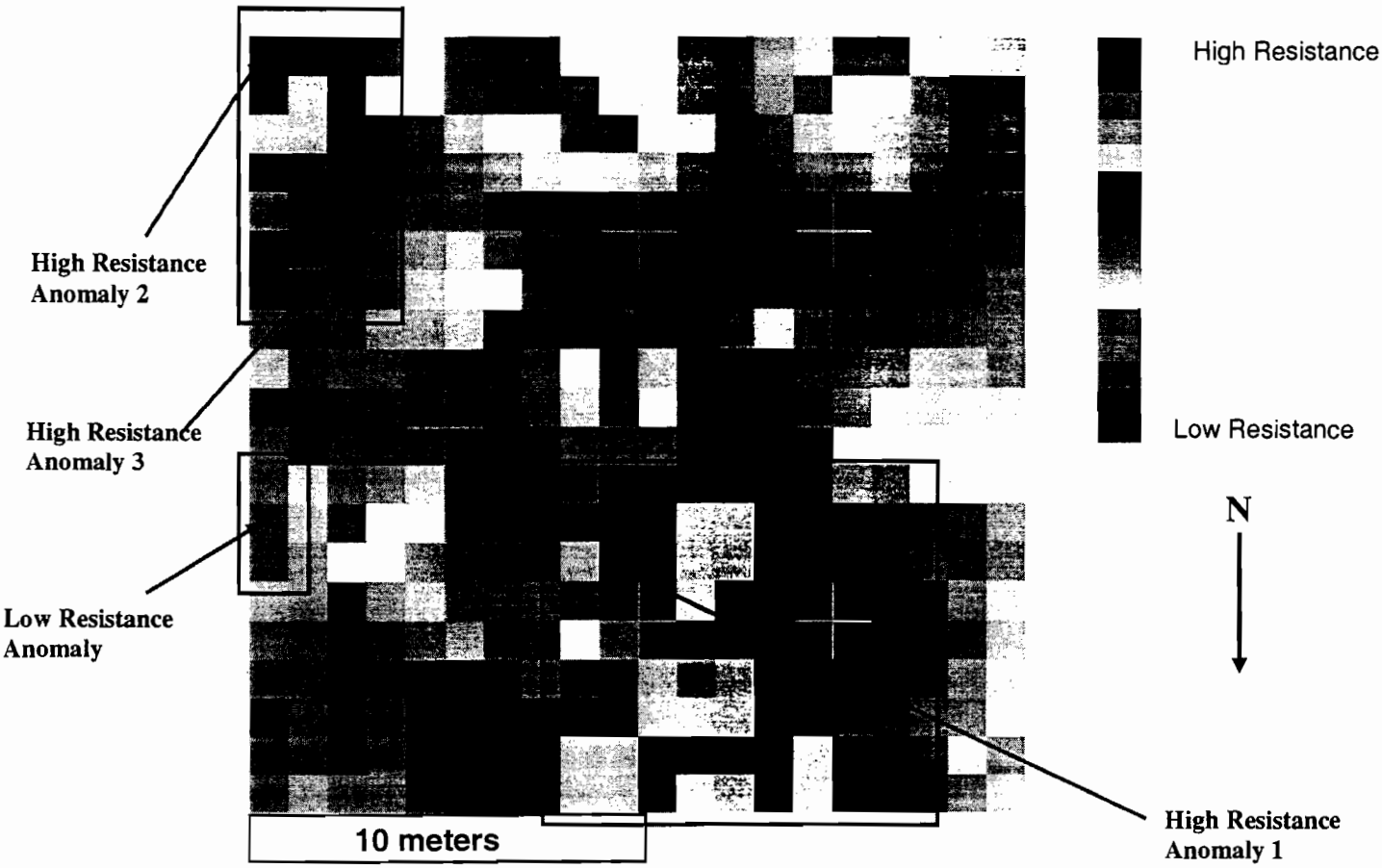

Figure 1 resistance meter survey results of grid 1.

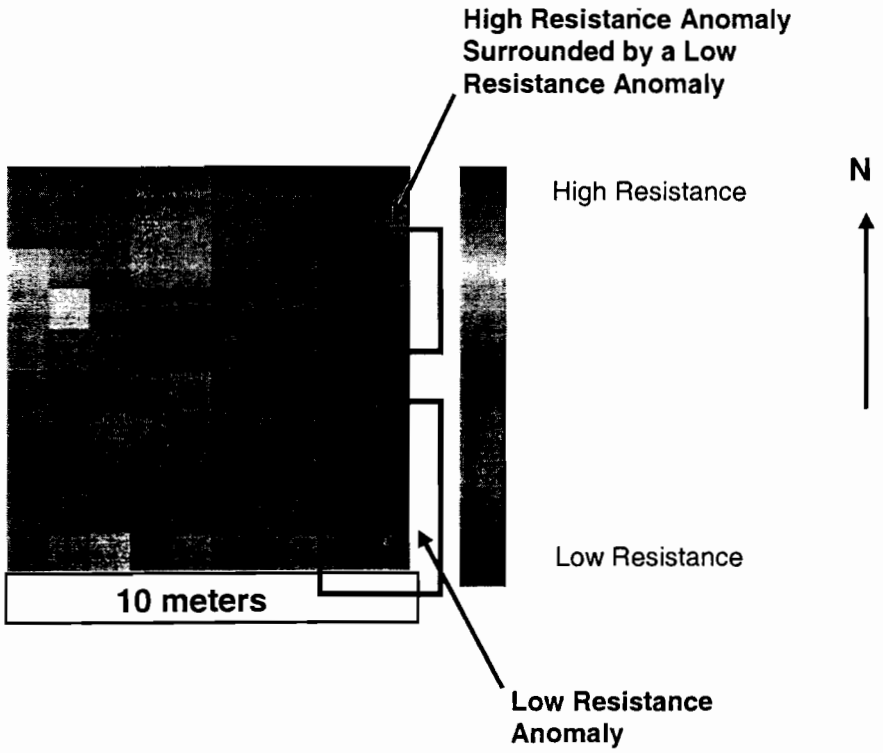

Figure 2: results of resistance meter survey for grid no.2.

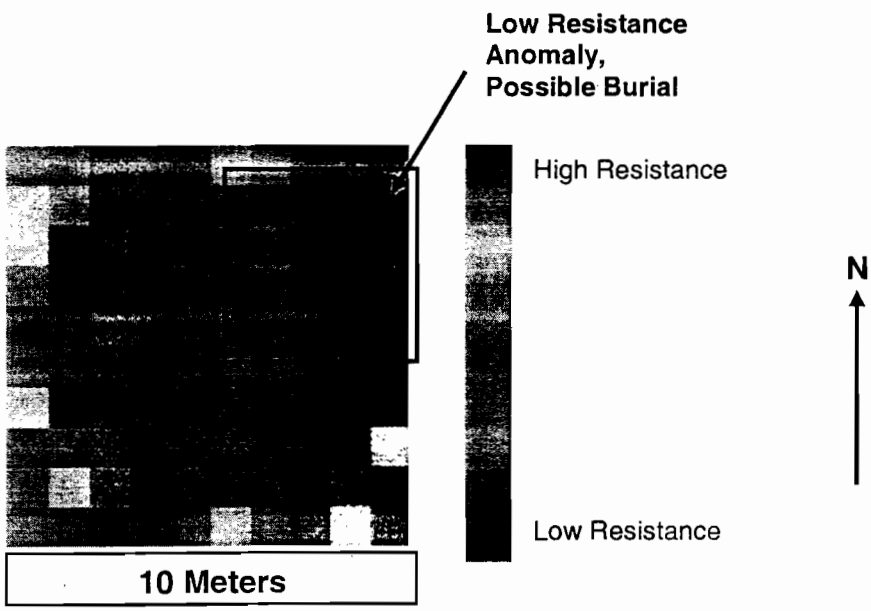

Figure 3: results of resistance meter survey for grid no.3.

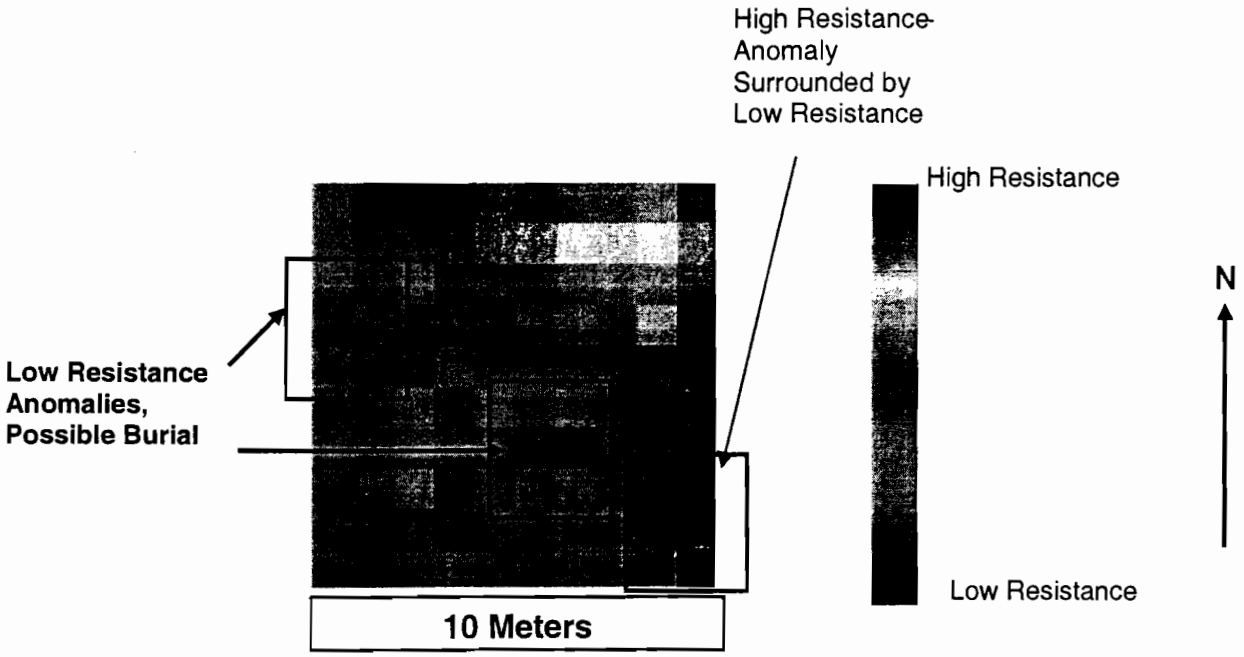

Figure 4 results of resistance meter survey for grid no.4.

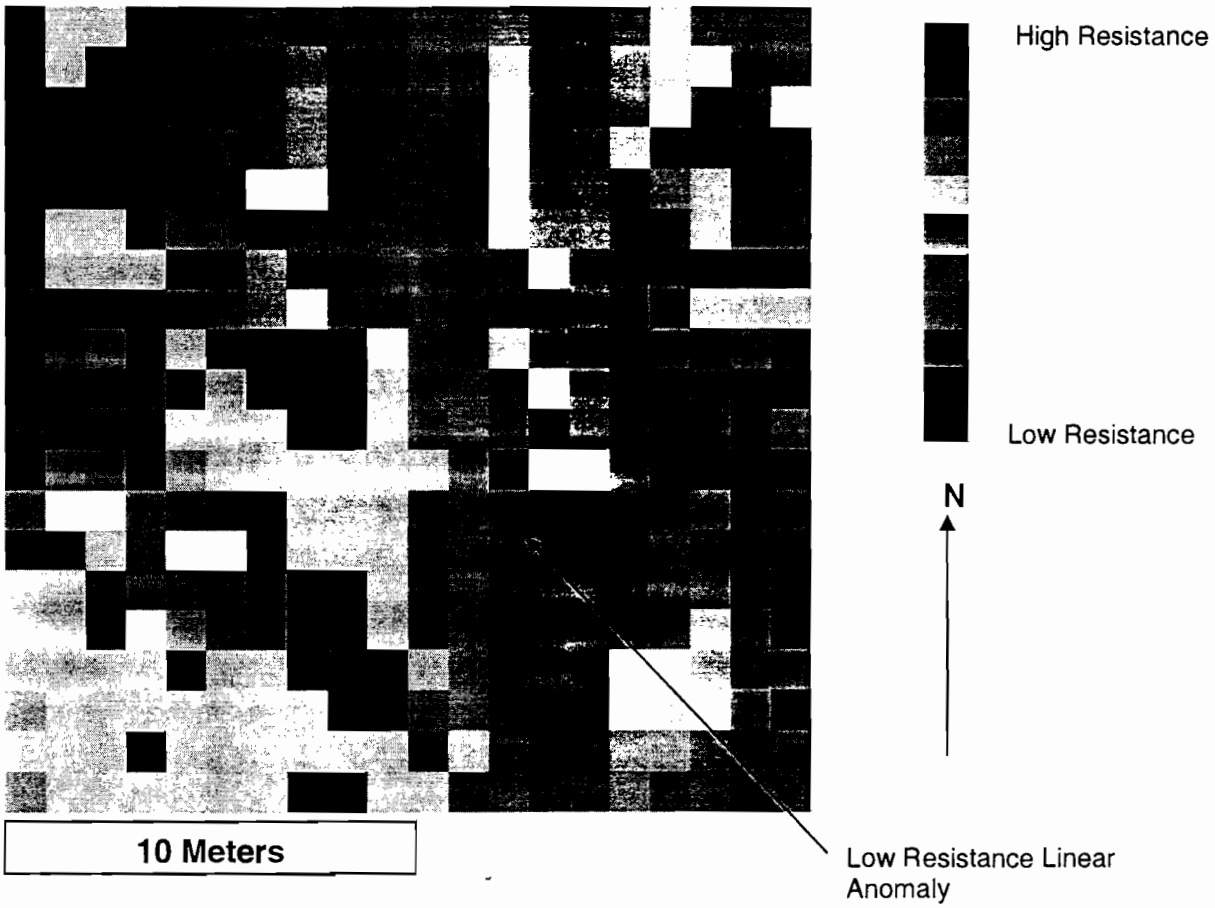

Figure 5 results of resistance meter survey for grid no.5.

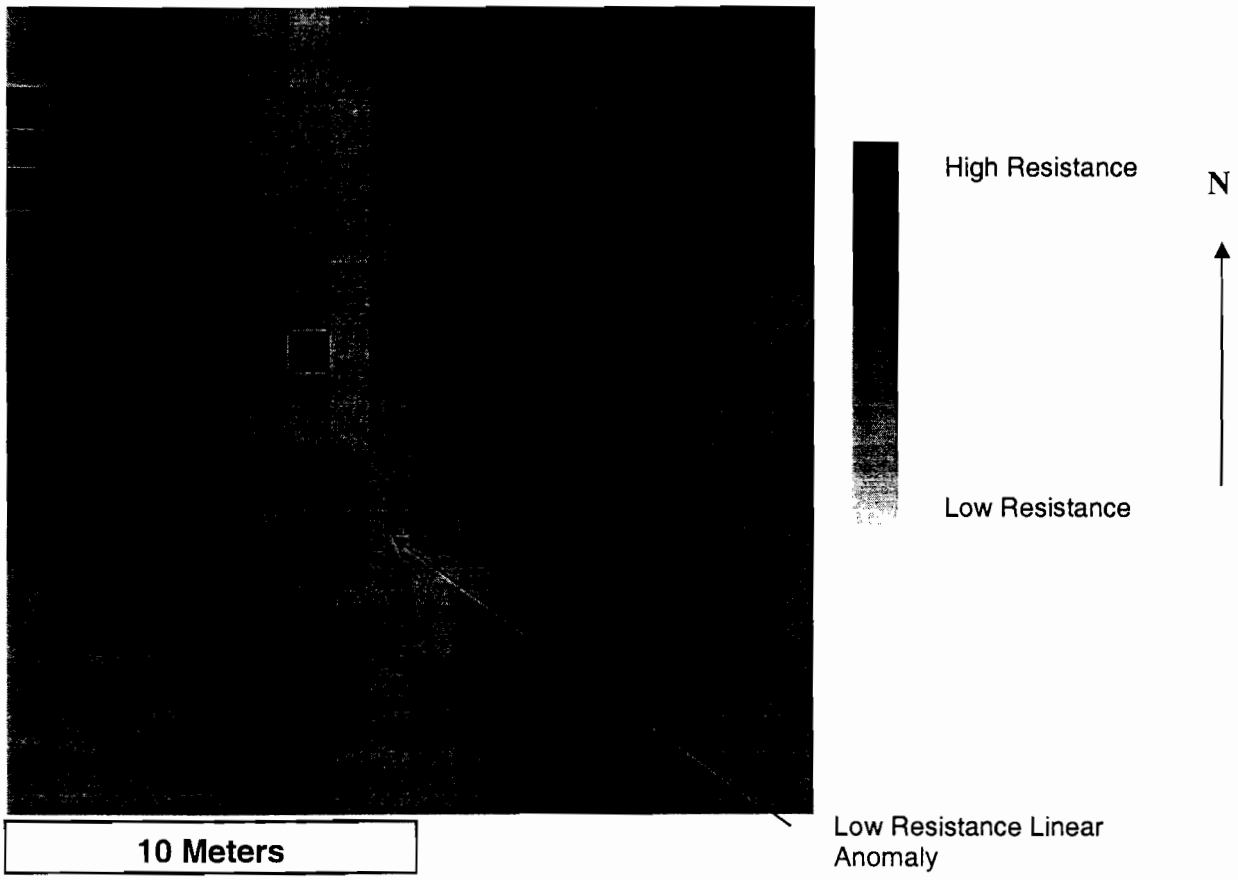

Figure 6 results of resistance meter survey for grid no. 5 in gray scale.

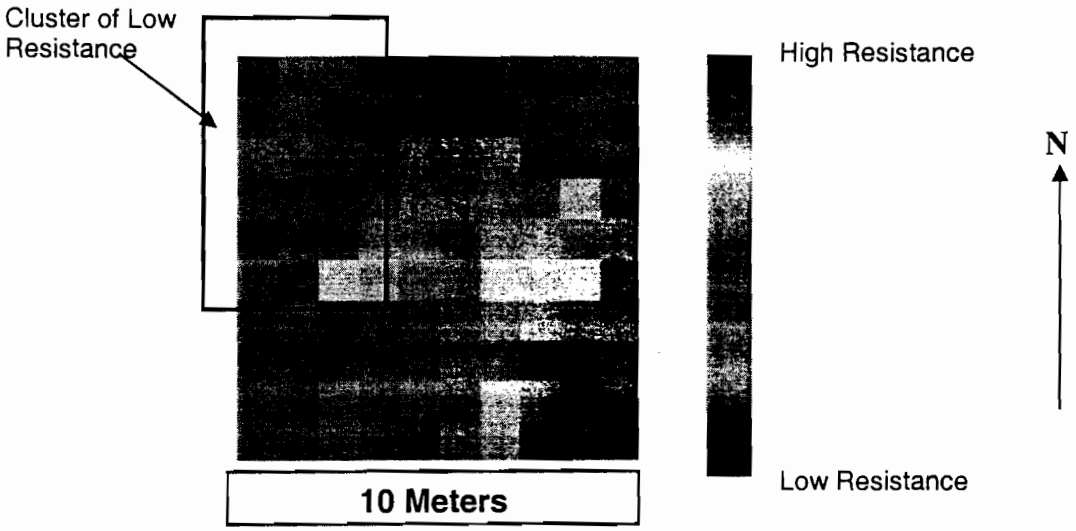

Figure 7 results of resistance meter survey for grid no.6.

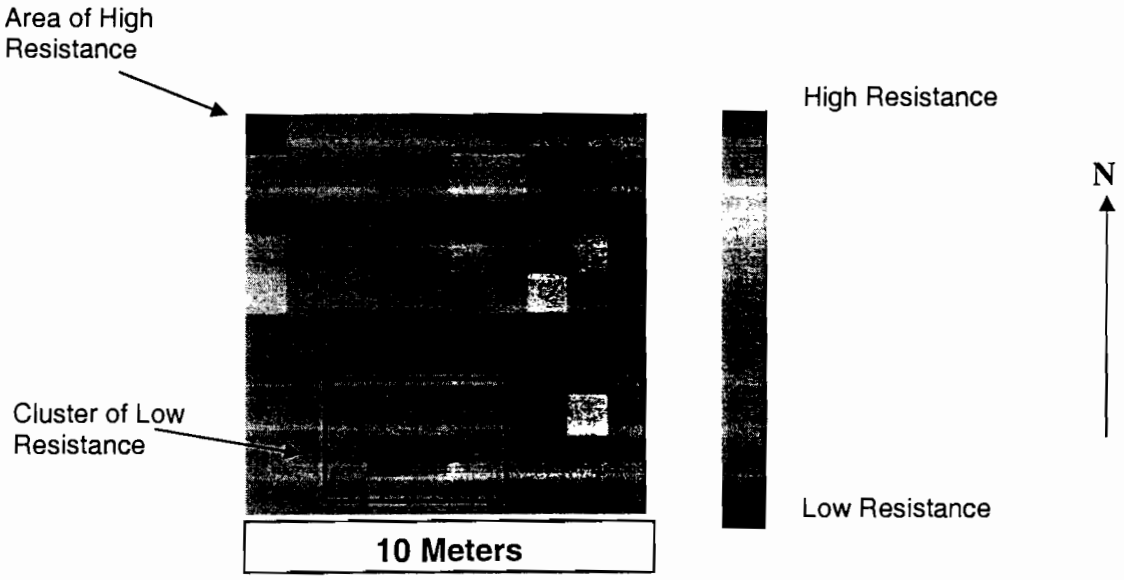

Figure 8 results of resistance meter survey for grid no.7.

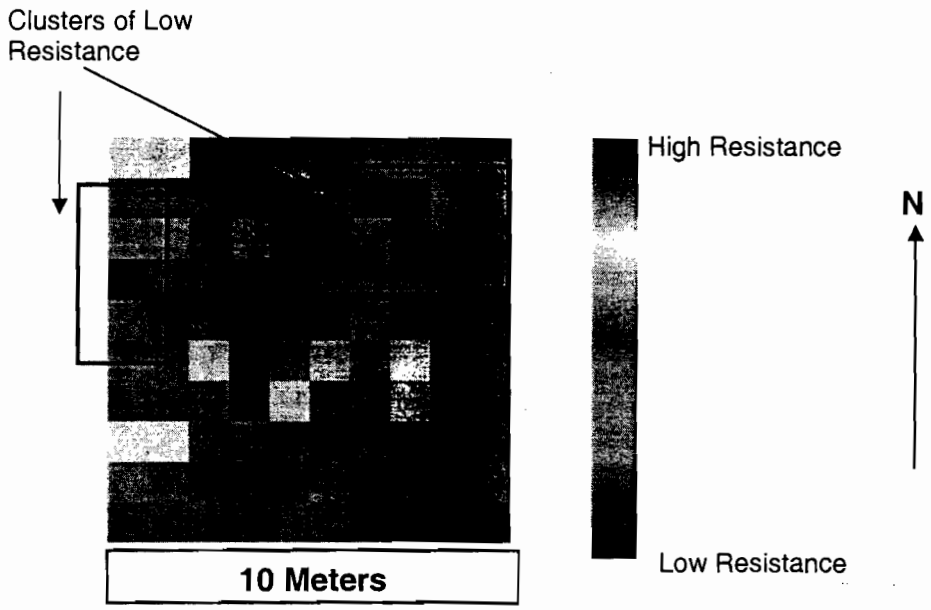

Figure 9 results of resistance meter survey for grid no.8.

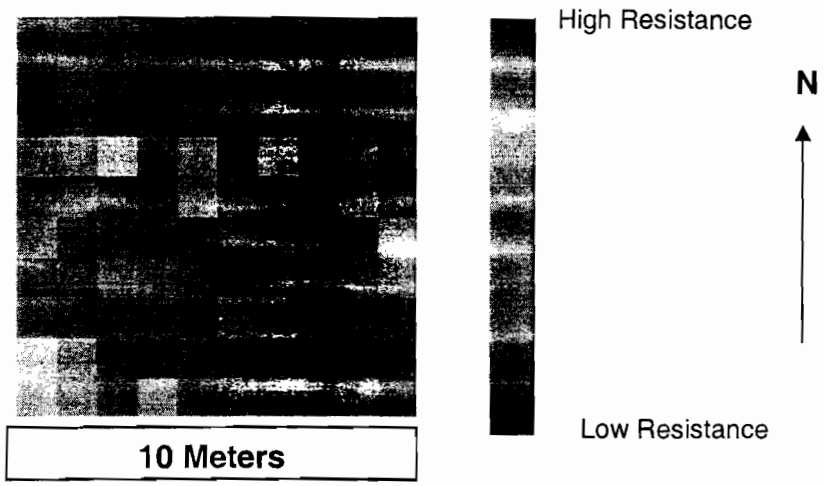

Figure 10 results of resistance meter survey for grid no.9.

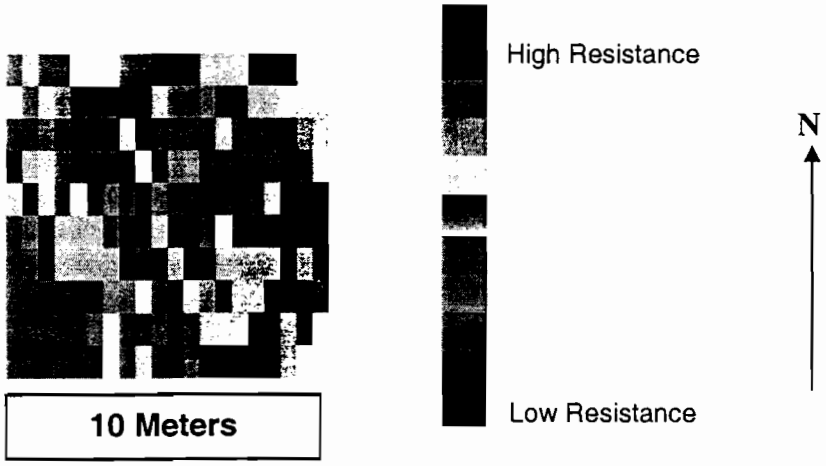

Figure 10 results of resistance meter survey for grid no.9H (completed in half meter intervals).