

United States Department of Agriculture  
Natural Resources Conservation Service

Folsom, PA 19033

Subject: Ground-Penetrating Radar Assistance      Date: 4 December 1995  
and Training; Franklin County, Massachusetts;  
28-29 November 1995

To: Bruce Thompson  
State Soil Scientist  
USDA - NRCS  
Amherst, MA

**Purpose:**

To provide ground-penetrating radar (GPR) soil assistance and training.

**Participants:**

Albert Averill, Jr., Soil Scientist, NRCS, Greenfield, MA  
James Doolittle, Research Soil Scientist, NRCS, Folsom, PA  
James Turenne, Soil Survey Project Leader, NRCS, West Wareham, MA

**Activities:**

I completed my travel to Greenfield, Massachusetts on the morning of 28 November 1995. The afternoon was spent conducting radar transects. On 29 November, radar activities were curtailed by snow and slippery ground conditions. I returned to Chester, Pennsylvania, on the afternoon of 29 November.

**Equipment:**

The radar unit used in this study was the Subsurface Interface Radar (SIR) System-2 manufactured by Geophysical Survey Systems, Inc. (GSSI). 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.

**Discussion:**

Radar traverses were selected in relatively steep and inaccessible forested areas of select map units. The SIR System-2 radar is backpack-portable and provides soil scientist the opportunity to conduct radar transects away from open fields, trails, or roads.

Transects were conducted in areas of Tunbridge-Lyman complex, 8-15 percent slopes (M.U. 122C), Monadnock-Tunbridge complex, 15-25 percent slopes (M.U. 128D) Canton-Chatfield complex, 25-45 percent slopes (M.U. 112E). Canton is a member of the coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Dystochrept family. Chatfield is a member of the coarse-loamy, mixed, mesic Typic Dystochrept family. Lyman is a member of the loamy, mixed, frigid Lithic Haplorthod family. Monadnock is a member of the coarse-loamy over sandy or sandy-skeletal, mixed,

frigid Typic Haplorthod family. Tunbridge is a member of the coarse-loamy, mixed, frigid Typic Haplorthod family.

Table 1 summarizes the results of the radar transects. Data has been group according to frequency of observation in soil depth classes.

Table 1

Depth Class (cm)	Depths to Bedrock (Frequency of Observations)				
	Transect #				
	1	2	3	4	5
0 to 50	10	0	16	6	4
50 to 100	36	17	50	50	25
100 to 150	27	50	28	39	54
150 to 200	27	33	6	5	13
200 to 250	0	0	0	0	4

Table 2 summarizes the interpreted scanning times and depths to bedrock for each transect.

Table 2  
Transect Data

Transect 1		
MU 122C - TUNBRIDGE-LYMAN COMPLEX, 8-15%		
Obs.	Time(ns)	Depth(m)
0.00	25.10	0.81
1.00	37.10	1.20
2.00	47.50	1.53
3.00	52.50	1.69
4.00	40.60	1.31
5.00	47.10	1.52
6.00	42.70	1.38
7.00	17.80	0.57
8.00	25.30	0.82
9.00	11.40	0.37
10.00	20.90	0.67

**Transect 2**

**MU128D - MONADNOCK-TUNBRIDGE COMPLEX, 15-25%**

<u>Obs.</u>	<u>Time(ns)</u>	<u>Depth(m)</u>
0.00	49.20	1.59
1.00	46.20	1.49
2.00	48.10	1.55
3.00	39.40	1.27
4.00	41.30	1.33
5.00	23.80	0.77
6.00	32.40	1.05
7.00	30.70	0.99
8.00	31.10	1.00
9.00	51.60	1.67
10.00	49.20	1.59
11.00	35.00	1.13

**Transect 3**

**MU128D - MONADNOCK-TUNBRIDGE COMPLEX, 15-25%**

<u>Obs.</u>	<u>Time(ns)</u>	<u>Depth(m)</u>
0.00	34.20	1.10
1.00	33.80	1.09
2.00	24.20	0.78
3.00	15.60	0.50
4.00	16.60	0.54
5.00	18.90	0.61
6.00	27.40	0.88
7.00	58.70	1.89
8.00	59.30	1.91
9.00	42.30	1.37
10.00	38.60	1.25
11.00	42.70	1.38
12.00	41.90	1.35
13.00	41.30	1.33
14.00	35.70	1.15
15.00	38.00	1.23
16.00	19.70	0.64
17.00	14.50	0.47
18.00	18.30	0.59
19.00	21.10	0.68
20.00	13.10	0.42
21.00	14.70	0.47
22.00	18.20	0.59
23.00	15.30	0.49
24.00	14.70	0.47
25.00	17.00	0.55
26.00	18.20	0.59
27.00	23.20	0.75
28.00	23.20	0.75
29.00	15.60	0.50
30.00	16.60	0.54
31.00	15.70	0.51

## Transect 4

MU112E - CANTON-CHATFIELD COMPLEX, 25-45%

Obs.	Time (ns)	Depth(m)
0.00	22.50	0.73
1.00	19.30	0.62
2.00	12.90	0.42
3.00	28.60	0.92
4.00	56.20	1.81
5.00	39.00	1.26
6.00	42.10	1.36
7.00	39.40	1.27
8.00	32.30	1.04
9.00	41.30	1.33
10.00	39.20	1.27
11.00	36.30	1.17
12.00	25.70	0.83
13.00	26.30	0.85
14.00	25.30	0.82
15.00	16.00	0.52
16.00	27.60	0.89
17.00	27.00	0.87

## Transect 5

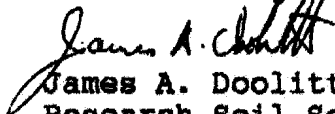
MU112E - CANTON-CHATFIELD COMPLEX, 25-45%

Obs.	Time(ns)	Depth(m)
0.00	44.40	1.43
1.00	54.30	1.75
2.00	41.30	1.33
3.00	30.10	0.97
4.00	29.60	0.96
5.00	38.40	1.24
6.00	35.40	1.14
7.00	31.50	1.02
8.00	41.70	1.35
9.00	33.60	1.08
10.00	35.90	1.16
11.00	38.60	1.25
12.00	39.20	1.27
13.00	48.10	1.55
14.00	28.40	0.92
15.00	18.70	0.60
16.00	14.30	0.46
17.00	23.90	0.77
18.00	52.00	1.68
19.00	76.30	2.46
20.00	31.30	1.01
21.00	41.10	1.33
22.00	28.80	0.93
23.00	35.80	1.16

**Results:**

1. This field trip provided soil scientists with an opportunity to become familiar with the operation of the SIR System-2 radar unit.
2. The SIR System-2 radar unit is highly portable and suited to the surveying relatively inaccessible areas in the western highlands of Massachusetts. Because of concerns for injury and harm to the radar equipment, surveys with the SIR System-2 radar unit should not be conducted in steeply sloping, forested, uplands, when the surface is made slippery by rain or snow.

With kind regards.

  
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cc:

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