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United States Department of Agriculture | Soil Conservation Service | 160 East 7th Street Chester, PA 19013-6092

Subject: SOI- Ground-Penetrating Radar and Electromagnetic Induction Field studies at the Kentland Farm Historic and Archaeological District, Blacksburg, Virginia 24 - 27 February 1992

Date: March 9, 1992

To: George Norris
State Conservationist
Soil Conservation Service
Richmond, Virginia

Purpose:
To conduct ground-penetrating radar (GPR) and electromagnetic induction (EM) archaeological surveys at the Kentland Farm Historic and Archaeological District.

Participants:
James Baker, Professor of Soils, VPI & SU, Blacksburg, VA
Clifford Boyd, Archaeologists, Radford University
James Doolittle, Soil Specialist, SCS, Chester, PA
Michael Fisher, Construction Inspector, SCS, Christianburg, Va
Brian Ganoe, State Geologist, SCS, Richmond, VA
Tommy Green , District Conservationist, SCS, Christianburg, VA
Dean Rector, State Soil Scientist, SCS, Richmond, VA
Dwight Paulette, College Farm Coordinator, VPI & SU, Blacksburg, VA
Barry Skiles, Area Engineer, SCS, Christianburg, VA

Activities:
All field work was completed on 25 and 26 February 1992. Inclement weather and wet field conditions limited survey activities.

Equipment:
The ground-penetrating radar unit is the Subsurface Interface Radar (SIR) System-8 manufactured by Geophysical Survey Systems, Inc. [1]. Components of the SIR System-8 used in this study were the model 4800 control unit, ADTEK SR 8004H graphic recorder, ADTEK DT 6000 tape recorder, power distribution unit, transmission cable (30 m),

1. Use of trade names in this report is for identification purposes only and does not constitute endorsement by the authors or their institutions.

and the model 3110 (120 MHz) antenna. A scanning time of 70 nanoseconds and a scanning rate of 25.6 scan/sec. were used. The system was powered by a 12-volt vehicular battery.

The electromagnetic induction meter was the EM38 manufactured by GEONICS Limited.[1] Measurements of conductivity are expressed as milliSiemens per meter (mS/m). Two-dimensional contour plots of the EM and elevation data were prepared using SURFER software developed by Golden Software, Inc.[1]

Field Methods:
A ground-penetrating radar survey was completed along a portion a proposed pipeline corridor. The surveyed portion was located along two farm roads which bordered the Norfolk and Western Railroad line. This survey area was along the southeastern border of the Kentland Farm Historic and Agricultural District. In addition, an EM survey was conducted within a 160 by 280 foot area near the farm office building. These study areas were located in areas of Hayter loam, 2 to 7 percent slopes. Hayter is a member of the fine-loamy, mixed, mesic Ultic Hapludalfs family.

Two transect lines were established along a farm road (see Figure 1, A & B). One transect line, Line A, was 2100 feet; the other, Line B, was 3050 feet long. Along each transect line, observation flags were inserted in the ground at 50 foot intervals. Numbering began at point "0" on the end of each line adjacent to letters "A" and "B" (see Figure 1). Two pass were made with the 120 MHz antenna along each transect line. This provided a 33 % coverage of a 10 foot wide corridor.

A 160 by 280 foot grid (see hatched area in Figure 1) was established in an area near the farm office building. Survey flags were inserted in the ground at 20 foot intervals. At each of the 126 grid intersects, measurements were obtained with the EM38 meter in the vertical dipole mode. The EM38 meter scans to a depth of about 1.5 meters in the vertical dipole mode.

Results:
1. No prominent, buried, structural feature or cultural layer were identified on the radar profiles from the proposed corridor.

2. Numerous point reflectors were observed along lines A and B. As no ground truth observations were made, the identity of these anomalies can only be inferred. Some undoubtedly represent artifacts from the nearby railroad and standing structures. The general locations of anomaly clusters has been identified in red in Figure 1.

Stones and cobbles are common in this area of Hayter soils. Many of these point reflectors are believed to represent buried rock fragments. Along each transect, the occurrence of metallic point reflectors was common. Buried metallic objects produce distinguishing reverberations on radar profiles. These reflectors

were more common on the radar traverse which passed closest to the farm boundary and nearest to the railroad line.

3. Two areas having unusual graphic signatures have been identified in blue in Figure 1. These areas are believed to represent heavily disturbed soil conditions (line B) and a distinctive, subsurface feature (line A).

4. The EM survey revealed a heavily disturbed area. Generally, soil patterns produce a regular pattern of broadly-spaced contour lines. With the exception of the northeast corner of the grid area (lower right corner of Figures 2 and 3), the contour pattern is highly irregular. A highly irregular pattern often indicates manipulation and the presence of buried cultural features. activities.

The contour pattern in Figure 3 suggest the most probable location of a former structure. In constructing Figure 3, it was assumed that foundation or structural materials from a former building would be generally more resistive than the surrounding soil matrix. While the grid interval was too coarse to adequately define the boundaries of a former structure, the general location of a possible feature can be inferred from these figures.

Conclusions:

Geophysical techniques were used successfully at Kentland Farms to search for buried cultural features. No major buried cultural feature was identified along surveyed portions of a proposed pipeline corridor. Several clusters of dominantly metallic point reflectors were identified as were areas having disturbed or unique subsurface features.

An EM survey within a grid area suggests the presence of a former structural feature. The survey established the general location of possible structure(s).

The feasibility of using these technique on other similar soils in this portion of Virginia has been established. The radar profiles and the two-dimensional contour plots of the grid site can be used to assist future archaeological investigations at Kentland Farms.

All graphic profiles have been return to Dean Rector for review and disposition. It was a pleasure to work with members of your staff and I thank you for this opportunity.

With kind regards.

James A. Doolittle

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A
B
NORFOLK
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1
¾
½
¼
0
5 000
4 000
3 000
2 000
1 000
0

FIGURE 2

EM38(V) SURVEY OF SUSPECTED ARCHAEOLOGICAL SITE

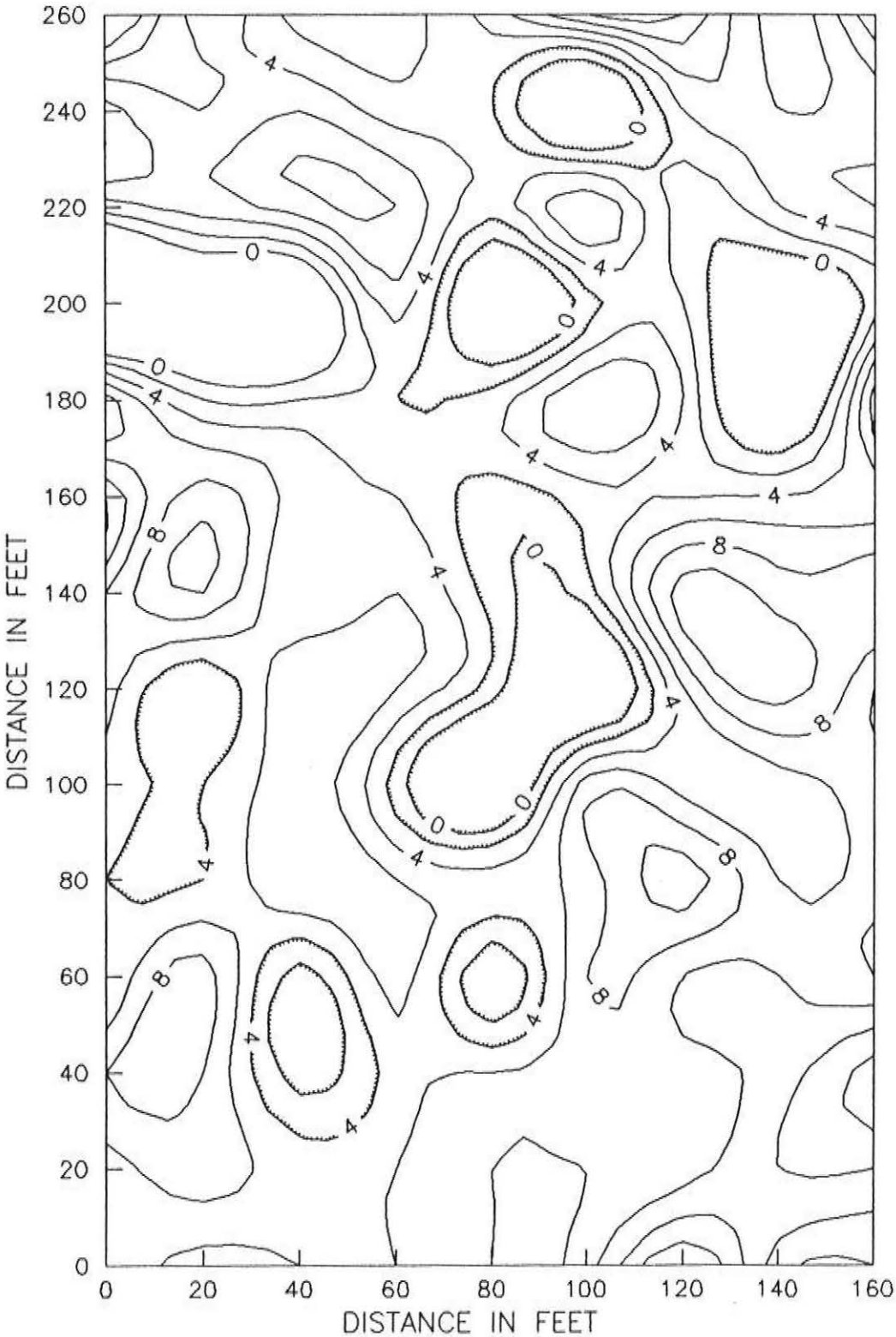
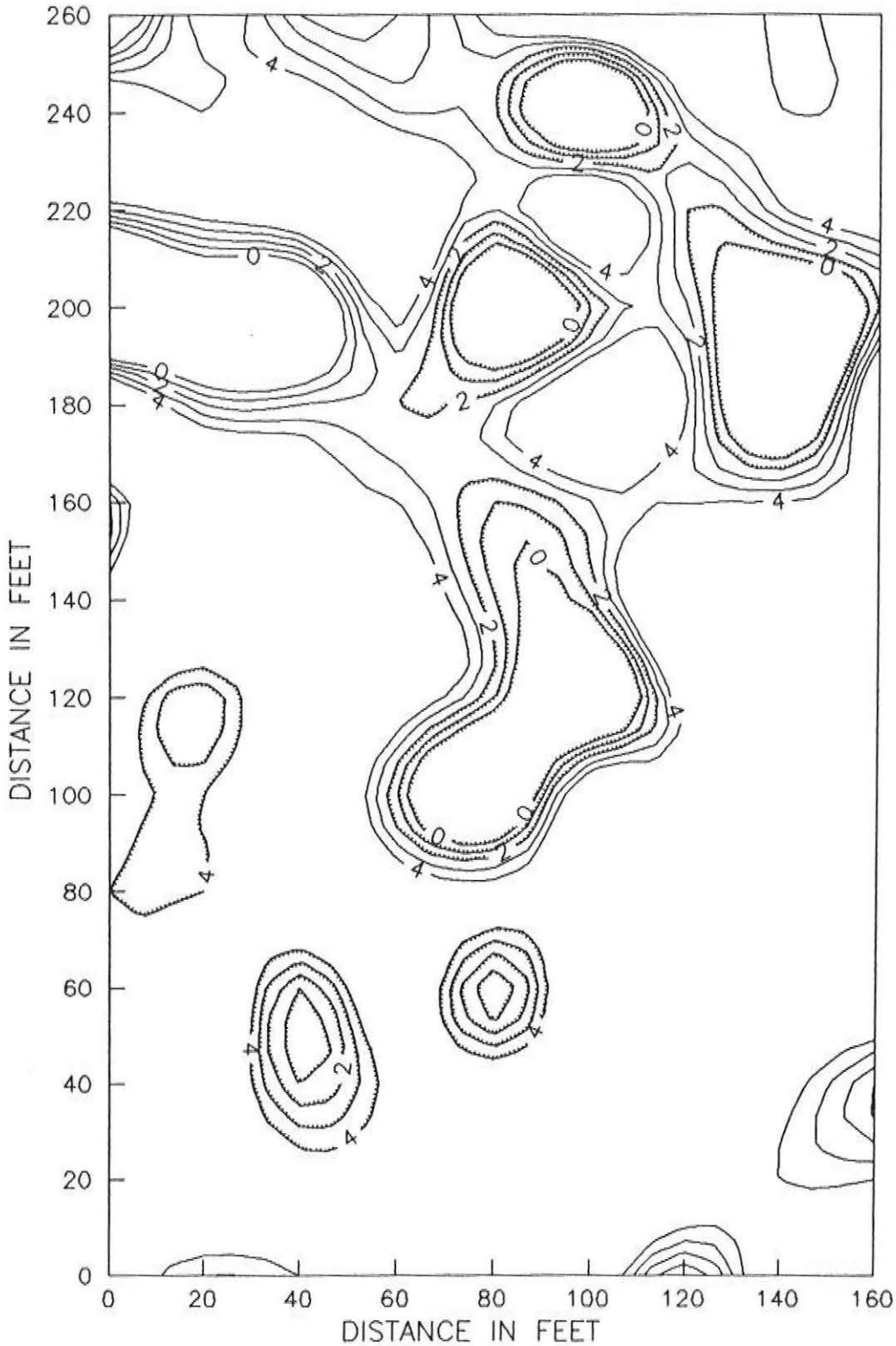


FIGURE 3

EM38(V) SURVEY OF SUSPECTED ARCHAEOLOGICAL SITE

RESISTIVE AREAS (0–4 mS/m)