**United States Department of Agriculture Service**

**Natural Resources Conservation**

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**Subject:** SOI -- Geophysical Assistance **Date:** 21 September 2005

**To:** Joyce A. Swartzendruber
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**Purpose:**
Ground-penetrating radar (GPR) was used to determine the depths to bedrock and the composition (by soil depth class) of soil map units. In many areas of Maine, it is exceedingly difficult to examine soil profiles and determine the depth to bedrock with conventional soil survey tools. Rock fragments limit the depth of observation and our understanding of the depth to bedrock within many soil map units. GPR provides a continuous profile of the subsurface and can be effectively used to chart bedrock depths.

**Participants:**
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**Activities:**
All field activities were completed during the period of 12 to 15 September 2005. GPR surveys were conducted in northern Washington and southern Penobscot Counties.

**Summary:**
A total of 58 radar traverses were conducted across areas of four map units in Washington County. As each traverse was about 60 m long, this provided about 3480 m of continuous subsurface data. Along these transect lines, the depth to parent rock was determined at 754 observation points and summarized in Table 3 of this report.

A total of 77 radar traverses were conducted across areas of fifteen map units in Penobscot County. As each traverse was about 60 m long, this provided about 4620 m of continuous subsurface data. Along these transect lines, the depth to parent rock was determined at 1001observation points and summarized in Table 4 of this report.

Data from this study may be used by soil scientists to determine map unit composition (based on soil depth criteria) and names. In addition, the data contained in this report may help to confirm mapping concepts used by soil scientists.

As always, it was my pleasure to work in Maine and with members of your fine staff.

With kind regards,

James A. Doolittle
Research Soil Scientist

cc:
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**Study Areas:**

Northern Washington County

Multiple transects were conducted in areas of the map units listed in Table 1. All radar traverse lines were located along logging and access roads that had a minimum of cut and fill. Site 1 was located in an area of map unit 40C in Township T31 MD (near 44.97535 N Lat. and 67.79607 W Long.). Site 2 was located in areas of map unit 38C in Township T31 MD and T37 MD (near 44.96216 N Lat. and 67.80942 W Long.; and near 44.98533 N Lat. and 67.83115 W Long., respectively). Site 3 was located in an area of map unit 942C on Dill Hill in Kossuth Township (near 45.39170 N Lat. and 67.94227 W Long.). Site 4 was located in an area of map unit 942E on Musquash Mountain in Torsfield Township (near 45.338856 N Lat. and 67.79688 W Long.).

**Table 1**
**Soil Map Units traversed with GPR in Washington County, Maine**

| Name | Symbol |
|---|---|
| **Skerry-Becket Association, 3 to 15 % slopes, very stony** | 38C |
| **Becket-Skerry-Tunbridge Association, 5 to 15 percent slopes, very stony** | 40C |
| **Lyman-Abram Complex, 4 to 25 % slopes, very stony** | 942C |
| **Lyman-Abram Complex, 20 to 60 % slopes, very stony** | 942E |

Southern Penobscot County

Multiple transects were conducted in areas of the map units listed in Table 2. Radar traverses were conducted in cultivated fields or along trails and unimproved roads that had a minimum of cut and fill. Each area was assigned a site number and a subscript of either “A” or “B” for surveys completed on Wednesday and Thursday, respectively. Site 1A was located in areas of map unit 5C, 36B, and 311C near Etna Center (near 44.78848 N Lat. and 69.09598 W Long.). Areas of map unit 5C and 36B were in hayland; the area of map unit 311C was in woodland. Site 2A was located in areas of map unit 236B and 277B along Palmyra Road in Corinna (near 44.91401 N Lat. and 69.28095 W Long.). These delineations were in potatoes. Site 3A was located in areas of map unit 55B and 136B in cultivated fields off of Smith Road in Corinna (near 44.90730 N Lat. and 69.23065 W Long.). Site 4A was located in an area of map unit 277B off of Durham Bridge Road near North Newport (near 44.86623 N Lat. and 69.21823 W Long.).

**Table 2**
**Soil Map Units traversed with GPR in Penobscot County, Maine**

| Name | Symbol |
|---|---|
| **Bangor silt loam, 3 to 8 % slopes** | 5C |
| **Chesuncook-Telos complex, 8-15% slopes, very stony** | 22C |
| **Elliottsville-Chesuncook complex, 3 to 8 % slopes** | 36B |
| **Lyman-Abram complex, 3 to 8 % slopes** | 44B |
| **Corinna-Penobscot complex, 3 to 8 % slopes** | 55B |
| **Tunbridge-Lyman complex, 3 to 8% slopes, very stoney** | 82B |
| **Thorndike-Winnecook complex, 0-15 % slopes, very stony** | 179C |
| **Penobscot-Sebasticook complex, 3 to 8 % slopes** | 136B |
| **Elliotsville-Monson complex, 3 to 8 % slopes** | 236B |
| **Monson-Elliottsville-Abram complex, 3 to 8 % slopes** | 277B |
| **Berkshire-Danforth-Tunbridge complex, 3 to 15 % slopes** | 304C |
| **Chesuncook-Elliottsville-Telos association, 3 to 15 % slopes, very stony** | 311C |
| **Elliottsville-Monson complex, 5 to 15 % slopes** | 318C |
| **Telos-Monarda-Monson association, 1 to 8 % slopes** | 342B |
| **Lyman-Tunbridge complex, 3 to 15 % slopes** | 423C |

Site 1B was located in an area of map unit 36B along Valley Road in Plymouth (near 44.7893 N Lat. and 69.20265 W Long.). This area was in hayland. Site 2B was located in areas of map unit 311C and 22C along North Shore Road in Plymouth (near 44.74834 N Lat. and 69.22642 W Long.). Site 3B was located in an area of map unit 179C along Packard Road in Plymouth (near 44.73455 N Lat. and 69.22179 W Long.). Site 4B was located in areas of map unit 342B and 311C along Dunham Road in Etna (near 44.77354 N Lat. and 69.14411 W Long.). Site 5B was located in areas of map unit 423C and 318C along New Sweden Road in Etna (near 44.85027 N Lat. and 69.12617 W Long.). Site 6B was located in an area of map unit 304C along a road in Levant (near 44.86874 N Lat. and 69.06117 W Long.). Site 7B was located in an area of map unit 318C along a trail in Carmel (near 44.83658 N Lat. and 69.02200 W Long.).

The taxonomic classification of the soils traversed with GPR in Washington and Penobscot Counties are listed in Table 3.

**Table 3**
**Soil Series Profiled with GPR in Washington and Penobscot Counties, Maine**

| Series | Taxonomic Classification |
|---|---|
| **Abram** | Loamy, isotic, frigid Lithic Haplorthods |
| **Bangor** | Coarse-loamy, isotic, frigid Typic Haplorthods |
| **Becket** | Coarse-loamy, isotic, frigid Oxyaquic Haplorthods |
| **Berkshire** | Coarse-loamy, isotic, frigid Typic Haplorthods |
| **Chesuncook** | Coarse-loamy, isotic, frigid Aquic Haplorthods |
| **Corinna**[1] | Coarse-loamy, isotic, frigid, Lithic Eutrudepts |
| **Danforth** | Loamy-skeletal, isotic, frigid Typic Haplorthods |
| **Elliottsville** | Coarse-loamy, isotic, frigid Typic Haplorthods |
| **Lyman** | Loamy, isotic, frigid Lithic Haplorthods |
| **Monarda** | Loamy, mixed, active, acid, frigid, shallow Aeric Endoaquepts |
| **Monson** | Loamy, isotic, frigid Lithic Haplorthods |
| **Penobscot**[2] | Coarse-loamy, isotic, frigid, Dystric Eutrudepts |
| **Sebasticook**[2] | Coarse-loamy, mixed, semi-active, frigid, Dystric Eutrudepts. |
| **Skerry** | Coarse-loamy, isotic, frigid Aquic Haplorthods |
| **Telos** | Coarse-loamy, isotic, frigid, shallow Aquic Haplorthods |
| **Thorndike** | Loamy-skeletal, isotic, frigid Lithic Haplorthods |
| **Tunbridge** | Coarse-loamy, isotic, frigid Typic Haplorthods |
| **Winnecook** | Loamy-skeletal, isotic, frigid Typic Haplorthods |

**Equipment:**
The radar unit is the TerraSIRch Subsurface Interface Radar (SIR) System-3000 (here after referred to as the SIR System-3000), manufactured by Geophysical Survey Systems, Inc.[2] The use and operation of GPR are discussed by Daniels (2004). The SIR System-3000 consists of a digital control unit (DC-3000) with keypad, SVGA video screen, and connector panel. A 10.8-volt lithium-ion rechargeable battery powers the system. The SIR System-3000 weighs about 4.1 kg (9 lbs) and is backpack portable. With an antenna, this system requires two people to operate. A 400 MHz antenna was used in this study.

**Field Procedures**:
Each radar traverse was completed by pulling the antenna by hand. Although, GPR provides a continuous profile of the subsurface, interpretations were restricted to observation points. For each transect, observation points were spaced at a uniform time interval of 5 sec or about 5 paces. At each observation point, the radar operator impressed

[1] Proposed soil series.
[2] Manufacturer's names are provided for specific information; use does not constitute endorsement.

a dashed, vertical line on the radar record. This line identified an observation point on the radar record. Each radar traverse was stored as a separate file on a hard disc. Radar records were reviewed and the bedrock surface was identified. At each observation point, the depth to bedrock was interpreted from the radar record.

**Calibration of GPR:**

Ground-penetrating radar is a time scaled system. This system measures the time that it takes electromagnetic energy to travel from the antenna to an interface (e.g., bedrock, soil horizon, stratigraphic layer) and back. To convert the travel time into a depth scale, either the velocity of pulse propagation or the depth to a reflector must be known. The relationships among depth (D), two-way pulse travel time (T), and velocity of propagation (V) are described in the following equation (Daniels, 2004):

$$V = 2D/T \qquad [1]$$

The velocity of propagation is principally affected by the relative dielectric permittivity ($E_r$) of the profiled material(s) according to the equation:

$$E = (C/V)^2 \qquad [2]$$

where C is the velocity of propagation in a vacuum (0.298 m/ns). Velocity is expressed in meters per nanosecond (ns). A nanosecond is one billionth of a second. The amount and physical state of water (temperature dependent) have the greatest effect on the dielectric permittivity of a material.

In each county, the velocity of propagation and a depth scale were determined by comparing the interpreted depth to a known reflector (buried metallic reflector) on the radar record with the measured depth. In Washington County, based on the measured depth and the two-way travel time to this interface, and equation [1], the velocity of propagation was estimated to be about 0.11 m/ns. The relative dielectric permittivity was 7.3. A scanning time of 50 ns was used in this investigation. Using equation [1], a scanning time of 50 ns, and a propagation velocity of 0.11 m/ns, the maximum depth of observation was 2.75 m.

Soils in Penobscot County had slightly higher clay and moisture contents. In Penobscot County, the velocity of propagation was estimated to be 0.0868 m/ns. The relative dielectric permittivity was 11.8. A scanning time of 50 ns was used in this investigation. Using equation [1], a scanning time of 50 ns, and a propagation velocity of 0.868 m/ns, the maximum depth of observation was 2.17 m.

**Results:**

Washington County:

Table 3 contains the tabulated depths to bedrock for each radar traverse conducted in Washington County. Adjustments were made to account for layers of fill along some of these transects. Depths are expressed in centimeters. Also summarizes in this table are the frequency distributions of observations by soil depth classes (depth to bedrock). Depth classes are shallow (0 to 50 cm), moderately deep (50 to 100 cm), deep (100 to 150 cm) and very deep (>150 cm). Where bedrock was exposed at the surface the observation depth was 0 and the depth class was “Outcrop.”

Twenty-six radar transects were conducted along skid roads in an area of map unit 40C at Site 1. A total of 338 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 2 %, moderately deep at 7 %, deep at 13 % and very deep at 77 % of the observation points. Outcrops of parent rock accounted for 1 % of the observations.

Ten radar transects were conducted along skid roads in an area of map unit 38C at Site 2. A total of 130 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 0 %, moderately deep at 6 %, deep at 4 % and very deep at 90 % of the observation points. Outcrops of parent rock were not observed. Four of these traverses were conducted parallel with the base of the drumloidal feature. Here, soils were deep (2 %) and very deep (98%). Six transects were conducted across upper sideslope

and orthogonal to the long axis of this feature. Here, soils at observation points were moderately deep (10 %), deep (5 %) and very deep (85 %) to bedrock.

Eighteen radar transects were conducted along skid roads in an area of map unit 942C at Site 3. A total of 234 observations were made along these transects. Radar records 39 thru 50 were collected along more steeply sloping sideslope areas. Radar records 51 thru 56 were collected across a more level summit. Soils were noticeably deeper on the broad summit area. Based on radar interpretations and soil depth criteria, soils were shallow at 41 %, moderately deep at 33 %, deep at 11 % and very deep at 12 % of the observation points. Outcrops of parent rock accounted for 3 % of the observations.

Four radar transects were conducted along trails and an access road in an area of map unit 942E at Site 4. A total of 52 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 27 %, moderately deep at 46 %, deep at 12 % and very deep at 2 % of the observation points. Outcrops of parent rock accounted for 13 % of the observations.

Penobscot County:

Table 4 contains the tabulated depths to bedrock for each radar traverse conducted in Penobscot County. Also summarizes in this table are the frequency distributions of observations by soil depth classes (depth to bedrock). Adjustments were made to account for layers of fill along some of these transects.

Eight radar transects were conducted across a field in an area of map unit 5C at Site 1A. A total of 104 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 1 %, moderately deep at 17 %, deep at 67 % and very deep at 14 % of the observation points. No outcrops of parent rock were observed.

Three radar transects were conducted along an unimproved road in a wooded area of map unit 311C at Site 1A. A total of 39 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 13 %, moderately deep at 33 %, deep at 36 % and very deep at 18 % of the observation points. No outcrops of parent rock were observed.

Five radar transects were conducted across a field in an area of map unit 36B at Site 1A. Because of poor imagery, radar interpretations were considered unreliable along one traverse line. This line was omitted from analysis. A total of 52 observations were made along the remaining transects. Based on radar interpretations and soil depth criteria, soils were shallow at 4 %, moderately deep at 42 %, deep at 46 % and very deep at 8 % of the observation points. No outcrops of parent rock were observed.

Five radar transects were conducted across a potato field in an area of map unit 236B at Site 2A. A total of 65 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 2 %, moderately deep at 54 %, deep at 42 % and very deep at 3 % of the observation points. No outcrops of parent rock were observed.

Six radar transects were conducted across a potato field in an area of map unit 277B at Site 2A. A total of 78 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 3 %, moderately deep at 40 %, deep at 51 % and very deep at 5 % of the observation points. Outcrops of parent rock accounted for 1 % of the observations.

Five radar transects were completed at Site 3A in areas of map units 55B (3 transects) and 136B (2 transects). Radar records were of poor interpretative quality. Because of low confidence in interpretations, all but one of these transects were omitted from further analysis.

Seven radar transects were completed at Site 4A in areas of map units 277B (3 transects) and 82B (4 transects). Radar records were of poor interpretative quality. Because of low confidence in interpretations, all of these transects were omitted from further analysis.

Six radar transects were conducted across a hayland that was located in an area of map unit 36B at Site 1B. A total of 78 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 0 %, moderately deep at 14 %, deep at 68 % and very deep at 18 % of the observation points. No outcrops of parent rock were observed.

Six radar transects were conducted along a skid road in an area of map unit 311C at Site 2B. A total of 78 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 0 %, moderately deep at 12 %, deep at 71 % and very deep at 18 % of the observation points. No outcrops of parent rock were observed.

Five radar transects were conducted along an unimproved road in an area of map unit 22C at Site 2B. A total of 65 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 1 %, moderately deep at 11 %, deep at 67 % and very deep at 18 % of the observation points. Outcrops of parent rock accounted for 3 % of the observations.

Seven radar transects were conducted along an unimproved road in an area of map unit 179C at Site 3B. A total of 91 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 8 %, moderately deep at 64 %, deep at 21 % and very deep at 5 % of the observation points. Outcrops of parent rock accounted for 2 % of the observations.

Ten radar transects were completed along an unimproved road at Site 4B in areas of map units 342B (4 transects) and 311C (6 transects). In areas of map unit 342B, a total of 52 observations were made along the transect lines. Based on radar interpretations and soil depth criteria, soils within this area of map unit 342B were shallow at 8 %, moderately deep at 35 %, deep at 27 % and very deep at 23 % of the observation points. Outcrops of parent rock accounted for 8 % of the observations. In areas of map unit 311C, a total of 78 observations were made along the transect lines. Based on radar interpretations and soil depth criteria, soils within this area of map unit 311C were shallow at 11 %, moderately deep at 19 %, deep at 18 % and very deep at 47 % of the observation points. Outcrops of parent rock accounted for 5 % of the observations.

Nine radar transects were completed along an unimproved road at Site 5B in areas of map units 423C (4 transects) and 318C (5 transects). However, one transect collected within each of these map units was discarded because of the poor interpretative quality of the radar record. In areas of map unit 423C a total of 39 observations were made along the transect lines. Based on radar interpretations and soil depth criteria, soils within this area of map unit 423C were shallow at 31 %, moderately deep at 44 %, deep at 10 % and very deep at 10 % of the observation points. Outcrops of parent rock accounted for 5 % of the observations. In areas of map unit 318C, a total of 52 observations were made along the transect lines. Based on radar interpretations and soil depth criteria, soils within this area of map unit 318C were shallow at 42 %, moderately deep at 33 %, deep at 15 % and very deep at 2 % of the observation points. Outcrops of parent rock accounted for 8 % of the observations.

Six radar transects were conducted along an unimproved road in an area of map unit 304C at Site 6B. A total of 78 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 0 %, moderately deep at 3 %, deep at 47 % and very deep at 50 % of the observation points. No outcrops of parent rock were observed.

Four radar transects were conducted along an unimproved road in an area of map unit 318C at Site 7B. A total of 52 observations were made along these transects. Based on radar interpretations and soil depth criteria, soils were shallow at 10 %, moderately deep at 38 %, deep at 31 % and very deep at 21 % of the observation points. No outcrops of parent rock were observed.

**References**:

Daniels, D. J. 2004. Ground Penetrating Radar; 2nd Edition. The Institute of Electrical Engineers, London, United Kingdom.

**Table 3**
**Depths to Bedrock GPR Determinations made in Washington County, Maine**
**(All depths are in cm)**

| | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| **Map unit** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 0 | 194 | >245 | >245 | 175 | 222 | 159 | >245 | 179 | 230 |
| 2 | 190 | >245 | >245 | 239 | 184 | 230 | >245 | >245 | 205 | 248 |
| 3 | 212 | 221 | >245 | 241 | 215 | >245 | >245 | >245 | 151 | 268 |
| 4 | 225 | 154 | >245 | >245 | >245 | >245 | 231 | >245 | 193 | 173 |
| 5 | 178 | 93 | >245 | 222 | >245 | >245 | 189 | 224 | >275 | 64 |
| 6 | 148 | 160 | >245 | 245 | 144 | >245 | >245 | 146 | 182 | 41 |
| 7 | 123 | 126 | >245 | >245 | 144 | >245 | 220 | 188 | 233 | 26 |
| 8 | 50 | 131 | >245 | 196 | >245 | >245 | >245 | 184 | 235 | 118 |
| 9 | 112 | 182 | >245 | >245 | >245 | 230 | >245 | 201 | 171 | 231 |
| 10 | 103 | 192 | >245 | 227 | >245 | >245 | >245 | 135 | 181 | >275 |
| 11 | 121 | 112 | 128 | 209 | >245 | >245 | >245 | 157 | 192 | >275 |
| 12 | 111 | 175 | 150 | 198 | 224 | >245 | >245 | >245 | 254 | >275 |
| 13 | 100 | 137 | 189 | 222 | 235 | >245 | >245 | >245 | 253 | >275 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 |
| **Mod Deep** | 0.08 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| **Deep** | 0.46 | 0.31 | 0.15 | 0.00 | 0.15 | 0.00 | 0.00 | 0.15 | 0.00 | 0.08 |
| **Very Deep** | 0.38 | 0.62 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.69 |

| | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 | Site 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **12** | **13** | **14** | **15** | **16** | **18** | **19** | **21** | **22** | **23** |
| **Map unit** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** | **40C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 187 | 216 | 228 | 78 | 155 | 174 | >275 | 116 | 192 | 123 |
| 2 | >275 | 222 | >275 | 210 | 208 | 179 | >275 | 136 | 135 | 136 |
| 3 | 270 | 170 | >275 | 193 | 127 | >275 | >275 | >275 | 106 | 80 |
| 4 | >275 | 231 | >275 | 157 | 127 | >275 | >275 | >275 | 63 | 218 |
| 5 | >275 | 227 | >275 | 123 | 98 | >275 | >275 | >275 | 77 | 234 |
| 6 | >275 | >275 | 252 | 109 | 119 | >275 | >275 | 153 | 62 | 182 |
| 7 | 200 | >275 | 214 | 135 | 79 | >275 | >275 | 99 | 73 | 107 |
| 8 | 240 | >275 | 219 | 196 | 115 | >275 | >275 | 26 | 212 | 194 |
| 9 | 228 | >275 | 253 | 172 | 116 | 248 | >275 | 26 | >275 | 109 |
| 10 | 185 | >275 | >275 | 200 | 75 | >275 | >275 | 0 | >275 | 84 |
| 11 | 166 | >275 | >275 | 163 | 81 | >275 | >275 | >275 | >275 | 133 |
| 12 | 143 | 269 | >275 | 234 | 81 | >275 | >275 | >275 | >275 | 66 |
| 13 | 262 | 263 | >275 | 153 | 93 | >275 | >275 | >275 | >275 | 0 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.08 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 |
| **Mod Deep** | 0.00 | 0.00 | 0.00 | 0.08 | 0.46 | 0.00 | 0.00 | 0.08 | 0.31 | 0.23 |
| **Deep** | 0.08 | 0.00 | 0.00 | 0.23 | 0.38 | 0.00 | 0.00 | 0.15 | 0.15 | 0.38 |
| **Very Deep** | 0.92 | 1.00 | 1.00 | 0.69 | 0.15 | 1.00 | 1.00 | 0.54 | 0.54 | 0.31 |

**Table 3 (continued)**
**Depths to Bedrock GPR Determinations made in Washington County, Maine**

| | Site 1 | Site 1 | Site 1 | Site 1 | Site 4 | Site 2 | Site 2 | Site 2 | Site 2 | Site 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **24** | **25** | **26** | **27** | **39** | **29** | **30** | **31** | **32** | **33** |
| **Map unit** | **40C** | **40C** | **40C** | **40C** | **942C** | **38C** | **38C** | **38C** | **38C** | **38C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 33 | 208 | 247 | >275 | 237 | 163 | >225 | >225 | >225 | >275 |
| 2 | 54 | 141 | 253 | >275 | 228 | 158 | >225 | >225 | >225 | >275 |
| 3 | 106 | 234 | >275 | >275 | 205 | 197 | >225 | >225 | >225 | >275 |
| 4 | 105 | >275 | >275 | >275 | 182 | >225 | >225 | >225 | >225 | >275 |
| 5 | 103 | >275 | >275 | >275 | 210 | 126 | >225 | >225 | >225 | >275 |
| 6 | 89 | 264 | >275 | >275 | 67 | 169 | >225 | >225 | >225 | >275 |
| 7 | 123 | 262 | >275 | 257 | 68 | 179 | >225 | >225 | >225 | >275 |
| 8 | 94 | >275 | >275 | 257 | 82 | 198 | >225 | >225 | >225 | >275 |
| 9 | 62 | >275 | >275 | 258 | 92 | 199 | >225 | >225 | >225 | >275 |
| 10 | 103 | >275 | >275 | 254 | 24 | >225 | >225 | >225 | >225 | >275 |
| 11 | 164 | >275 | >275 | 246 | 25 | >225 | >225 | >225 | >225 | >275 |
| 12 | >275 | >275 | >275 | 249 | 37 | >225 | >225 | >225 | >225 | >275 |
| 13 | >275 | >275 | >275 | 269 | 42 | >225 | >225 | >225 | >225 | >275 |
| | | | | | **Frequency Distribution by Soil Depth Classes** | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.08 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Mod Deep** | 0.31 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Deep** | 0.38 | 0.08 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Very Deep** | 0.23 | 0.92 | 1.00 | 1.00 | 0.38 | 0.92 | 1.00 | 1.00 | 1.00 | 1.00 |

| | Site 2 | Site 2 | Site 2 | Site 2 | Site 2 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **34** | **35** | **36** | **37** | **38** | **40** | **41** | **42** | **43** | **44** |
| **Map unit** | **38C** | **38C** | **38C** | **38C** | **38C** | **942C** | **942C** | **942C** | **942C** | **942C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 93 | 81 | >275 | >275 | 258 | 35 | 41 | 50 | 110 | 46 |
| 2 | 108 | 111 | >275 | >275 | >275 | 34 | 54 | 66 | 53 | 40 |
| 3 | 53 | 218 | >275 | >275 | >275 | 36 | 57 | 0 | 72 | 42 |
| 4 | 89 | 219 | >275 | 212 | >275 | 43 | 101 | 23 | 104 | 86 |
| 5 | 163 | 231 | >275 | 208 | >275 | 35 | 57 | 36 | 131 | 50 |
| 6 | >275 | >275 | >275 | 231 | 232 | 30 | 66 | 36 | 46 | 38 |
| 7 | >275 | >275 | >275 | >275 | >275 | 40 | 32 | 24 | 35 | 0 |
| 8 | 134 | >275 | >275 | 268 | >275 | 34 | 33 | 26 | 53 | 37 |
| 9 | 135 | >275 | >275 | >275 | >275 | 39 | 37 | 30 | 58 | 33 |
| 10 | 83 | >275 | >275 | >275 | >275 | 36 | 56 | 0 | 68 | 18 |
| 11 | 68 | >275 | >275 | >275 | >275 | 42 | 68 | 39 | 90 | 39 |
| 12 | 86 | >275 | >275 | 241 | 256 | 69 | 62 | 55 | 66 | 0 |
| 13 | 98 | >275 | 236 | 255 | 236 | 103 | 70 | 45 | 84 | 40 |
| | | | | | **Frequency Distribution by Soil Depth Classes** | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.15 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.85 | 0.31 | 0.69 | 0.15 | 0.77 |
| **Mod Deep** | 0.54 | 0.08 | 0.00 | 0.00 | 0.00 | 0.08 | 0.62 | 0.15 | 0.62 | 0.08 |
| **Deep** | 0.23 | 0.08 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 | 0.23 | 0.00 |
| **Very Deep** | 0.23 | 0.85 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 3 (continued)**
**Depths to Bedrock GPR Determinations made in Washington County, Maine**

| | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 | Site 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **45** | **46** | **47** | **48** | **49** | **50** | **51** | **52** | **53** | **54** |
| **Map unit** | **942C** | **942C** | **942C** | **942C** | **942C** | **942C** | **942C** | **942C** | **942C** | **942C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 90 | 34 | 36 | 34 | 51 | 46 | 51 | 62 | 260 | 187 |
| 2 | 151 | 35 | 47 | 35 | 55 | 73 | 49 | 64 | 208 | 153 |
| 3 | 122 | 46 | 48 | 33 | 53 | 89 | 47 | 72 | 121 | 135 |
| 4 | 121 | 54 | 40 | 55 | 48 | 57 | 69 | 59 | 89 | 84 |
| 5 | 105 | 48 | 128 | 63 | 69 | 39 | 92 | 92 | 121 | 121 |
| 6 | 46 | 20 | 47 | 28 | 46 | 49 | 107 | 103 | 183 | 47 |
| 7 | 37 | 0 | 41 | 36 | 37 | 43 | 102 | 190 | 151 | 58 |
| 8 | 27 | 25 | 33 | 40 | 41 | 34 | 94 | 52 | 98 | 158 |
| 9 | 39 | 35 | 34 | 53 | 38 | 88 | 91 | 48 | 98 | 229 |
| 10 | 54 | 51 | 39 | 56 | 45 | 62 | 60 | 48 | 79 | 178 |
| 11 | 27 | 24 | 44 | 82 | 56 | 53 | 74 | 48 | 76 | 118 |
| 12 | 37 | 24 | 40 | 57 | 43 | 56 | 68 | 38 | 148 | 40 |
| 13 | 27 | 0 | 42 | 73 | 56 | 53 | 57 | 37 | 189 | 163 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.54 | 0.69 | 0.92 | 0.46 | 0.54 | 0.38 | 0.15 | 0.38 | 0.00 | 0.15 |
| **Mod Deep** | 0.23 | 0.15 | 0.00 | 0.54 | 0.46 | 0.62 | 0.69 | 0.46 | 0.38 | 0.15 |
| **Deep** | 0.08 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.15 | 0.08 | 0.23 | 0.23 |
| **Very Deep** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.38 | 0.46 |

| | Site 3 | Site 3 | Site 4 | Site 4 | Site 4 | Site 4 |
|---|---|---|---|---|---|---|
| **File** | **55** | **56** | **57** | **58** | **59** | **60** |
| **Map unit** | **942C** | **942C** | **942E** | **942E** | **942E** | **942E** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 42 | 97 | 37 | 0 | 114 | 88 |
| 2 | 67 | 168 | 34 | 25 | 72 | 129 |
| 3 | 111 | 118 | 0 | 0 | 61 | 65 |
| 4 | 112 | 109 | 32 | 0 | 49 | 78 |
| 5 | 109 | 49 | 39 | 0 | 43 | 92 |
| 6 | 175 | 55 | 91 | 40 | 46 | 89 |
| 7 | 246 | 67 | 97 | 24 | 78 | 76 |
| 8 | 212 | 121 | 58 | 38 | 39 | 97 |
| 9 | 147 | 183 | 37 | 56 | 118 | 74 |
| 10 | 178 | 193 | 78 | 84 | 88 | 97 |
| 11 | 129 | 181 | 52 | 42 | 89 | 141 |
| 12 | 103 | 191 | 0 | 51 | 118 | 107 |
| 13 | 79 | 231 | 0 | 72 | 86 | 156 |
| | | | **Frequency Distribution by Soil Depth Classes** | | | |
| **Outcrop** | 0.00 | 0.00 | 0.23 | 0.31 | 0.00 | 0.00 |
| **Shallow** | 0.08 | 0.08 | 0.38 | 0.38 | 0.31 | 0.00 |
| **Mod Deep** | 0.15 | 0.23 | 0.38 | 0.31 | 0.46 | 0.69 |
| **Deep** | 0.46 | 0.23 | 0.00 | 0.00 | 0.23 | 0.23 |
| **Very Deep** | 0.31 | 0.46 | 0.00 | 0.00 | 0.00 | 0.08 |

**Table 4**
**Depths to Bedrock GPR Determinations made in Penobscot County, Maine.**
**(All depths are in cm)**

| | Site 1A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **Map unit** | **5C** | **5C** | **5C** | **5C** | **5C** | **5C** | **5C** | **5C** | **311C** | **311C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 132 | 142 | 99 | 127 | 161 | 136 | 138 | 122 | 125 | 70 |
| 2 | 104 | 131 | 161 | 128 | 138 | 161 | 154 | 77 | 73 | 112 |
| 3 | 112 | 112 | 157 | 123 | 172 | 106 | 166 | 117 | 121 | 57 |
| 4 | 64 | 131 | 155 | 152 | 120 | 104 | 109 | 110 | 86 | 156 |
| 5 | 8 | 113 | 132 | 149 | 119 | 136 | 176 | 92 | 86 | 162 |
| 6 | 92 | 133 | 110 | 126 | 83 | 123 | 150 | 118 | 112 | 157 |
| 7 | 95 | 134 | 109 | 151 | 77 | 103 | 129 | 105 | 78 | 69 |
| 8 | 117 | 128 | 130 | 135 | 158 | 115 | 101 | 123 | 77 | 149 |
| 9 | 89 | 120 | 124 | 154 | 109 | 146 | 109 | 129 | 74 | 78 |
| 10 | 101 | 92 | 118 | 121 | 99 | 158 | 121 | 92 | 47 | 121 |
| 11 | 109 | 123 | 100 | 136 | 110 | 98 | 87 | 157 | 45 | 152 |
| 12 | 122 | 129 | 123 | 118 | 114 | 136 | 139 | 101 | 40 | 133 |
| 13 | 121 | 145 | 89 | 126 | 111 | 95 | 115 | 64 | 87 | 116 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 |
| **Mod Deep** | 0.31 | 0.08 | 0.23 | 0.00 | 0.23 | 0.15 | 0.08 | 0.31 | 0.54 | 0.31 |
| **Deep** | 0.62 | 0.92 | 0.54 | 0.77 | 0.54 | 0.69 | 0.69 | 0.62 | 0.23 | 0.38 |
| **Very Deep** | 0.00 | 0.00 | 0.23 | 0.23 | 0.23 | 0.15 | 0.23 | 0.08 | 0.00 | 0.31 |

| | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 1 A | Site 2 A | Site 2 A | Site 2 A | Site 2 A | Site 2 A |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **11** | **12** | **13** | **14** | **15** | **22** | **23** | **24** | **25** | **26** |
| **Map unit** | **311C** | **36B** | **36B** | **36B** | **36B** | **236B** | **236B** | **236B** | **236B** | **236B** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 94 | 120 | 84 | 86 | 66 | 61 | 52 | 101 | 97 | 74 |
| 2 | 165 | 170 | 65 | 137 | 91 | 57 | 78 | 78 | 104 | 121 |
| 3 | 72 | 130 | 95 | 107 | 106 | 57 | 81 | 92 | 101 | 125 |
| 4 | 142 | 153 | 63 | 109 | 49 | 80 | 76 | 80 | 116 | 100 |
| 5 | 50 | 142 | 68 | 68 | 102 | 106 | 62 | 117 | 78 | 102 |
| 6 | 41 | 94 | 95 | 132 | 107 | 147 | 52 | 107 | 74 | 88 |
| 7 | 115 | 115 | 78 | 69 | 166 | 170 | 98 | 117 | 89 | 110 |
| 8 | 130 | 97 | 45 | 77 | 115 | 155 | 78 | 77 | 65 | 111 |
| 9 | 144 | 89 | 136 | 87 | 125 | 122 | 73 | 108 | 56 | 101 |
| 10 | 154 | 86 | 112 | 120 | 117 | 103 | 114 | 78 | 74 | 83 |
| 11 | 189 | 132 | 103 | 112 | 161 | 118 | 112 | 126 | 98 | 72 |
| 12 | 140 | 91 | 82 | 103 | 135 | 108 | 118 | 94 | 55 | 124 |
| 13 | 107 | 83 | 80 | 102 | 130 | 66 | 60 | 106 | 48 | 107 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.15 | 0.00 | 0.08 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 |
| **Mod Deep** | 0.15 | 0.46 | 0.69 | 0.38 | 0.15 | 0.38 | 0.77 | 0.46 | 0.69 | 0.38 |
| **Deep** | 0.46 | 0.38 | 0.23 | 0.62 | 0.62 | 0.46 | 0.23 | 0.54 | 0.23 | 0.62 |
| **Very Deep** | 0.23 | 0.15 | 0.00 | 0.00 | 0.15 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 4 (continued)**
**Depths to Bedrock GPR Determinations made in Penobscot County, Maine.**
**(All depths are in cm)**

| | Site 2 A | Site 2 A | Site 2 A | Site 2 A | Site 2 A | Site 2 A | Site 3 A | Site 1B | Site 1 B | Site 1 B |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **27** | **28** | **29** | **30** | **31** | **32** | **35** | **1** | **2** | **3** |
| **Map unit** | **277B** | **277B** | **277B** | **277B** | **277B** | **277B** | **55B** | **36B** | **36B** | **36B** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 0 | 136 | 151 | 78 | 81 | 76 | 42 | 140 | 126 | 123 |
| 2 | 93 | 132 | 116 | 100 | 101 | 78 | 61 | 145 | 131 | 151 |
| 3 | 155 | 107 | 63 | 125 | 46 | 83 | 70 | 147 | 132 | 132 |
| 4 | 130 | 116 | 104 | 74 | 116 | 72 | 132 | 133 | 148 | 120 |
| 5 | 111 | 140 | 78 | 73 | 124 | 54 | 108 | 145 | 122 | >217 |
| 6 | 115 | 124 | 118 | 151 | 98 | 63 | 61 | 139 | 116 | >217 |
| 7 | 173 | 126 | 74 | 124 | 70 | 97 | 45 | 120 | 136 | >217 |
| 8 | 138 | 85 | 123 | 49 | 97 | 57 | 31 | 125 | 131 | >217 |
| 9 | 130 | 108 | 134 | 55 | 111 | 87 | 29 | 131 | 134 | 182 |
| 10 | 112 | 126 | 98 | 81 | 101 | 120 | 73 | 94 | 141 | 153 |
| 11 | 104 | 108 | 123 | 101 | 101 | 96 | 40 | 120 | 116 | 152 |
| 12 | 101 | 98 | 122 | 105 | 60 | 104 | 50 | 123 | 138 | 135 |
| 13 | 91 | 89 | 112 | 83 | 121 | 122 | 62 | 99 | 119 | 131 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 | 0.46 | 0.00 | 0.00 | 0.00 |
| **Mod Deep** | 0.15 | 0.23 | 0.31 | 0.54 | 0.38 | 0.77 | 0.38 | 0.15 | 0.00 | 0.00 |
| **Deep** | 0.62 | 0.77 | 0.62 | 0.31 | 0.54 | 0.23 | 0.15 | 0.85 | 1.00 | 0.38 |
| **Very Deep** | 0.15 | 0.00 | 0.08 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.62 |

| | Site 1 B | Site 1 B | Site 1 B | Site 2 B | Site 2 B | Site 2 B | Site 2 B | Site 2 B | Site 2 B | Site 2 B |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| **Map unit** | **36B** | **36B** | **36B** | **311C** | **311C** | **311C** | **311C** | **311C** | **311C** | **22C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 163 | 128 | 89 | 128 | 144 | 135 | 141 | 108 | 137 | 120 |
| 2 | 108 | 106 | 94 | 127 | 137 | 142 | 119 | 136 | 124 | 115 |
| 3 | 123 | 175 | 99 | 217 | 120 | 100 | 125 | 134 | 129 | 103 |
| 4 | 157 | 137 | 92 | 217 | 126 | 119 | 117 | 155 | 112 | 137 |
| 5 | 155 | 126 | 89 | 217 | 113 | 123 | 164 | 191 | 145 | 51 |
| 6 | 148 | 131 | 99 | 98 | 131 | 204 | 139 | 121 | 128 | 0 |
| 7 | 131 | 124 | 118 | 123 | 98 | 130 | 127 | 98 | 155 | 0 |
| 8 | 162 | 139 | 133 | 84 | >217 | 138 | 131 | 115 | 154 | 0 |
| 9 | 169 | 131 | 130 | 217 | 123 | >217 | 121 | 133 | >217 | 0 |
| 10 | 137 | 123 | 129 | 97 | 141 | 135 | 117 | 108 | 107 | 0 |
| 11 | 143 | 113 | 97 | 54 | 116 | 125 | 141 | 128 | 130 | 122 |
| 12 | 136 | 111 | 90 | 58 | 132 | 131 | 182 | 109 | 114 | 83 |
| 13 | 127 | 104 | 96 | 60 | 131 | 135 | 126 | 127 | 133 | 27 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| **Mod Deep** | 0.00 | 0.00 | 0.69 | 0.46 | 0.08 | 0.08 | 0.00 | 0.08 | 0.00 | 0.15 |
| **Deep** | 0.62 | 0.92 | 0.31 | 0.23 | 0.85 | 0.77 | 0.85 | 0.77 | 0.77 | 0.38 |
| **Very Deep** | 0.38 | 0.08 | 0.00 | 0.31 | 0.08 | 0.15 | 0.15 | 0.15 | 0.23 | 0.00 |

**Table 4 (continued)**
**Depths to Bedrock GPR Determinations made in Penobscot County, Maine.**
**(All depths are in cm)**

| | Site 2 B | Site 2 B | Site 2 B | Site 2 B | Site 3 B | Site 3 B | Site 3 B | Site 3 B | Site 3 B | Site 3 B |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** |
| **Map unit** | **22C** | **22C** | **22C** | **22C** | **179C** | **179C** | **179C** | **179C** | **179C** | **179C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 134 | 122 | 131 | 217 | 101 | 81 | 112 | 52 | 66 | 151 |
| 2 | 115 | 120 | 127 | 217 | 63 | 39 | 85 | 70 | 92 | 132 |
| 3 | 111 | 110 | 125 | 217 | 93 | 84 | 204 | 74 | 91 | 144 |
| 4 | 91 | 108 | 98 | 134 | 59 | 60 | 103 | 80 | 60 | 155 |
| 5 | 120 | 90 | 116 | 152 | 88 | 85 | 115 | 105 | 68 | 106 |
| 6 | 105 | 98 | 126 | 168 | 81 | 79 | 136 | 186 | 69 | 120 |
| 7 | 128 | 107 | 117 | 141 | 69 | 88 | 78 | 130 | 0 | 98 |
| 8 | 123 | 112 | 126 | 202 | 21 | 45 | 68 | 66 | 111 | 77 |
| 9 | 98 | 113 | 131 | >217 | 20 | 59 | 88 | 82 | 53 | 100 |
| 10 | 134 | 111 | 111 | >217 | 81 | 39 | 84 | 96 | 61 | 130 |
| 11 | 117 | 121 | 108 | >217 | 104 | 96 | 66 | 39 | 71 | 120 |
| 12 | 127 | 132 | 105 | 205 | 86 | 72 | 83 | 0 | 66 | 87 |
| 13 | 118 | 123 | 129 | 185 | 70 | 88 | 105 | 78 | 93 | 90 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.23 | 0.00 | 0.08 | 0.00 | 0.00 |
| **Mod Deep** | 0.15 | 0.15 | 0.08 | 0.00 | 0.69 | 0.77 | 0.54 | 0.62 | 0.85 | 0.38 |
| **Deep** | 0.85 | 0.85 | 0.92 | 0.15 | 0.15 | 0.00 | 0.38 | 0.15 | 0.08 | 0.46 |
| **Very Deep** | 0.00 | 0.00 | 0.00 | 0.85 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 | 0.15 |

| | Site 3 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B | Site 4 B |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** |
| **Map unit** | **179C** | **342B** | **342B** | **342B** | **342B** | **311C** | **311C** | **311C** | **311C** | **311C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 103 | 127 | 103 | 47 | 104 | 0 | 90 | 78 | >217 | >217 |
| 2 | 63 | 109 | 107 | 67 | 71 | 34 | 35 | 111 | >217 | >217 |
| 3 | 95 | 84 | 74 | 51 | 108 | 29 | 0 | 144 | >217 | >217 |
| 4 | 88 | 159 | >217 | 58 | 133 | 40 | 25 | >217 | >217 | >217 |
| 5 | 90 | 114 | 151 | 0 | 80 | 46 | 19 | >217 | >217 | >217 |
| 6 | 76 | 99 | 132 | 0 | 82 | 44 | 29 | >217 | >217 | >217 |
| 7 | 70 | 101 | 117 | 60 | 107 | 36 | 42 | >217 | >217 | >217 |
| 8 | 21 | >217 | >217 | 0 | 57 | 107 | 121 | >217 | >217 | >217 |
| 9 | 76 | >217 | >217 | 54 | 56 | >217 | 142 | 142 | >217 | >217 |
| 10 | 98 | >217 | >217 | 0 | 43 | >217 | 155 | >217 | >217 | >217 |
| 11 | 143 | >217 | 87 | 59 | 39 | 81 | >217 | 156 | >217 | >217 |
| 12 | 152 | >217 | 54 | 45 | 70 | 71 | >217 | 195 | >217 | >217 |
| 13 | 144 | >217 | 141 | 80 | 149 | 53 | >217 | 140 | >217 | >217 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.08 | 0.08 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.08 | 0.00 | 0.00 | 0.15 | 0.15 | 0.46 | 0.38 | 0.00 | 0.00 | 0.00 |
| **Mod Deep** | 0.62 | 0.15 | 0.23 | 0.54 | 0.46 | 0.23 | 0.08 | 0.08 | 0.00 | 0.00 |
| **Deep** | 0.23 | 0.31 | 0.38 | 0.00 | 0.38 | 0.08 | 0.15 | 0.31 | 0.00 | 0.00 |
| **Very Deep** | 0.08 | 0.54 | 0.38 | 0.00 | 0.00 | 0.15 | 0.31 | 0.62 | 1.00 | 1.00 |

**Table 4 (continued)**
**Depths to Bedrock GPR Determinations made in Penobscot County, Maine.**
**(All depths are in cm)**

| | Site 4 B | Site 5 B | Site 5 B | Site 5 B | Site 5 B | Site 5 B | Site 5 B | Site 5 B | Site 6 B | Site 6 B |
|---|---|---|---|---|---|---|---|---|---|---|
| **File** | **34** | **35** | **36** | **37** | **40** | **41** | **42** | **43** | **44** | **45** |
| **Map unit** | **311C** | **423C** | **423C** | **423C** | **318C** | **318C** | **318C** | **318C** | **304C** | **304C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 162 | 32 | 37 | 0 | 69 | 58 | 100 | 27 | 96 | 101 |
| 2 | 203 | 100 | 40 | 56 | 78 | 69 | 102 | 35 | 138 | 149 |
| 3 | >217 | 71 | 28 | 78 | 91 | 68 | 84 | 33 | 107 | 80 |
| 4 | 147 | 79 | 26 | 37 | 75 | 29 | 76 | 21 | 131 | 127 |
| 5 | >217 | 127 | 59 | 58 | 152 | 29 | 40 | 31 | 153 | 136 |
| 6 | >217 | 52 | 37 | 159 | 116 | 37 | 23 | 0 | 143 | 144 |
| 7 | >217 | 122 | 62 | 93 | 83 | 39 | 21 | 46 | >217 | 126 |
| 8 | >217 | 90 | 94 | 0 | 98 | 37 | 0 | 41 | 135 | 159 |
| 9 | >217 | >217 | 85 | 111 | 106 | 39 | 84 | 50 | >217 | 146 |
| 10 | >217 | 151 | 45 | 65 | 127 | 43 | 97 | 27 | >217 | 129 |
| 11 | >217 | 194 | 55 | 47 | 106 | 19 | 91 | 84 | >217 | 127 |
| 12 | 172 | 122 | 53 | 39 | 111 | 0 | 147 | 43 | 131 | 145 |
| 13 | 170 | 61 | 43 | 31 | 142 | 39 | 60 | 0 | 113 | 155 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.00 | 0.08 | 0.54 | 0.31 | 0.00 | 0.08 | 0.08 | 0.15 | 0.00 | 0.00 |
| **Mod Deep** | 0.00 | 0.46 | 0.46 | 0.38 | 0.00 | 0.69 | 0.23 | 0.77 | 0.00 | 0.00 |
| **Deep** | 0.08 | 0.23 | 0.00 | 0.08 | 0.46 | 0.23 | 0.54 | 0.08 | 0.08 | 0.08 |
| **Very Deep** | 0.92 | 0.23 | 0.00 | 0.08 | 0.46 | 0.00 | 0.15 | 0.00 | 0.54 | 0.77 |

| | Site 6 B | Site 6 B | Site 6 B | Site 6 B | Site 7 B | Site 7 B | Site 7 B | Site 7 B |
|---|---|---|---|---|---|---|---|---|
| **File** | **46** | **47** | **48** | **49** | **50** | **51** | **52** | **53** |
| **Map unit** | **304C** | **304C** | **304C** | **304C** | **318C** | **318C** | **318C** | **318C** |
| **OBS.** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** | **Depth** |
| 1 | 182 | 197 | >217 | 146 | 88 | 119 | 98 | 150 |
| 2 | 152 | >217 | 163 | >217 | 27 | 75 | 106 | 193 |
| 3 | 160 | >217 | >217 | >217 | 30 | 106 | 163 | 160 |
| 4 | 151 | >217 | 198 | 114 | 63 | 77 | 42 | 127 |
| 5 | 125 | 197 | 138 | 139 | 62 | 99 | 25 | 110 |
| 6 | 148 | 164 | 151 | 102 | 51 | 111 | 48 | 112 |
| 7 | 151 | >217 | 153 | 136 | 65 | 154 | 88 | 90 |
| 8 | 142 | 147 | 193 | 133 | 60 | 136 | 80 | 115 |
| 9 | 144 | 173 | 178 | 147 | 93 | >217 | 96 | 120 |
| 10 | 166 | 165 | 156 | 180 | 95 | 137 | 159 | 137 |
| 11 | 183 | 168 | 134 | 133 | 69 | 162 | 147 | 104 |
| 12 | 156 | 135 | 153 | 146 | 89 | >217 | 184 | 145 |
| 13 | 151 | 133 | 142 | 140 | 89 | 99 | 156 | 155 |
| | | | | **Frequency Distribution by Soil Depth Classes** | | | | |
| **Outcrop** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shallow** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Mod Deep** | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.23 | 0.00 |
| **Deep** | 0.00 | 0.00 | 0.00 | 0.00 | 0.85 | 0.31 | 0.31 | 0.08 |
| **Very Deep** | 0.31 | 0.23 | 0.23 | 0.77 | 0.00 | 0.38 | 0.15 | 0.69 |