United States Department of Agriculture
Natural Resources Conservation Service

Chester, PA 19013
610-490-6042

Subject: Geophysical Assistance;
Archaeological Field Camp, SUNY
Binghamton; near Wellsburg, New York
June 16, 1995

Date: 21 June 1995

To: Tyrone M. Goddard
State Soil Scientist
USDA - NRCS
Syracuse, New York

Purpose:
To provide electromagnetic induction (EM) and ground-penetrating radar (GPR) field assistance to the summer field camp of the Department of Archaeology, State University of New York at Binghamton.

Principal Participants:
Cal Behnke, Earth Team Volunteer, NRCS, Utica, NY
Jim Doolittle, Soil Specialist, NRCS, Chester, PA
Jennifer Hundertfund, Student, SUNY Binghamton, Binghamton, NY
Edward Jonett, Graduate Student, SUNY Binghamton, Binghamton, NY
Dean Kartsonis, Student, SUNY Binghamton, Binghamton, NY
Eryn Klosko, Graduate Student, SUNY Binghamton, Binghamton, NY
Jared Klumpp, Graduate Student, SUNY Binghamton, Binghamton, NY
Tim Knapp, Graduate Student, SUNY Binghamton, Binghamton, NY
Viktoras Liogys, Graduate Student, SUNY Binghamton, Binghamton, NY
Mick Lipton, Student, SUNY Binghamton, Binghamton, NY
Debie Longer, Student, SUNY Binghamton, Binghamton, NY
Laurie Miroff, Graduate Student, SUNY Binghamton, Binghamton, NY
Tom Petruzzell, Electronic Engineer, SUNY Binghamton, Binghamton, NY
Ed Stein, Area Soil Resource Specialist, NRCS, Utica, NY
Radhika Sundararajan, Student, SUNY Binghamton, Binghamton, NY
Patrick Togni, Student, SUNY Binghamton, Binghamton, NY
Mia VanDeMark, Student, SUNY Binghamton, Binghamton, NY
Nina Versaggi, Director, Public Archaeology Facility, SUNY Binghamton, Binghamton, NY
Alissa Wood, Student, SUNY Binghamton, Binghamton, NY

Activities:
A demonstration was provided on the use of GPR and EM techniques for archaeological investigations. Following the demonstration, a brief reconnaissance survey was conducted of a selected site using both GPR and EM techniques.

Equipment:
The radar unit used in this study was the Subsurface Interface Radar (SIR) System-2 manufactured by Geophysical Survey Systems, Inc.[+] The SIR System-2 consists of a digital control unit (DC-2) with keypad,

VGA video screen, and connector panel. The system was powered by a 12-volt battery. The models 3110 (120 mHz) and 3102 (500 mHz) antennas were used in this investigation.

The electromagnetic induction meter used was the EM38 manufactured by Geonics Limited+. The depth of penetration is dependent upon the intercoil spacing, transmission frequency, and coil orientation relative to the ground surface. The EM38 meter integrates values of apparent conductivity over the upper 0.75 m in the horizontal dipole orientation, and over the upper 1.5 m in the vertical dipole orientation. Values of apparent conductivity are expressed in milliSiemens/meter (mS/m).

Discussion:
The study site was located north of Wellsburg on the floodplain of the Chemung River and in an area of Tioga fine sandy loam (Pearson et al., 1973)***. The Tioga series is a member of the coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts family. This deep, well drained soil formed in alluvium.

A 30- by 30-foot grid with a 3-foot grid interval was established over a selected area of Tioga soils. Radar profiles were developed by pulling the 500 mHz antenna along eleven, east-west orientated, 30-foot grid lines. At each of the 121 grid intersections, measurements were taken with the EM38 meter placed on the ground surface in both the horizontal and vertical dipole orientations.

Both GPR and EM techniques worked well at this site. The 500 mHz antenna provided adequate observation depths (1 to 1.5 m) and high resolution of subsurface features. Several point anomalies (including a buried metallic reflector at 20 inches) and soil horizons (including buried cultural layers) were detected and identified with GPR. At this site, for archaeological investigations, EM techniques proved to be less effective and appropriate than GPR. Generally, electromagnetic responses were low (<10 mS/m) and gradients imperceptible.

Results:
1. Ground-penetrating radar and electromagnetic induction techniques have been used infrequently on prehistoric, Native American sites. This field study provided an opportunity to improve interpretative skills and to assess the appropriateness of these techniques. Further studies are needed and recommended to improve NRCS ability to assess subsurface cultural features at similar sites.

+ Trade names have been used to provide specific information. Their mention does not constitute endorsement.

*** Pearson, C. S., R. A. Parsons, N. B. Hulbert, and W. C. Williams. 1973. Soil Survey of Chemung County, New York. USDA Soil Conservation Service. U.S. Government Printing Office, Washington, D. C. p. 100.

2. This field investigation and demonstration provided an opportunity for members of NRCS and SUNY Binghamton to exchange soil information and to conduct archaeological field work. This brief exchange has hopefully fostered increased appreciation within the archaeological community for the efforts being expended by USDA-NRCS to preserve and protect this nations cultural heritage.

3. All graphic profiles and EM data were turned over to SUNY Binghamton for further analysis.

It was my pleasure to work in New York and with Ed Stein.

With kind regards

James A. Doolittle
Research Soil Scientist

cc:
James Culver, Assistant Director, NSSC, MNTC, SCS, Lincoln, NE
Steve Holzhey, Assistant Director, NSSC, MNTC, SCS, Lincoln, NE
Ed Stein, Soil Resource Specialist, USDA-NRCS, 100 Lomond Court, Utica NY 13502