

Subject: GPR Field Assistance, Sussex County,
New Jersey; 4 April 1995

Date: 5 April 1995

To: Gail E. Updegraff
State Conservationist
USDA-NRCS
Somerset, New Jersey

Purpose:

To provide ground-penetrating radar (GPR) transect data on the depth to bedrock in various map units in Sussex County.

Principal Participants:

Jim Doolittle, Research Soil Scientist, NSSC, NRCS, Chester, PA
Christine Washer, Soil Conservationist, NRCS, Hackettstown, NJ

Activities:

Ground-penetrating radar transects were conducted in delineated areas of several map units in Sussex County on 4 April.

Equipment and Survey Procedures:

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 vehicular battery. The model 3110 (120 MHz) antenna with a model 705DA transceiver was used in this investigation.

The velocity of signal propagation through the upper part of the soil was estimated to be 0.24 ft/nanoseconds (ns). A scanning times 100 nanoseconds was used. This scanning time provided maximum observation depths of about 12 feet.

All GPR transects were conducted in open fields or along access roads. The antenna was towed behind a 4WD vehicle at a speed of about 3 km/hr. At timed intervals, reference marks were impressed on the radar profiles. Though the GPR provides a continuous record of subsurface conditions, estimates of the depth to bedrock were restricted to these referenced or observation points.

Results:

Several areas of Rockaway (coarse-loamy, mixed, mesic Typic Fragiudults), Washington (fine-loamy, mixed, mesic Ultic Hapludalfs), and Wassaic (fine-loamy, mixed, mesic Glossoboric Hapludalfs) soils were traversed with GPR. These soils are well drained. Rockaway and Washington soils are deep (1.0 to 1.5 m) and Wassaic soils are moderately deep (0.5 to 1.0 m) to bedrock. In most areas of these soils, the interpretative quality of radar profiles was generally good.

The following table summarizes data from GPR transects conducted in Sussex² County. Data were collected in delineated areas of Rockaway gravelly loam, 3 to 8 percent slopes (RoB); Rockaway gravelly loam, 8 to 15 percent slopes (RoC); Washington very stony loam, 3 to 15 percent slopes (WkC); and Washington-Wassaic complex, 3 to 15 percent slopes (WiC). In the following table, data are expressed in terms of frequency of observation by soil depth. All depths are expressed in meters.

Map Unit	Obs.	SOIL DEPTH CLASSES (meters)						
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	> 3.0
WkC (1)	22	-	-	64%	23%	4%	-	9%
WkC (2)	15	-	13%	20%	40%	20%	7%	-
WkC (3)	20	15%	20%	25%	20%	15%	5%	-
WkC (4)	23	-	58%	10%	13%	10%	8%	1%
WiC	20	-	30%	70%	-	-	-	-
RoB	28	-	18%	25%	21%	4%	-	32%
RoC (1)	23	-	13%	35%	39%	9%	-	4%
RoC (2)	20	-	10%	20%	40%	20%	-	10%

A Magellan NAV PRO 500 GPS was used to determine the locations of the final end point for most of the transects. These locations are:

WkC	#1	40° 59' 46" N	074° 47' 54"W
WkC	#2	40° 59' 24" N	074° 48' 39"W
WkC	#4	40° 59' 31" N	074° 48' 34"W
WiC		40° 59' 18" N	074° 48' 29"W
RoC	#1	40° 57' 56" N	074° 45' 02"W
RoB		40° 57' 54" N	074° 45' 21"W

Recommendations:

Ground-penetrating radar techniques can be used to extend the depth and increase the frequency of observation. For soil depth or bedrock investigations, GPR is faster and is less labor intensive than traditional soil survey methods. In New Jersey, the use of GPR as a quality control tool for the soil survey updates is recommended.

It was again my pleasure to work in your state and with members of your staff.

With kind regards.


James A. Doolittle
Research Soil Scientist

cc:

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