



Final License Application Volume II of III

Part 2 - Exhibit E Appendices

Lowell Hydroelectric Project
(FERC No. 2790)

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Central Rivers Power

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Appendix A

United States Department of
Agriculture Soil Descriptions



Established Series

REV. WHT-CAW-SMF

01/2013

AGAWAM SERIES

The Agawam series consists of very deep, well drained soils formed in sandy, water deposited materials. They are level to steep soils on outwash plains and high stream terraces. Slope ranges from 0 to 15 percent. Saturated hydraulic conductivity is moderately high or high in the upper solum and high or very high in the lower solum and substratum. Mean annual temperature is about 48 degrees F. and mean annual precipitation is about 47 inches.

TAXONOMIC CLASS: Coarse-loamy over sandy or sandy-skeletal, mixed, active, mesic Typic Dystrudepts

TYPICAL PEDON: Agawam fine sandy loam in a nearly level cultivated field at an elevation of about 124 feet. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam; light brownish gray (10YR 6/2) dry; weak medium and coarse subangular blocky structure; very friable; common fine and medium roots; strongly acid; abrupt smooth boundary. (5 to 14 inches thick)

Bw1--11 to 16 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium and coarse subangular blocky structure; very friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

Bw2--16 to 26 inches; light olive brown (2.5Y 5/4) fine sandy loam; weak medium subangular blocky structure; very friable; common fine and medium roots; strongly acid; clear smooth boundary. (Combined thickness of the Bw horizons is 10 to 30 inches)

2C1--26 to 45 inches; olive(5Y 5/3) loamy fine sand; massive; very friable; few fine roots; strongly acid; clear smooth boundary.

2C2--45 to 55 inches; olive brown (2.5Y 4/4) loamy fine sand; massive; very friable; strongly acid; abrupt smooth boundary.

2C3--55 to 65 inches; olive (5Y 5/3) loamy sand; single grain; loose; strongly acid.

TYPE LOCATION: Hampshire County, Massachusetts; Town of Hatfield; 700 feet north of Elm Street at a point 1,600 feet west of its intersection with Prospect Street. USGS Mt. Holyoke quadrangle; Lat. 42 degrees 22 minutes 00 seconds N. and 72 degrees 36 minutes 42 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 15 to 35 inches. Coarse fragments range from 0 to 10 percent by volume in the surface, 0 to 30 percent in the B and C horizons above a depth of 40 inches and 0 to 60 percent below. The soil ranges from very strongly acid to slightly acid, unless limed.

The Ap horizon has hue of 7.5YR to 2.5Y, value of 3 or 4, and chroma of 2 to 4. Dry value is 6 or more. It is fine sandy loam, very fine sandy loam, or loam. Undisturbed pedons have an A horizon that has hue of 7.5YR to 2.5Y, value of 2 to 3, and chroma of 1 to 3. It is 1 to 4 inches thick. Some pedons have a thin E horizon directly below the A.

The upper part of the Bw horizon has hue of 5YR to 10YR, value of 4 to 7, and chroma of 3 to 8. The lower part has hue of 10YR to 5Y with value and chroma ranges the same as the upper part. Texture is fine sandy loam, very fine sandy loam, or loam in the upper part and fine sandy loam or very fine sandy loam in the lower part. Structure is very weak, weak or moderate granular or subangular blocky or the horizon is massive.

A BC horizon of sandy loam or loamy sand is present in some pedons. Color and texture ranges are the same as the lower part of the Bw. Structure is very weak, weak or moderate granular or the horizon is massive. It is up to 5 inches thick.

The C horizon has hue of 10YR to 5Y, value of 3 to 7, and chroma of 1 to 4. It is stratified loamy fine sand, loamy sand, fine sand, sand, or their gravelly analogues and is very gravelly below a depth of 40 inches in some pedons. Consistence is very friable or loose.

COMPETING SERIES: These are the [Barnstable](#), [Branford](#), [Haven](#), and [Narragansett](#) series. Barnstable soils formed in till over outwash and have rock fragments in the solum that are dominantly angular. Branford soils have hue of 5YR or redder throughout the B and C horizons. Narragansett soils lack stratified layers and have coarse fragments that are dominantly angular. Haven soils typically have more than 40 percent silt in the lower part of the Bw horizon.

GEOGRAPHIC SETTING: Agawam soils are level to steep soils on outwash plains and high stream terraces. Most areas are on slopes that are less than 15 percent. Steeper slopes are on terrace escarpments and steep sides of gullies in dissected outwash plains. The soils formed in sandy water deposited material derived principally from schist, granite, gneiss, and phyllite. Mean annual precipitation ranges from 28 to 55 inches and mean annual air temperature from 45 degrees to 50 degrees F. The mean growing season ranges from 120 to 200 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Enfield](#), [Hadley](#), [Hartland](#), [Hinckley](#), [Merrimac](#), [Ninigret](#), [Occum](#), [Walpole](#), and [Windsor](#) soils on nearby landscapes. The excessively drained Hinckley and Windsor, somewhat excessively drained Merrimac, and well drained Enfield and Hartland soils are on associated outwash terraces and glacial lake plains. Well drained Hadley and Occum soils are on nearby floodplains. The moderately well drained Ninigret and poorly drained Walpole soils are associated in a drainage sequence with Agawam soils.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Runoff and internal drainage are negligible to low. Saturated hydraulic conductivity is moderately high or high in the upper solum and high or very high in the lower solum and substratum.

USE AND VEGETATION: Most areas are used for growing cultivated hay, silage corn, tobacco, potatoes, and truck crops. Some areas are used for growing pasture. Native vegetation is forest composed mainly of white pine, gray birch, red maple, red, white, black, and scarlet oaks.

DISTRIBUTION AND EXTENT: Connecticut, Massachusetts, New Hampshire, eastern New York, and Rhode Island; MLRA's 101, 142, 144A, and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Hampden and Hampshire Counties, Massachusetts, 1928.

REMARKS: It should be noted that as a competing series, Haven soils typically have soil temperatures that may be slightly warmer but a precise difference could not be quantified based on available data and historical use.

Diagnostic horizons and other features recognized in this pedon are:

1. Ochric epipedon - the zone from 0 to 11 inches (Ap horizon).
2. Cambic horizon - the zone from 11 to 26 inches (Bw horizons).
3. Contrasting particle-size - the coarse-loamy material contains less than 50 percent fine or coarser sand and the transition zone is less than 12.5 cm thick.

ADDITIONAL DATA: Reference samples from pedons S54MA023006, S58MA011002, S57NH013003, S70CT003001, S85VT027017, S85VT027018, S91MA011008, S93MA011003, S93MA011003, S93MA011004 from numerous counties and states, by NSSL, Lincoln, NE, various years. Pedon S70 CT-3-1 sampled in Hartford, Connecticut. Analysis by Beltsville soil survey laboratory.

National Cooperative Soil Survey
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BELGRADE SERIES

The Belgrade series consists of very deep, moderately well drained soils formed in glaciolacustrine material. They are nearly level to moderately steep soils on terraces. Slope ranges from 0 to 25 percent. Saturated hydraulic conductivity is moderately high or high in the solum and moderately low to high in the substratum. Mean annual precipitation is about 44 inches, and the mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Coarse-silty, mixed, active, mesic Aquic Dystric Eutrudepts

TYPICAL PEDON: Belgrade silt loam - on a 1 percent slope in a cultivated field at an elevation of about 8 meters. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 9 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; very weak fine and medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary. (5 to 10 inches thick)

Bw1--9 to 20 inches; yellowish brown (10YR 5/6) very fine sandy loam; weak fine granular structure; very friable; common fine roots; slightly acid; clear wavy boundary. (6 to 32 inches thick)

BC--20 to 30 inches; light olive brown (2.5Y 5/4) very fine sandy loam; massive; very friable; few very fine roots; common prominent distinct strong brown (7.5YR 5/6) masses of iron accumulation and gray (5Y 5/1) iron depletions; slightly acid; clear wavy boundary. (0 to 12 inches thick)

C1--30 to 42 inches; light olive brown (2.5Y 5/4) very fine sandy loam; massive; very friable; many medium and coarse prominent yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) masses of iron accumulation, and gray (5Y 6/1) iron depletions; slightly acid; abrupt wavy boundary.

C2--42 to 65 inches; gray (5Y 6/1) loamy very fine sand; massive; very friable; common lenses of fine sand; many coarse prominent yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) masses of iron accumulation; neutral.

TYPE LOCATION: Essex County, Massachusetts; Town of Amesbury, 3.2 miles southwest of Amesbury Village, 550 feet north of Pleasant Valley Road and 700 feet east of Amesbury-Merrimac town line. Lat. 42 degrees 49 minutes 30 seconds N., and long. 70 degrees 58 minutes 04 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 44 inches. Reaction ranges from very strongly acid to neutral in the solum and from moderately acid to slightly alkaline in the C horizon; however, some subhorizon between depths of 10 and 30 inches is moderately acid to neutral. Redox depletions with a chroma of 2 or less are within a depth of 24 inches (60 cm). Gravel content ranges from 0 to 5 percent to a depth of 40 inches and 0 to 30 percent below 40 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. Dry value is 6 or more. It is silt loam or very fine sandy loam. Undisturbed areas have an A horizon with colors and textures similar to the Ap.

The Bw horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 3 to 6. Some pedons have lower Bw horizons with hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 6, with common or many redoximorphic features. The Bw horizon is typically silt loam or very fine sandy loam but includes loamy very fine sand. Structure is weak coarse prismatic, weak fine subangular blocky or weak or moderate, fine or medium granular, or the horizon is massive. Consistence ranges from firm to very friable.

The BC horizon, where present, has characteristics similar to those of the lower Bw horizons.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silt loam, very fine sandy loam, or loamy very fine sand in the fine-earth fraction. Some pedons have thin strata of loamy fine sand, fine sand, or silt. Below a depth of 40 inches some pedons have unconforming strata of sand or sand and gravel, or very thin strata or varves of contrasting material. The C horizon has common to many redoximorphic features. It is usually massive, but some pedons have platy structure. Consistence ranges from firm to loose.

COMPETING SERIES: There are no other series in this family. The [Bridgehampton](#), [Boxford](#), [Dartmouth](#), [Enfield](#), [Georgia](#), [Hartland](#), [Raynham](#), [Scio](#), [Suffield](#), [Tisbury](#), [Unadilla](#), and [Wapping](#) are similar soils in related families. Boxford soils are fine. Georgia soils are coarse-loamy. Suffield soils are coarse-silty over clayey. Bridgehampton, Dartmouth, Enfield, Scio, Tisbury, Unadilla, and Wapping soils have base saturation of less than 60 percent in the upper 30 inches. In addition, Enfield and Tisbury soils have sand and gravel within a depth of 40 inches. Hartland soils do not have redox depletions within a depth of 24 inches. Raynham soils have dominant chroma of 2 or less within a depth of 20 inches.

GEOGRAPHIC SETTING: Belgrade soils are nearly level to moderately steep soils on glaciolacustrine terraces. Slope ranges from 0 to 25 percent. The upper part of the soil formed in water or wind deposited material high in silt and very fine sand. The material below 40 inches is variable and ranges from gravelly sand to silt. Mean annual temperature ranges from 45 to 52 degrees F. and mean annual precipitation ranges from 40 to 47 inches. The frost free season ranges from 135 to 195 days.

GEOGRAPHICALLY ASSOCIATED SOILS: Belgrade soils are in a drainage sequence with the well drained [Hartland](#), poorly drained [Raynham](#), and very poorly drained [Birdsall](#) soils. [Agawam](#), [Deerfield](#), [Enfield](#), [Haven](#), [Merrimac](#), [Ninigret](#), [Sudbury](#), [Tisbury](#), and [Windsor](#) soils

are on nearby glacial outwash landforms. [Hadley](#), [Limerick](#), [Occum](#), [Pootatuck](#), [Rippowam](#), and [Winooski](#) soils are on nearby flood plains.

DRAINAGE AND PERMEABILITY: Moderately well drained. Runoff is negligible to high. Saturated hydraulic conductivity is moderately high or high in the solum and moderately low to high in the substratum.

USE AND VEGETATION: Most areas are cleared and are used mainly for growing grasses, and legumes for hay or pasture, and for silage. Some areas are used for growing potatoes, sweet corn, vegetables, and other crops and some areas are used as urban land. Common trees in woodlots are white, red and black oak, hickory, sugar maple, red maple, ash, tulip, black birch, yellow birch, beech, white pine, and hemlock.

DISTRIBUTION AND EXTENT: Massachusetts, New Hampshire, New York, and Vermont (MLRAs 142, 144A, 144B, 145, and 149B). The soil is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Hartford County, Connecticut, 1959.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon - the zone from the soil surface to a depth of 9 inches (Ap horizon).
2. Cambic horizon - the zone from 9 to 30 inches (Bw and BC horizon).
3. Coarse-silty feature - the zone from 10 to 40 inches contains less than 15 percent sand that is coarser than very fine sand, including gravel, and about 5 to 10 percent clay (Bw, BC and Cl horizons).

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Established Series

Rev. DAS-DCP-MCT-DHZ

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CANTON SERIES

The Canton series consists of very deep, well drained soils formed in a loamy mantle underlain by sandy till. They are on nearly level to very steep moraines, hills, and ridges. Slope ranges from 0 to 45 percent. Saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum. The mean annual temperature is about 9 degrees C and the annual precipitation is about 1205 mm.

TAXONOMIC CLASS: Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Typic Dystrudepts

TYPICAL PEDON: Canton fine sandy loam on a west-facing, convex, 8 percent slope in an extremely stony forested area at an elevation of about 210 meters. (Colors are for moist soil unless otherwise noted.)

Oi-- 0 to 5 cm; slightly decomposed plant material; (0 to 13 cm thick.)

A-- 5 to 13 cm; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; friable; common fine roots; 5 percent gravel; very strongly acid (pH 4.6); abrupt smooth boundary. (3 to 10 cm thick.)

Bw1-- 13 to 30 cm; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; 5 percent gravel; very strongly acid (pH 4.6); clear smooth boundary.

Bw2-- 30 to 41 cm; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; 5 percent gravel; strongly acid (pH 5.1); clear smooth boundary.

Bw3-- 41 to 56 cm; yellowish brown (10YR 5/4) gravelly fine sandy loam; weak medium subangular blocky; friable; common fine and medium roots; 15 percent gravel; strongly acid (pH 5.1); abrupt smooth boundary. (Combined thickness of the Bw horizons is 43 to 84 cm.)

2C-- 56 to 170 cm; grayish brown (2.5Y 5/2) gravelly loamy sand; massive; friable; 25 percent gravel; moderately acid (pH 5.6).

TYPE LOCATION: Worcester County, Massachusetts; Town of Douglas; 150 feet south on Wallum Lake Road from the junction of Cedar and South West Main Streets, and 165 feet

southwest of Wallum Lake Road. USGS Oxford, MA quadrangle; Latitude 42 degrees, 2 minutes, 43.2 seconds N., and Longitude 71 degrees, 45 minutes, 44.8 seconds W., NAD 83.

RANGE IN CHARACTERISTICS: Solum thickness is commonly 46 to 91 cm, but ranges to 36 cm. It corresponds closely to the depth to the sandy till. Rock fragment content consists of 0 to 20 percent gravel and 0 to 5 percent cobbles in the solum. Stones and boulders are 0 to 15 percent of the surface and solum. Gravel content is 10 to 30 percent, cobbles 5 to 10 percent, and stones 0 to 10 percent in the substratum. Rock fragments are dominantly granite, gneiss, and quartzite. The soil ranges from extremely acid to moderately acid.

The O horizons, where present, consist of slightly, moderately, and/or highly decomposed organic material.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. Texture is sandy loam, fine sandy loam, loam, or very fine sandy loam in the fine-earth fraction. Some pedons have an Ap horizon with properties similar to the A horizon. It is up to 20 cm thick.

Some pedons have a thin E or AE horizon that has hue of 7.5YR or 10YR, value of 3 to 5 and chroma of 1 or 2 with similar textures to the A horizon. It is up to 8cm thick.

The upper Bw horizons commonly have hue of 10YR, and includes 7.5YR when a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (greater than 0.15) exists, value of 4 or 5, and chroma of 4 to 8. The lower Bw horizons have hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 4 to 8. Texture of the fine-earth fraction of the Bw horizons is commonly fine sandy loam and less commonly sandy loam, loam, and very fine sandy loam. Structure of the Bw horizons is granular or subangular blocky.

Some pedons have a Bs, Bh, or BC horizon with texture similar to the Bw horizons.

The 2C horizon typically has hue of 2.5Y or 5Y, value of 5 to 7, and chroma of 2 or 3. In some pedons hue is 10YR with chroma of 4 to 6. The texture of the fine-earth fraction is loamy fine sand or coarser. It is single grain or massive. Consistence is friable, very friable or loose. Thin lenses or small pockets of firm or very firm finer textured material are common below 91 cm.

COMPETING SERIES: There are no other soils currently in the same family.

The [Agawam](#), [Barnstable](#), [Branford](#), [Brookfield](#), [Charlton](#), [Haven](#), and [Narragansett](#) series are in closely related families. The Agawam, Branford, and Haven soils have stratified sand or sand and gravel in the series control section. In addition, the Branford soils have hues redder than 7.5YR throughout the B horizon. Barnstable soils formed in till over outwash and have less than 30 percent fine sand in the lower part of the Bw horizon. Brookfield soils formed in sulfur bearing parent materials and have a ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron less than 0.15 and have pedogenic iron contents greater than 1 percent throughout the pedon. Charlton soils lack a lithologic discontinuity of abrupt change in sand distribution. Narragansett soils have more than 55 percent silt and very fine sand in the solum.

GEOGRAPHIC SETTING: Canton soils are on moraines and glaciated upland hills and ridges. Slope ranges from 0 to 45 percent. The soils formed in an acid coarse loamy supraglacial melt out till over loose sandy till of Wisconsin age derived from gneiss, granite and schist along with some fine-grained sandstone in some pedons. The loamy mantle in some pedons is influenced or derived from eolian sources. The climate is humid temperate. The mean annual air temperature is 7 to 11 degrees C, and the mean annual precipitation ranges from 1016 to 1295 mm.

GEOGRAPHICALLY ASSOCIATED SOILS: The [Newfields](#) series is the moderately well drained member of the same toposequence. The [Agawam](#), [Haven](#), [Merrimac](#), and [Warwick](#) soils are on nearby glacial outwash kames and plains. The [Barnstable](#), [Brookfield](#), [Charlton](#), [Cheshire](#), [Dutchess](#), [Gloucester](#), [Hollis](#), [Montauk](#), [Narragansett](#), and [Paxton](#) soils are on nearby glaciated uplands. Brookfield, Charlton, Cheshire, Dutchess, Gloucester, Hollis, Montauk, and Paxton soils do not have a contrasting particle size in the control section.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Runoff is negligible to medium. Internal drainage is medium. Saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum.

USE AND VEGETATION: Mostly forested. Some areas have been cleared of surface stones and are used for crops and pasture. Native vegetation is forest composed of eastern white pine, northern red, white, and black oaks, hickory, red maple, sugar maple, gray birch, yellow birch, beech, eastern hemlock, and white ash.

DISTRIBUTION AND EXTENT: Glaciated uplands in Connecticut, Massachusetts, New Hampshire, eastern New York, and Rhode Island, also in the Massachusetts Coastal Islands; MLRAs 144A, 145, and 149B. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Herkimer County, New York, 1969.

REMARKS:

Diagnostic horizons and features recognized in this pedon are:

- 1) Ochric epipedon - the zone from 0 to 13 cm (Oi and A horizons).
- 2) Cambic horizon - the zone from 13 to 56 cm (Bw1, Bw2, and Bw3 horizons).
- 3) Contrasting particle size - the coarse-loamy material contains less than 50 percent fine sand or coarser, and the transition zone between the two parts of the particle-size control section is less than 12 cm thick. (Coarse-loamy over sandy or sandy skeletal).
- 4) Lithologic discontinuity - abrupt change in sand distribution at 56 cm (2C horizon).
- 6) Particle-size control section - the zone from 30 to 105 cm (Bw1, Bw2, Bw3, and 2C horizons).

ADDITIONAL DATA: M.S. Thesis work by Shawn McVey, University of Connecticut, 2006. Full characterization data for sample no. S1982CT007001, S1999CT013001, S1999CT013004, S2000CT007003, S2004CT011003, and pedons of similar soils is available through the National

Cooperative Soil Survey Soil Characterization Database:
<http://ncsslabdatamart.sc.egov.usda.gov/>

National Cooperative Soil Survey
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Established Series
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CHARLTON SERIES

The Charlton series consists of very deep, well drained soils formed in loamy melt-out till. They are nearly level to very steep soils on moraines, hills, and ridges. Slope ranges from 0 to 60 percent. Saturated hydraulic conductivity is moderately high or high. Mean annual temperature is about 9 degrees C and mean annual precipitation is about 1205 mm.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts

TYPICAL PEDON: Charlton fine sandy loam - forested, very stony, at an elevation of about 170 meters. (Colors are for moist soil unless otherwise noted.)

Oe -- 0 to 4 cm; black (10YR 2/1) moderately decomposed forest plant material. (0 to 5 cm thick.)

A -- 4 to 10 cm; dark brown (10YR 3/3) fine sandy loam; weak fine granular structure; very friable; many fine roots; 5 percent gravel; very strongly acid; abrupt smooth boundary. (2 to 15 cm thick.)

Bw1 -- 10 to 18 cm; brown (7.5YR 4/4) fine sandy loam; weak coarse granular structure; very friable; many fine and medium roots; 5 percent gravel; very strongly acid; clear wavy boundary.

Bw2 -- 18 to 48 cm; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; very friable; common fine and medium roots; 10 percent gravel and cobbles; very strongly acid; clear wavy boundary.

Bw3 -- 48 to 69 cm; light olive brown (2.5Y 5/4) gravelly fine sandy loam; massive; very friable; few medium roots; 15 percent gravel and cobbles; very strongly acid; abrupt wavy boundary. (Combined thickness of the Bw horizons is 35 to 91 cm.)

C -- 69 to 165 cm; grayish brown (2.5Y 5/2) gravelly fine sandy loam with thin lenses of loamy sand; massive; friable, some lenses firm; few medium roots; 25 percent gravel and cobbles; strongly acid.

TYPE LOCATION: New Haven County, Connecticut; town of Middlebury, 3800 feet along Long Meadow Road from the intersection with South Street, 450 feet southeast along a gravel road and 50 feet west of the gravel road, 400 feet northeast of Long Meadow Pond, in a wooded area. USGS Naugatuck topographic quadrangle, Latitude 41 degrees 29 minutes 48.40 seconds

N., Longitude 73 degrees 7 minutes 04.59 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 31 to 109 cm. Depth to bedrock is commonly more than 180 cm. Rock fragments range from 5 to 35 percent by volume to a depth of 100 cm and up to 50 percent below 100 cm. Except where the surface layer is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments. Unless limed, reaction ranges from extremely acid to moderately acid.

The O horizon, where present, ranges from slightly decomposed to highly decomposed plant material.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Disturbed pedons have an Ap horizon with value of 3 or 4 and chroma of 2 to 4. The A or Ap horizon is sandy loam, fine sandy loam, or loam in the fine-earth fraction. It has weak or moderate granular structure and is friable or very friable.

Some pedons have a thin AE or E horizon below the O horizon or a thin E horizon below the A horizon. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. Texture, structure, and consistence are like the A horizon.

The upper part of the Bw horizon has commonly hue of 7.5YR or 10YR, and includes 7.5YR when a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (greater than 0.15) exists, and value and chroma of 4 to 6. The lower part of the Bw horizon has hue of 10YR or 2.5Y and value and chroma of 4 to 6. Texture of the Bw horizon is loam, fine sandy loam, or sandy loam with less than 65 percent silt plus very fine sand in the fine earth fraction. It has weak granular or subangular blocky structure. Consistence is friable or very friable.

Some pedons have a BC horizon with value and chroma like the lower part of the Bw horizon, but includes hue of 5Y. The BC horizon commonly has texture, structure, and consistence like the Bw horizon but the range includes geologically derived structure appearing in the form of thin plates.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 6. Texture is loam, fine sandy loam, or sandy loam in the fine-earth fraction, with pockets or thin lenses of loamy sand. The horizon is massive or has plates of geogenic origin. Consistence commonly is very friable or friable but in some pedons includes firm.

COMPETING SERIES: These are [Chadakoin](#), [Chatfield](#), [Maplecrest](#), [Riverhead](#), [Stinger](#) and [Valois](#). Chadakoin and Valois soils formed in till derived primary from sedimentary rock parent materials. Chatfield soils have a lithic contact at 50 to 100 cm below the mineral soil surface. Maplecrest soils formed in till derived from red sedimentary rock parent materials. Riverhead soils formed in glacial outwash deposits and have sandy textures in the substratum. Stinger soils are moderately deep to a paralithic contact and formed in colluvium on mountain side slopes in Oregon.

GEOGRAPHIC SETTING: Charlton soils are nearly level to very steep soils on moraines and glaciated upland hills and ridges. Slope ranges from 0 to 60 percent. The soils formed in acid melt-out till derived mainly from schist, gneiss, or granite. Mean annual temperature ranges from 7 to 11 degrees C and mean annual precipitation commonly ranges from 940 to 1245 cm, but the range includes as low as 660 cm in some places east of the Adirondack Mountains in the Champlain Valley of New York. The growing season ranges from 115 to 185 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Acton](#), [Brookfield](#), [Chatfield](#), [Essex](#), [Hollis](#), [Leicester](#), [Rainbow](#), [Ridgebury](#), [Sutton](#), [Wapping](#), [Whitman](#), and [Woodbridge](#) soils on nearby landscapes. The moderately well drained Sutton and the poorly drained Leicester soils are associated in a drainage sequence. Acton and Wapping soils are moderately well drained. Brookfield soils formed in iron sulfide bearing parent materials and have a ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron less than 0.15 and have pedogenic iron contents greater than 1 percent throughout the pedon. Chatfield soils have bedrock within a depth of 50 to 100 cm. Essex soils have a sandy particle-size control section and a dense substratum. Hollis soils have bedrock within a depth of 25 to 50 cm. Rainbow and Woodbridge soils are moderately well drained with a dense substratum. Ridgebury soils are poorly drained and have a dense substratum. Whitman soils are very poorly drained with a dense substratum.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Runoff is negligible to medium. Saturated hydraulic conductivity is moderately high or high in the mineral soil.

USE AND VEGETATION: Areas cleared of stones are used for cultivated crops, specialty crops, hay, and pasture. Many scattered areas are used for community development. Stony areas are mostly wooded. Common trees are northern red, white, and black oak, hickory, sugar maple, red maple, black and gray birch, white ash, beech, white pine, and hemlock.

DISTRIBUTION AND EXTENT: Glaciated uplands in Connecticut, Massachusetts, New Hampshire, New York, and Rhode Island. MLRAs 142,144A, and 145. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Worcester County, Massachusetts, 1922.

REMARKS: Diagnostic horizons and features recognized in this pedon include:

1. Ochric epipedon - the zone from 0 to 10 cm (Oe and A horizons).
2. Cambic horizon - the zone from 10 to 69 cm (Bw1, Bw2, and Bw3 horizons).
3. Particle-size class - coarse-loamy in the control section from 29 to 109 cm.

ADDITIONAL DATA: M.S. Thesis work by Shawn McVey, University of Connecticut, 2006.

Full characterization data for sample numbers S1999NY005001 and S1999CT013003. Pedons analyzed by the KSSL, Lincoln, NE.

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Established Series
Rev. LWK-ERS-JTI
04/2017

CHATFIELD SERIES

The Chatfield series consists of well drained soils formed in loamy melt-out till. They are moderately deep to bedrock. They are nearly level to very steep soils on bedrock-controlled hills and ridges. Slope ranges from 0 to 70 percent. Crystalline bedrock is at depths of 50 to 100 cm. Saturated hydraulic conductivity is moderately high or high in the mineral soil. Mean annual temperature is about 9 degrees C, and mean annual precipitation is about 1205 mm.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts

TYPICAL PEDON: Chatfield fine sandy loam, on a 13 percent slope in a wooded area. (Colors are for moist soil unless otherwise noted).

Oi -- 0 to 3 cm, slightly decomposed leaf, needle, and twig litter; extremely acid, pH 4.2. (0 to 15 cm thick.)

A -- 3 to 5 cm, very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1), dry; weak fine subangular blocky structure; friable; many fine and medium roots throughout; 5 percent mixed gravel and cobbles; very strongly acid, pH 4.5; abrupt smooth boundary. (1 to 25 cm thick.)

Bw1-- 5 to 33 cm, strong brown (7.5YR 5/6) gravelly fine sandy loam; weak fine subangular blocky structure; friable; common fine roots throughout and common medium roots throughout; 15 percent mixed gravel and cobbles; very strongly acid, pH 4.5; abrupt wavy boundary.

Bw2 -- 33 to 76 cm, strong brown (7.5YR 5/6) gravelly fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots throughout; 20 percent mixed rock fragments; very strongly acid, pH 4.5; abrupt irregular boundary. (Combined thickness of the Bw horizons is 10 to 80 cm.)

2R -- 76 cm; fractured slightly-weathered schist bedrock.

TYPE LOCATION: Merrimack County, New Hampshire; Town of Epsom, 450 feet north-northwest from point 3,550 feet southwest along Old Mountain Road from intersection of Mountain Road and Tarlton Road. USGS Gossville, NH topographic quadrangle; Latitude 43 degrees, 11 minutes, 55.79 seconds N. and Longitude 71 degrees, 19 minutes, 22.31 seconds W., WGS 1984.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 40 to 97 cm. Depth to

bedrock ranges from 50 to 100 cm from the mineral soil surface. Rock fragments range from 5 to 50 percent by volume in the A horizon and from 5 to 35 percent in the B and C horizons. Rock fragments are typically gravel or channers, but include cobbles, stones, boulders and flagstones, particularly just above the bedrock.

The O horizon has hue of 5YR to 2.5Y, value of 2 or 3, and chroma of 0 to 2. It is slightly, intermediately, and/or highly decomposed plant material. Reaction ranges from extremely acid to moderately acid.

The A, or Ap horizon where present, has hue of 7.5YR to 2.5Y, value of 2 to 4, and chroma of 1 to 4. Dry value is 6 or higher. Texture is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam in the fine-earth fraction. Structure is granular. Consistence is friable or very friable. Reaction ranges from extremely acid to moderately acid, unless limed.

The AB or BA horizon, where present, has hue of 7.5YR to 2.5Y, value of 3 or 4, and chroma of 2 to 4. Texture is similar to the A horizon.

The Bw horizon commonly has hue of 10YR or 2.5Y, and includes 7.5YR when a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (greater than 0.15) exists, value of 3 to 6, and chroma of 4 to 6. Texture is similar to the A horizon. The Bw horizon has subangular blocky or granular structure and is friable or very friable. Reaction ranges from very strongly acid to moderately acid.

Some pedons have a BC horizon with color and texture similar to the C horizon.

The C horizon, where present, has hue of 7.5YR to 5Y, value of 4 or 5, and chroma of 2 to 4, and the 7.5YR hue is limited to horizons having a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (≥ 0.15). Texture is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam in the fine-earth fraction and may have lenses or pockets of loamy sand. It is massive and may have plate-like divisions. It is friable or firm. Reaction ranges from very strongly through moderately acid.

The 2R horizon is dominantly schist, granite, or gneiss bedrock. In places it is massive, but it dominantly has vertical and horizontal fractures in the upper 30 to 76 cm.

COMPETING SERIES: These are the [Chadakoin](#), [Charlton](#), [Maplecrest](#), [Riverhead](#), [Stinger](#), and [Valois](#) series. Chadakoin, Maplecrest, and Valois soils formed in till derived primarily from sedimentary rock parent materials and are greater than 100 cm to bedrock. Charlton soils formed in similar parent material to that of Chatfield but are greater than 150 cm to bedrock. Riverhead soils formed in glacial outwash deposits and are greater than 100 cm to bedrock. Stinger soils are not from Region R and have a paralithic contact.

GEOGRAPHIC SETTING: Chatfield soils are nearly level through very steep, and are on bedrock-controlled glaciated upland landscapes. The soils formed in a moderately thick mantle of melt-out till overlying granite, gneiss, or schist bedrock. Slope ranges from 0 to 70 percent. Mean annual precipitation ranges from 660 to 1270 mm, mean annual temperature ranges from 7

to 13 degrees C, and the frost free season ranges from 130 to 180 days. Elevation ranges from 0 to 305 meters above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Brimfield](#), [Brookfield](#), [Cardigan](#), [Charlton](#), [Hollis](#), [Narragansett](#), [Nipmuck](#), and [Paxton](#) soils and their wetter associates on nearby landscapes where the soil mantle is deeper than 100 cm. Brimfield, Brookfield and Nipmuck soils formed in sulfur bearing parent materials and have a ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron less than 0.15 and have pedogenic iron contents greater than 1 percent throughout the pedon. Brookfield, Charlton, Narragansett, and Paxton soils are very deep soils. Cardigan soils are moderately deep soils that formed in till derived from phyllite, slate, shale, and schist. Hollis soils are shallow to bedrock and are on nearby ridge crests and areas adjacent to rock outcrops.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Potential for surface runoff ranges from low to high. Saturated hydraulic conductivity is moderately high or high in the mineral soil.

USE AND VEGETATION: Most areas of Chatfield soils are in woodland. Major tree species include white and northern red oaks, sugar maple, beech, eastern hemlock, eastern white pine, eastern red cedar, and shagbark hickory. Some small cleared areas are used for pasture, are idle, or are sites for residential and recreational development.

DISTRIBUTION AND EXTENT: Connecticut, eastern New York, Massachusetts, New Jersey, and New Hampshire. MLRAs 142, 143, 144A and 145. The soils are of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Orange County, New York, 1940.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon - the zone from 0 to 5 cm (Oi and A horizons).
Cambic horizon - the zone from 5 to 76 cm (Bw1 and Bw2 horizons).
Lithic contact - bedrock at 76 cm (2R horizon).
Particle-size control section - the zone from 28 to 76 cm (part of the Bw1 horizon and all of the Bw2 horizon).
Lithologic discontinuity - at a depth of 76 cm.

ADDITIONAL DATA: M.S. Thesis work by Shawn McVey, University of Connecticut, 2006. Full characterization data for pedons with User Pedon IDs of S1955NH015003, S1982CT007005, S1982CT007005, S1982NY061001, S1995NH013003, S1995NJ037003, S1998NY005001, S1999NY005004, S2000NY005002, S2000NY005004, S2000NY005008, S2000NY119002, S2000NY119003, S2002CT005007, and S2002CT005008. Pedons analyzed by the NSSL, Lincoln, NE. The laboratory characterization data for these pedons and similar soils is available through the National Cooperative Soil Survey Soil Characterization Database: <http://ncsslabdatamart.sc.egov.usda.gov/>

National Cooperative Soil Survey
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Established Series
Rev. CAW-MFF
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DEERFIELD SERIES

The Deerfield series consists of very deep, moderately well drained soils formed in glaciofluvial deposits. They are nearly level to strongly sloping soils on terraces, deltas, and outwash plains. Slope ranges from 0 to 15 percent. Saturated hydraulic conductivity is high or very high. Mean annual temperature is about 49 degrees F. and mean annual precipitation is about 47 inches.

TAXONOMIC CLASS: Mixed, mesic Aquic Udipsamments

TYPICAL PEDON: Deerfield loamy sand in a cultivated field at an elevation of about 114 meters. (Colors are for moist soil.)

Ap --0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; moderately acid; abrupt smooth boundary. (6 to 12 inches thick)

Bw1 --9 to 15 inches; yellowish brown (10YR 5/6) loamy sand; very weak fine granular structure; very friable; common fine roots; moderately acid; clear wavy boundary.

Bw2 --15 to 19 inches; yellowish brown (10YR 5/4) loamy sand; very weak fine and medium granular structure; very friable; common fine roots; common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid; clear smooth boundary. (Combined thickness of the Bw horizons is 5 to 27 inches thick)

BC --19 to 27 inches; olive brown (2.5Y 4/4) sand; single grain; loose; few fine roots; common fine and medium prominent strong brown (7.5YR 5/8) and reddish brown (5YR 4/4) masses of iron accumulation, and common fine and medium distinct grayish brown (10YR 5/2) iron depletions; moderately acid; abrupt smooth boundary. (0 to 20 inches thick)

C --27 to 65 inches; olive gray (5Y 4/2) sand grading with depth to dark gray (5Y 4/1) fine sand; single grain; loose; common fine and medium prominent strong brown (7.5YR 5/8) and reddish brown (5YR 4/4) masses of iron accumulation, and common fine and medium distinct grayish brown (10YR 5/2) iron depletions; moderately acid.

TYPE LOCATION: Franklin County, Massachusetts; Town of Montague, 800 feet west of a point on West Mineral Road that is 4,000 feet from the intersection of West Mineral Road and Millers Falls Road, in a cultivated field. Lat. 42 degrees 35 minutes 36.4 seconds N. and long. 72 degrees 30 minutes 48.2 seconds W., NAD 83.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 15 to 40 inches. Gravel, generally fine pebbles, ranges from 0 to 15 percent in the solum and 0 to 20 percent in the substratum. Reaction ranges from very strongly acid through slightly acid unless limed. Iron depletions with chroma of two or less are between depths of 15 and 40 inches from the mineral soil surface.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is fine sandy loam, sandy loam, loamy fine sand, loamy sand, fine sand, or sand. Undisturbed pedons commonly have an O horizon, and a thin sequence of A, E, and Bs, Bhs or Bh horizons, or an AB horizon. The Ap or A horizon has weak or moderate very fine to medium granular structure.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture of the upper part of the Bw horizon, within a depth of 10 inches from the soil surface, has the same range as the A horizon. Below 10 inches texture is loamy fine sand, loamy sand, fine sand, sand or coarse sand. Structure is weak, very fine to medium granular or subangular blocky, or is single grain.

The BC horizon, where present, has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 2 to 4. Texture range is the same as the lower part of the Bw horizon. Structure is weak, very fine to medium granular, or is single grain.

The C horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 4. Texture is loamy fine sand, loamy sand, fine sand, sand or coarse sand. It is commonly single grain but may be very weak or weak granular.

COMPETING SERIES: These are the [Algansee](#), [Altmar](#), [Brems](#), [Brockatonorton](#), [Elnora](#), [Fortress](#), [Livonia](#), [Morocco](#), [Ottokee](#), [Partridge](#), [Tedrow](#), and Zaborowsky series. The Algansee, Brems, Brockatonorton, [Meckling](#), Morocco, Ottokee, Partridge, Tedrow, and Zaborowsky soils are from outside of region R. Algansee soils have an irregular decrease of organic matter with depth. Altmar soils have rock fragments dominated by sandstone. [Birchwood](#) soils formed in sandy sediments over glacial till. Brems and Ottokee soils have sola more than 40 inches thick, and Ottokee soils have lamellae. Elnora soils contain more fine sand in the lower part of the series control section. Fortress soils formed in anthropotransported soil material from eolian sand, outwash, ordredging activities. Livonia soils formed in glaciolacustrine parent material with neutral to moderately alkaline reaction and average less than 960 mm of annual precipitation. Meckling soils are calcareous throughout. Morocco soils have redox features within a depth of 15 inches. Partridge soils have bedrock at depths of 20 to 40 inches. Tedrow and [Zaborosky](#) soils have carbonates.

GEOGRAPHIC SETTING: Deerfield soils are level to strongly sloping soils on terraces, deltas, and outwash plains. Slope gradients are commonly 0 to 3 percent, but range to 15 percent. The soils formed in thick deposits of sand derived mainly from granite, gneiss and quartzite, but in places containing materials from schist and sandstone. The sand is poorly graded; medium sand is generally dominant and typically contains little or no gravel. Mean annual temperature ranges from 45 to 52 degrees F. and the mean annual precipitation typically ranges from 38 to 55

inches but the range includes as low as 26 inches in some places east of Adirondack Mountains in the Champlain Valley of New York. The mean growing season ranges from 120 to 200 days.

GEOGRAPHICALLY ASSOCIATED SOILS: Deerfield soils are in a drainage sequence that includes the excessively drained [Carver](#) and [Windsor](#) soils, the somewhat poorly drained [Pipestone](#) and [Wareham](#) soils, and the very poorly drained [Scarboro](#) soils. The well drained [Agawam](#), somewhat excessively drained [Merrimac](#), and the excessively drained [Hinckley](#) and [Penwood](#) soils are on nearby glacial outwash landforms and have sandy and gravelly substrata. The excessively drained [Plymouth](#), somewhat excessively drained [Gloucester](#), well drained [Canton](#), [Charlton](#), [Cheshire](#), [Essex](#) and [Paxton](#), and moderately well drained [Woodbridge](#) soils are on nearby glacial till uplands.

DRAINAGE AND PERMEABILITY: Moderately well drained. Runoff is negligible to low. Saturated hydraulic conductivity is high or very high.

USE AND VEGETATION: Mainly cleared and used for truck crops, tobacco, potatoes, hay, pasture and silage corn. Forested areas have pitch pine, white pine, gray birch, red maple, oaks, and sugar maple. Some areas are in urban uses.

DISTRIBUTION AND EXTENT: New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and New York. (MLRA's 101, 142, 144A, 144B, 145, and 149B) The soils of this series are moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Franklin County, Massachusetts, 1964.

REMARKS: The use of very weak structure in the A horizon is no longer an approved choice for grade of structure and has been removed from this description. Some pedons may exist where this grade of structure has been described.

Diagnostic horizons and features recognized in this pedon include:

1. Ochric epipedon - the zone from 0 to 9 inches (Ap horizon).
2. Aquic feature - the zone from 19 to 40 inches has redox depletions with chroma of 2 or less. (BC and C horizons).

National Cooperative Soil Survey
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Established Series
Rev. CAW-SMF-DCP
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HINCKLEY SERIES

The Hinckley series consists of very deep, excessively drained soils formed in glaciofluvial materials. They are nearly level through very steep soils on outwash terraces, outwash plains, outwash deltas, kames, kame terraces, and eskers. Saturated hydraulic conductivity is high or very high. Slope ranges from 0 to 60 percent. Mean annual temperature is about 7 degrees C, and mean annual precipitation is about 1143 mm.

TAXONOMIC CLASS: Sandy-skeletal, mixed, mesic Typic Udorthents

TYPICAL PEDON: Hinckley loamy sand in woodland at an elevation of about 240 meters. (All colors are for moist soil.)

Oe -- 0 to 3 cm; moderately decomposed plant material derived from red pine needles and twigs. (0 to 5 cm thick.)

Ap -- 3 to 20 cm; very dark grayish brown (10YR 3/2) loamy sand; weak fine and medium granular structure; very friable; many fine and medium roots; 5 percent fine gravel; very strongly acid; abrupt smooth boundary. (3 to 25 cm thick.)

Bw1 -- 20 to 28 cm; strong brown (7.5YR 5/6) gravelly loamy sand; weak fine and medium granular structure; very friable; common fine and medium roots; 20 percent gravel; very strongly acid; clear smooth boundary.

Bw2 -- 28 to 41 cm; yellowish brown (10YR 5/4) gravelly loamy sand; weak fine and medium granular structure; very friable; common fine and medium roots; 25 percent gravel; very strongly acid; clear irregular boundary. (Combined thickness of the Bw horizon is 8 to 41 cm.)

BC -- 41 to 48 cm; yellowish brown (10YR 5/4) very gravelly sand; single grain; loose; common fine and medium roots; 40 percent gravel; strongly acid; clear smooth boundary. (0 to 13 cm thick)

C -- 48 to 165 cm; light olive brown (2.5Y 5/4) extremely gravelly sand consisting of stratified sand, gravel and cobbles; single grain; loose; common fine and medium roots in the upper 20 cm and very few below; 60 percent gravel and cobbles; moderately acid.

TYPE LOCATION: Worcester County, Massachusetts; Town of Petersham, Harvard Forest, 240 feet north of Tom Swamp Road at a point 1.15 miles east of the intersection of Athol Road

and Tom Swamp Road. USGS Athol, MA topographic quadrangle, Latitude 42 degrees, 30 minutes, 41.8 seconds N., and Longitude 72 degrees, 12 minutes, 28.9 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 30 to 87 cm. Rock fragment content of the solum ranges from 5 through 50 percent gravel, 0 through 30 percent cobbles, and 0 through 3 percent stones. Rock fragment content of individual horizons of the substratum ranges from 10 through 55 percent gravel, 5 through 25 percent cobbles, and 0 through 5 percent stones. In some places gravel content throughout the soil ranges up through 75 percent. The soil ranges from extremely acid through moderately acid, except where limed.

The O horizons, where present, consist of slightly, moderately, and/or highly decomposed plant material. They have hue N or 2.5YR through 7.5YR, value of 2 or 3, and chroma of 0 through 3.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 through 4, and chroma of 1 through 4. Texture of the fine-earth fraction is very fine sandy loam, fine sandy loam, sandy loam, coarse sandy loam, loamy fine sand, loamy sand, or loamy coarse sand. Structure is weak or moderate very fine through coarse granular or subangular blocky. Consistence is friable or very friable. Undisturbed areas have an A horizon that has hue of 10YR, value of 2 or 3, and chroma of 1 through 4.

Some pedons have thin E, Bhs, Bh, or Bs horizons below the A horizon.

The upper part of the Bw horizon has hue of 7.5YR or 10YR, value of 3 through 5, and chroma of 3 through 8. The lower part has hue of 7.5YR through 2.5Y, value of 3 through 6, and chroma of 3 through 8. Texture, to a depth of 25 cm from the surface, is fine sandy loam, sandy loam, coarse sandy loam, loamy fine sand, loamy sand, or loamy coarse sand in the fine-earth fraction. Below 25 cm it is loamy fine sand, loamy sand, loamy coarse sand, fine sand, sand, or coarse sand in the fine-earth fraction. Structure commonly is weak fine and/or medium granular or the horizon is structureless, but ranges through weak subangular blocky in some places. It is very friable, friable, or loose.

Some pedons have a BC horizon with characteristics similar to both the B and 2C horizons.

The C horizon has hue of 7.5YR through 5Y, value of 3 through 7, and chroma of 2 through 8. Texture is loamy fine sand, loamy sand, loamy coarse sand, fine sand, sand or coarse sand in the fine-earth fraction, and is stratified.

COMPETING SERIES: These are the [Bonaparte](#), [Manchester](#), [Mecosta](#), [Multorpor](#), [Otisville](#), [Quonset](#), and [Rikers](#) series. Mecosta and Multorpor soils are from outside [Land](#) Resource Region R. Bonaparte soils have carbonates within a depth of 100 cm. Manchester soils have 5YR or redder hue in the Bw and C horizons. Mecosta soils are calcareous and Multorpor soils do not have Bw horizons. Otisville soils have rock fragments dominated by sandstone, shale, and slate. Quonset soils have rock fragments dominated by phyllite, slate, and shale. Rikers soils have carboliths in the soil.

GEOGRAPHIC SETTING: Hinckley soils are nearly level through very steep soils on outwash

terraces, outwash plains, outwash deltas, kames, kame terraces, and eskers. Slope is generally 0 through 8 percent on tops of the terraces, outwash plains and deltas. Slope of 8 through 60 percent or more are on the kames, eskers and margins of the outwash plains, deltas, and terraces. The soils formed in glaciofluvial sand and gravel derived principally from granite, gneiss, and schist. Mean annual temperature ranges from 7 to 13 degrees C, and mean annual precipitation ranges from 1016 to 1270 mm. Length of the growing season ranges from 140 through 240 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Agawam](#), [Canton](#), [Charlton](#), [Deerfield](#), [Essex](#), [Gloucester](#), [Horseneck](#), [Mashpee](#), [Massasoit](#), [Merrimac](#), [Paxton](#), [Pompton](#), [Riverhead](#), [Scarboro](#), [Sudbury](#), [Walpole](#), [Wareham](#), and [Windsor](#) soils on nearby landscapes. Horseneck, Pompton, and Riverhead soils are commonly associates in the extreme southern portions of MLRA 144A. Agawam, Merrimac, and Riverhead soils are similar to Hinckley soils, but have cambic horizons. Canton, Charlton, Essex, Gloucester, and Paxton soils formed in till. Deerfield, Horseneck, and Sudbury soils are moderately well drained and Horseneck and Sudbury soils have Cambic horizons. Pompton soils have Cambic horizons and are moderately well and somewhat poorly drained. Scarboro soils are very poorly drained. Windsor soils have less than 15 percent rock fragments. Mashpee and Massasoit soils are poorly drained with spodic horizons. Walpole and Wareham soils are poorly drained.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Excessively drained. Surface runoff is negligible through low. Saturated hydraulic conductivity is high or very high.

USE AND VEGETATION: Cleared areas are used for hay, pasture, and silage corn. In the southern Connecticut River Valley, Hinckley soils are used for growing tobacco and truck crops and in eastern Massachusetts, truck crops. Most areas are forested, brush land or used as urban land. Northern red, black, white, scarlet and scrub oak, eastern white and pitch pine, eastern hemlock, and gray birch are the common trees. Unimproved pasture and idle land support hardhack, little bluestem, bracken fern, sweet fern, and low bush blueberry.

DISTRIBUTION AND EXTENT: Connecticut, southern Maine, Massachusetts, New Hampshire, northern New Jersey, New York, Rhode Island, and Vermont. MLRA's 101, 141, 142, 144A, 145, and 149B. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Oneida County, New York, 1913.

REMARKS: The use of the Hinckley series in frigid areas of Maine, and in MLRA 143 and 144B, is relict to before temperature classes. These have been removed from the SC file.

Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon - the zone from 3 to 20 cm (Ap horizon).
2. Sandy-skeletal feature - the zone from 25 to 100 cm has a weighted average content of rock fragments of 51 percent and a particle size of the fine-earth fraction is sandy (Bw, BC, and C horizons).

ADDITIONAL DATA: Reference samples from pedons S55NH015002, S56MA011002, S56MA011003, S57MA023005, S58NH015002, S73MA009001, S73MA005002, S73MA009004, S73MA005005, S96NH013003 from Massachusetts and New Hampshire, samples by NSSL, Lincoln, NE, various dates.

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LIMERICK SERIES

The Limerick series consists of very deep, poorly drained soils on flood plains. They formed in loamy alluvium. Saturated hydraulic conductivity is moderately high or high. Slope ranges from 0 through 3 percent. Mean annual precipitation is about 44 inches (1118 millimeters) and mean annual temperature is about 45 degrees F. (7 degrees C).

TAXONOMIC CLASS: Coarse-silty, mixed, superactive, nonacid, mesic Fluvaquentic Endoaquepts

TYPICAL PEDON: Limerick silt loam, on a nearly level slope in hay land at an elevation of about 10 feet. (Colors are for moist soil unless otherwise noted.)

Ap-- 0 to 8 inches (0 to 20 centimeters); dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common very fine and fine and few medium roots; moderately acid; clear smooth boundary. (3 to 10 inches, 8 to 25 centimeters thick.)

BCg1-- 8 to 20 inches (20 to 50 centimeters); olive gray (5Y 4/2) silt loam; massive; friable; few very fine and fine roots; common medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 10YR 5/6) soft masses of iron accumulation; moderately acid; clear smooth boundary.

BCg2-- 20 to 36 inches (50 to 91 centimeters); olive gray (5Y 4/2) silt loam; massive; common medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 10YR 5/6) soft masses of iron accumulation; moderately acid; clear smooth boundary.

BCg3-- 36 to 54 inches; (91 to 137 centimeters) dark gray (5Y 4/1) silt loam; massive; common medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 10YR 5/6) soft masses of iron accumulation; moderately acid; clear smooth boundary. (Combined thickness of the BCg horizons ranges from 6 to more than 60 inches (15 to 152 centimeters).)

Cg-- 54 to 65 inches (137 to 165 centimeters); dark greenish gray (5GY 4/1) silt loam; massive; few, fine prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 10YR 5/6) soft masses of iron accumulation; neutral.

TYPE LOCATION: Hartford County, Connecticut; town of Wethersfield, 1200 feet east on Second Lane Road from Interstate 91 underpass, 50 feet south of Second Lane Road, on the Hartford South. USGS Hartford South topographic quadrangle, Latitude 41 degrees, 41 minutes,

52 seconds N., Longitude 72 degrees, 38 minutes, 22 seconds W., NAD 1983, on the floodplain of the Connecticut River.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 17 through more than 60 inches (43 through 152 centimeters). Depth to bedrock is more than 60 inches (152 centimeters). Reaction ranges from strongly acid through neutral. The weighted average of fine and coarser sands, in the particle-size control section, is less than 15 percent.

The A or Ap horizon has hue of 10YR through 5Y, value of 3 or 4, and chroma of 1 or 2. Texture is commonly silt loam but includes very fine sandy loam. Structure is typically weak or moderate, fine or medium granular. Some A horizons have weak or moderate medium subangular blocky structure. Consistence is friable or very friable. Redoximorphic features, where present, are few through many, fine through coarse and faint through prominent.

Some pedons have one or more Ab horizons with hue of 10YR through 5Y, value of 3 or 4 and chroma of 1 or 2. Texture is commonly silt loam but includes very fine sandy loam. The horizons are massive and friable.

Some pedons have a Bg horizon, 6 through 8 inches (15 through 20 centimeters) thick, with hue of 10YR through 5Y, value of 4 through 6, and chroma of 1 or 2. Texture is commonly silt loam, but includes silt and very fine sandy loam. Structure is weak granular or subangular blocky, or the horizon is massive. Consistence is friable. Redoximorphic features are few through many, fine through coarse and distinct or prominent.

The BCg horizon, where present, has hue of 10YR through 5Y, value of 4 through 6 and chroma of 1 or 2. Texture is commonly silt loam, but includes silt and very fine sandy loam. Strata of loamy very fine sand, very fine sand, or fine sand .2 through .5 inches (.5 through 1.3 centimeters) thick are present in some horizons. The horizon is massive and friable or very friable. Redoximorphic features range from few through many, fine through coarse and faint through prominent.

The Cg horizon, where present, has hue of 10YR through 5GY, or is neutral, value of 4, and chroma of 0 through 2. Texture is commonly silt loam but includes silt and very fine sandy loam. Some pedons have thin strata (less than .2 inches) (.5 centimeters) that vary in color, texture, or reaction. Redoximorphic features, where present, are few through many and fine or medium prominent. The horizon is massive and friable.

Some pedons have a 2Cg horizon below a depth of 40 inches (100 centimeters). It has hue of 10YR through 5Y, value of 3 through 5, and chroma of 1 through 4. Texture is fine sandy loam through sand.

COMPETING SERIES: [Oridia](#) and [Skokomish](#) soils are currently the only other series in this family. Oridia and Skokomish series are from [Land](#) Resource Region A in the Pacific Northwest.

The [Lim](#), [Rippowam](#), and [Rumney](#) series are in related families. They have a weighted average of fine sand or coarser in the particle-size control section of more than 15 percent. Rumney soils have a cooler mean annual soil temperature.

GEOGRAPHIC SETTING: Limerick soils are on the flood plains of major rivers and their larger tributaries. In some places they are on the flood plains of small streams. They may be on broad flat areas or in shallow depressions. The soils formed in recent alluvial deposits that are dominantly silt and very fine sand. Mean annual temperature ranges from about 45 through 52 degrees F. (7 through 11 degrees C.), and mean annual precipitation ranges from 30 through 50 inches (762 through 1270 millimeters). The frost-free season ranges from 105 through 180 days.

GEOGRAPHICALLY ASSOCIATED SOILS: Limerick soils are the poorly drained member of the drainage sequence that includes the well drained [Hadley](#), the moderately well drained [Winooski](#), and the very poorly drained [Saco](#) soils. Common associated soils on nearby terraces are the [Agawam](#), [Enfield](#), [Hinckley](#), [Merrimac](#), and [Windsor](#) series.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. Saturated hydraulic conductivity is moderately high or high. Most areas are flooded for periods of several days each year, usually in late winter or early spring.

USE AND VEGETATION: Most areas are used for long term hay and pasture. A few areas have been drained, and cultivated crops are grown. Common trees in wooded areas are red maple and eastern white pine. Additional woody species are alders, willows, black ash, green ash, swamp birch, river birch, silky willow, and pussy willow. Common herbaceous species include cinnamon fern, nettle, and skunk cabbage.

DISTRIBUTION AND EXTENT: Connecticut, Massachusetts, New Hampshire, New York, and Vermont; MLRAs 142, 144A, and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Aroostook County, Maine, 1943.

REMARKS: 1. With this revision the classification is changed from Coarse-silty, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts to Coarse-silty, mixed, superactive, nonacid, mesic Fluvaquentic Endoaquepts. This reflects a review of current lab data available for this series, S70MA015004, S70MA015005 and S06CT003-001 were some of the selected lab pedons used to make the determination.

2. The use of the Limerick series in Maine, and in MLRA 143 and 144B, is relict to before temperature classes. These have been removed from the SC file.

3. Diagnostic horizons and features recognized in this pedon include:

- a. Ochric epipedon - the zone from 0 to 8 inches (0 to 20 centimeters) (Ap horizon).
- b. Cambic horizon - the zone from 8 to 54 inches (20 to 137 centimeters) (BCg horizons).
- c. Aquept feature - Within 20 inches (50 centimeters) of the soil surface the matrix has chroma of 2 or less with redox concentrations.
- d. Fluvaquentic feature: The organic-carbon content is presumed to decrease irregularly with depth between 10 through 50 inches (25 through 125 centimeters).
- e. Nonacid reaction class - the pH is presumed to be 5.0 or more in 0.01m CaCl₂ in at least some part of the control section.
- f. The material composing the Cg layer is presumed to change color upon exposure to air thereby not meeting the criteria for a Cambic horizon.

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Established Series
Rev. DGG-WHT-MFF
01/2013

MERRIMAC SERIES

The Merrimac series consists of very deep, somewhat excessively drained soils formed in outwash. They are nearly level through very steep soils on outwash terraces and plains and other glaciofluvial landforms. Slope ranges from 0 through 35 percent. Saturated hydraulic conductivity is high or very high. Mean annual temperature is about 48 degrees F. (9 degrees C.) and mean annual precipitation is about 42 inches (1067 millimeters).

TAXONOMIC CLASS: Sandy, mixed, mesic Typic Dystrudepts

TYPICAL PEDON: Merrimac fine sandy loam cultivated, at an elevation of about 122 meters. (Colors are for moist soil.)

Ap -- 0 to 10 inches (0 to 25 centimeters); very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; very friable; many fine roots; 10 percent fine gravel; strongly acid; abrupt smooth boundary. (1 to 14 inches (3 to 36 centimeters) thick.)

Bw1 -- 10 to 15 inches (25 to 38 centimeters); brown (7.5YR 4/4) fine sandy loam; weak fine and medium granular structure; very friable; common fine roots; 10 percent fine gravel; strongly acid; clear wavy boundary.

Bw2 -- 15 to 22 inches (38 to 56 centimeters); dark yellowish brown (10YR 4/4) gravelly sandy loam; weak fine and medium granular structure; very friable; few fine roots; 15 percent gravel; strongly acid; clear wavy boundary.

Bw3 -- 22 to 26 inches (56 to 66 centimeters); dark yellowish brown (10YR 4/4) gravelly loamy sand; very weak fine granular structure; very friable; few fine roots; 25 percent gravel; moderately acid; clear wavy boundary. (Combined thickness of the Bw horizons is 6 to 34 inches (15 to 86 centimeters).)

2C -- 26 to 65 inches (66 to 165 centimeters); 80 percent yellowish brown (10YR 5/4) and 20 percent dark grayish brown (10YR 4/2) very gravelly sand; single grain; loose; stratified; few fine roots in upper 4 inches; 40 percent gravel, 10 percent cobbles; moderately acid.

TYPE LOCATION: Franklin County, Massachusetts; Town of Leverett, 2.75 miles south-southeast of Montague Village, 0.13 miles southeast of Cranberry Pond, just west of Route 63. USGS Williamsburg, MA topographic quadrangle, Latitude 42 degrees, 29 minutes, 51 seconds

N. and Longitude 72 degrees, 31 minutes, 12 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 18 through 36 inches (46 through 91 centimeters). Rock fragments are commonly granite or gneiss or schist but up to 25 percent are flat, fine-grained slate, shale, or phyllite fragments. The upper part of the solum commonly has 2 through 20 percent gravel, but includes cobbles in some pedons, and the lower part 5 through 30 percent. The substratum contains 2 through 55 percent gravel and 5 through 15 percent cobbles. Total volume of rock fragments in the particle-size control section is less than 35 percent. Clay content is less than 18 percent. Reaction ranges from extremely acid through moderately acid, unless limed.

The O horizon, where present, ranges in thickness from 2 through 5 inches (4 through 13 centimeters). They have hue 2.5YR through 10YR, value 2 or 3, and chroma 1 through 3. They are fibric, hemic, or sapric material.

The Ap, A, or AE horizon has hue of 7.5YR or 10YR, value of 2 through 4, and chroma of 1 through 4. Texture is fine sandy loam, sandy loam, or very fine sandy loam in the fine-earth fraction.

The E horizon, where present, ranges in thickness from 1 through 3 inches (3 through 8 centimeters). They have hue 5YR through 10YR, value 4 through 6, and chroma 1 through 4. Texture is sandy loam or coarse sandy loam in the fine-earth fraction. Some pedons have thin Spodic horizons less than 2 inches (5 centimeters) thick with hue 7.5YR or 10YR, value 4, and chroma 3 through 6.

The Bw horizon has hue of 7.5YR or 10YR in the upper part and 7.5YR through 2.5Y in the lower part. Value ranges from 3 through 6 and chroma from 3 through 8. Texture of the upper part of the Bw horizon is fine sandy loam, sandy loam, coarse sandy loam, or very fine sandy loam in the fine-earth fraction. It has granular or subangular blocky structure or the horizon is massive. The lower part of the B horizon is sandy loam, coarse sandy loam, loamy coarse sand, loamy fine sand, or loamy sand in the fine-earth fraction. Sandy loam textures do not extend below a depth of 27 inches (69 centimeters), but a minimum thickness of 5 inches (13 centimeters) of sandy loam overlies any lower B or 2C horizon that is loamy fine sand or coarser. The B subhorizon that lies above the 2C horizon in many pedons is single grain. Some pedons have a BC horizon that is similar to the lower part of the Bw.

The 2C horizon has hue of 10YR through 5Y and ranges widely in value and chroma. It consists of stratified coarse sand, sand, gravel, and cobbles and has a weighted texture of gravelly or very gravelly sand or coarse sand. Some pedons have thin lenses of loamy fine sand or fine sand.

COMPETING SERIES: These are the [Hartford](#) and [Knickerbocker](#) series. Hartford soils have hues of 5YR or redder in the Bw horizon. Knickerbocker soils generally have less rock fragments in the substratum and the fragments are commonly slate and dark shale.

GEOGRAPHIC SETTING: Merrimac soils are level to very steep soils on outwash plains and valley trains, and associated kames, eskers, stream terraces and water deposited parts of

moraines. The steeper slopes are on the margin escarpments of terraces and plains, and on eskers and kames. Slope ranges from 0 through 35 percent. The soils formed in water sorted gravelly and sandy material derived mainly from granitic, gneissic, and some schistose rocks. Mean annual precipitation ranges from 28 through 55 inches (711 through 1397 millimeters); mean annual air temperature ranges from 45 through 50 degrees F. (7 through 10 degrees C.), mean growing season ranges from 120 through 200 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Agawam](#), [Hinckley](#), [Mashpee](#) (T), [Massasoit](#) (T), [Sudbury](#), [Scarboro](#), [Walpole](#), and [Windsor](#) soils on nearby landscapes. The well drained Agawam soils are coarse-loamy over sandy or sandy-skeletal. The excessively drained Hinckley soils are sandy-skeletal. The very poorly drained Scarboro soils are in depressions. The moderately drained Sudbury soils are on adjacent, slightly lower landforms. The poorly drained Mashpee (T), Massasoit (T), and Walpole soils are in drainageways and on low landforms. The excessively drained Windsor soils have loamy fine sand to sand textures in the Bw horizon and lack rock fragments.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat excessively drained. Runoff is negligible through medium. Saturated hydraulic conductivity is high or very high.

USE AND VEGETATION: Most areas are cultivated and used for growing hay, pasture, silage, corn, or truck crops. Some areas are used to grow tobacco in the Connecticut River Valley in Massachusetts and Connecticut. Some areas are forested with mostly white pine, gray birch, hemlock, red maple, and red, black, white, and scarlet oaks.

DISTRIBUTION AND EXTENT: Massachusetts, Connecticut, New Hampshire, New York, Vermont, and Rhode Island. MLRA's 142, 144A, 145, and 149B. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Merrimack County, New Hampshire, 1906.

REMARKS: The use of the Merrimac series in Maine, and in MLRA 143 and 144B, is relict to before temperature classes. These have been removed from the SC file.

Diagnostic horizons and other features recognized in this pedon are:

1. Ochric epipedon - the zone from 0 to 10 inches (0 to 25 centimeters) (Ap horizon).
2. Cambic horizon - the zone from 10 to 22 inches (25 to 56 centimeters) (Bw horizon).

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OCCUM SERIES

The Occum series consists of very deep, well drained loamy soils formed in alluvial sediments. They are nearly level soils on flood plains, subject to common flooding. Slope ranges from 0 to 3 percent. Saturated hydraulic conductivity is moderately high or high in the loamy layers and high or very high in the sandy substratum. Mean annual temperature is about 50 degrees F., and mean annual precipitation is about 43 inches.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Fluventic Dystrudepts

TYPICAL PEDON: Occum fine sandy loam in a hayfield at an elevation of about 200 feet. (Colors are for moist soil unless otherwise noted.)

Ap--0 to 10 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; very friable; many very fine and fine roots; moderately acid; clear smooth boundary. (5 to 12 inches thick)

Bw1--10 to 17 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; common very fine and fine roots; moderately acid; clear smooth boundary.

Bw2--17 to 28 inches; dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; very friable; few very fine and fine roots; moderately acid; clear smooth boundary. (Combined thickness of the Bw horizons is 14 to 35 inches.)

C1--28 to 32 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; moderately acid; clear smooth boundary.

C2--32 to 42 inches; brown (10YR 5/3) and light olive brown (2.5Y 5/4) sand; single grain; loose; 10 percent gravel; moderately acid; clear smooth boundary.

C3--42 to 65 inches; brown (10YR 5/3) and light olive brown (2.5Y 5/4) very gravelly coarse sand; single grain; loose; 35 percent gravel; moderately acid.

TYPE LOCATION: Hartford County, Connecticut; town of Granby, 50 feet north of Mechanicsville Road at a point 2,300 feet west of Route 10 and 50 feet east of East Branch Salmon Brook. USGS Tariffville topographic quadrangle, latitude 41 degrees 58 minutes 15 seconds N., longitude 72 degrees 48 minutes 11 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the coarse-textured substratum range from 20 to 40 inches. Gravel ranges from 0 to 15 percent by volume in the solum and from 0 to 60 percent in the substratum. Some pedons have up to 10 percent cobbles in the substratum. Unless limed, reaction ranges from very strongly acid to slightly acid.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 4. Texture is very fine sandy loam, fine sandy loam, or sandy loam. It has weak or moderate granular structure and is friable or very friable.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 3 to 8, and chroma of 3 to 6. It is commonly fine sandy loam or sandy loam, but the range includes very fine sandy loam or loam in the upper part. Some pedons have thin strata of loam, very fine sandy loam, or silt loam. The Bw horizon has granular or subangular blocky structure, or it is massive. Consistence is friable or very friable. Some pedons have thin Ab horizons.

The C horizon has hue of 7.5YR to 5Y, value of 3 to 7, and chroma of 2 to 6. Some pedons have redoximorphic features below a depth of 4 feet. Texture of individual layers ranges from loamy fine sand to coarse sand in the fine-earth fraction. Included in some pedons are thin loamy and/or extremely gravelly strata. Also, some pedons have a loamy C horizon layer just below the Bw horizon. The C horizon is single grain and loose in the sandy part. The loamy part is typically massive and friable. The thickness and number of subhorizons is variable and corresponds to the thickness and variability of the alluvial deposits.

COMPETING SERIES: [McNulty](#) and [Wenonah](#) are other soils currently in the same family. McNulty soils are from outside of LRR R. McNulty soils average more than 60 inches of precipitation per year. Wenonah soils formed in alluvium containing sandstone, siltstone, and shale.

GEOGRAPHIC SETTING: Occum soils are nearly level soils on flood plains, along rivers and streams. Slope ranges from 0 to 3 percent. The soils formed in recent alluvium derived mostly from gneiss, granite, and schist. Mean annual temperature ranges from 45 to 54 degrees F., mean annual precipitation ranges from 35 to 50 inches but the range includes as low as 26 inches in some places east of Adirondack Mountains in the Champlain Valley of New York. The growing season ranges from 115 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: The [Agawam](#), [Enfield](#), [Hadley](#), [Haven](#), [Hinckley](#), [Lim](#), [Limerick](#), [Merrimac](#), [Pootatuck](#), [Rippowam](#), [Saco](#), [Suncook](#), [Windsor](#), and [Winooski](#) series are on nearby landscapes. The moderately well drained Pootatuck and the poorly drained Rippowam soils are associated in a drainage sequence. Agawam, Enfield, Haven, and Merrimac soils have a regular decrease in organic carbon with depth. Hadley and [Hamlin](#) soils are coarse-silty. Pootatuck soils have low chroma mottles within a 24 inch depth. Hinckley and Windsor soils are on nearby terraces and outwash plains. Lim, Limerick, Saco, and Winooski soils are wetter silty floodplain associates. Suncook soils are sandy, excessively drained soils on floodplains.

DRAINAGE AND PERMEABILITY: Well drained. Surface runoff is negligible to low. Saturated hydraulic conductivity is moderately high or high in the loamy layers and high or very high in the sandy substratum. Many areas of these soils flood for short periods each year, but typically not during the growing season. The soils on higher positions flood occasionally.

USE AND VEGETATION: Cleared areas are used for cultivated crops, hay, and pasture. Common trees in wooded areas are sycamore, white pine, white, yellow, and gray birch, red maple, sugar maple, hemlock, and red and white oak.

DISTRIBUTION AND EXTENT: Holocene floodplains in Connecticut, Massachusetts, New Hampshire, New York, and Vermont; MLRAs 142, 144A and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Windham County, Connecticut, 1980.

REMARKS: Cation exchange activity class placement determined from a review of limited lab data and similar or associated soils.

Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon - the zone from 0 to 10 inches (Ap horizon).
2. Cambic horizon - the zone from 10 to 28 inches (Bw1, Bw2 horizons).
3. Fluventic feature - irregular decrease in organic carbon with depth and organic carbon is greater than 0.2 percent within 1.25 meters.
4. Particle-size class - averages coarse-loamy in the particle size control section from 10 to 40 inches (Bw1, Bw2, C1, C2 horizons).

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Established Series
Rev. JDL-NWS-MLK
09/2012

PIPESTONE SERIES

The Pipestone series consists of very deep, somewhat poorly drained soils formed in sandy outwash on outwash plains, lake plains, beach ridges, and water-worked till plains. Slope ranges from 0 to 8 percent. Mean annual precipitation is about 889 mm (35 inches), and mean annual temperature is about 10.0 degrees C (50 degrees F).

TAXONOMIC CLASS: Sandy, mixed, mesic Typic Endoaquods

TYPICAL PEDON: Pipestone sand, on an east-facing, convex, 1 percent slope in an idle field. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 20 cm (8 inches); very dark brown (10YR 2/2) sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary. [0 to 25 cm (10 inches) thick]

E--20 to 28 cm (8 to 11 inches); grayish brown (10YR 5/2) sand; moderate medium granular structure; very friable; common fine roots; common medium distinct dark yellowish brown (10YR 3/4) masses of oxidized iron in the matrix; moderately acid; abrupt broken boundary. [0 to 25 cm (10 inches) thick]

Bhs--28 to 38 cm (11 to 15 inches); dark reddish brown (5YR 3/3) sand; weak medium subangular blocky structure; very friable; few fine roots; common fine distinct brown (7.5YR 4/4) masses of oxidized iron in the matrix; strongly acid; abrupt wavy boundary. [0 to 25 cm (10 inches) thick]

Bs--38 to 79 cm (15 to 31 inches); yellowish brown (10YR 5/6) sand; single grain; loose; moderately acid; abrupt wavy boundary. [10 to 58 cm (4 to 23 inches) thick]

C--79 to 152 cm (31 to 60 inches); light brownish gray (10YR 6/2) sand; single grain; loose; slightly acid.

TYPE LOCATION: Berrien County, Michigan; about 4 miles northeast of Benton Harbor; 1,172 feet south and 99 feet west of the northeast corner of sec. 28, T. 3 S., R. 18 W.; USGS Benton Heights topographic quadrangle; lat. 42 degrees 10 minutes 59.5 seconds N. and long. 86 degrees 23 minutes 54 seconds W., WGS 84.

RANGE IN CHARACTERISTICS:

Thickness of the solum: 51 to 127 cm (20 to 50 inches)
Rock fragment content: 0 to 10 percent gravel throughout

Ap horizon:

Hue: 7.5YR or 10YR

Value: 2 to 4

Chroma: 1 to 3

Texture: sand, fine sand, loamy sand, loamy fine sand, or loamy coarse sand

Reaction: extremely acid to neutral

A horizon, where present:

Hue: 7.5YR or 10YR, or is neutral

Value: 2 to 4

Chroma: 0 to 3

Texture: sand, fine sand, loamy sand, loamy fine sand, or loamy coarse sand

Reaction: extremely acid to neutral

Some forested pedons have partially or well decomposed O horizons of forest litter up to 13 cm (5 inches) thick.

E horizon:

Hue: 7.5YR or 10YR

Value: 5 to 7

Chroma: 1 to 3

Texture: sand, loamy sand, fine sand, loamy fine sand, coarse sand, or loamy coarse sand

Reaction: extremely acid to neutral

Bhs horizon:

Hue: 5YR to 10YR

Value: 2 or 3

Chroma: 2 or 3

Texture: sand, loamy sand, fine sand, coarse sand, or loamy coarse sand

Ortstein content: 0 to 30 percent of the surface area exposed in a vertical cut through the Bhs horizon and is present in less than 50 percent of the pedons

Reaction: extremely acid to moderately acid

Bs horizon in pedons without a Bhs horizon:

Hue: 5YR or 7.5YR

Value: 3 or 4

Chroma: 4

Texture: sand, loamy sand, loamy fine sand, fine sand, coarse sand, or loamy coarse sand

Reaction: extremely acid to moderately acid

Bs horizon in pedons with a Bhs horizon:

Hue: 5YR to 10YR

Value: 3 to 6

Chroma: 4 to 8

Iron and manganese concretions: present in some pedons

Texture: sand, loamy sand, loamy fine sand, fine sand, coarse sand, or loamy coarse sand

Reaction: extremely acid to moderately acid

BC horizon, where present:

Hue: 10YR

Value: 5 to 7

Chroma: 4 to 6

Texture: sand, loamy sand, loamy fine sand, fine sand, coarse sand, or loamy coarse sand

Reaction: very strongly acid to neutral

C horizon:

Hue: 7.5YR or 10YR

Value: 5 to 7

Chroma: 2 to 6

Texture: sand, fine sand, coarse sand, or loamy coarse sand

Reaction: very strongly acid to neutral

COMPETING SERIES: There are no other series in the same family.

GEOGRAPHIC SETTING: Pipestone soils are on outwash plains, lake plains, beach ridges, and till plains of Wisconsinan age. Slope ranges from 0 to 8 percent but are dominantly 0 to 4 percent. Pipestone soils formed in sandy outwash. Mean annual precipitation ranges from 711 to 914 mm (28 to 36 inches). Mean annual temperature ranges from 7.2 to 10.0 degrees C (45 to 50 degrees F).

GEOGRAPHICALLY ASSOCIATED SOILS: The excessively drained [Oakville](#) and [Grattan](#) soils and the poorly drained or very poorly drained [Granby](#), [Kingsville](#), and [Newton](#) soils are in a drainage sequences with Pipestone soils.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat poorly drained. The water table fluctuates from near the surface during prolonged wet periods to depths greater than 122 cm (4 feet) in dry seasons. Depth to the top of a seasonal high water table ranges from 15 to 46 cm (0.5 to 1.5 feet) between October and June in normal years. Potential for surface runoff is negligible or very low. Saturated hydraulic conductivity is high or very high. Permeability is rapid.

USE AND VEGETATION: A large part is or has been cultivated. Some areas are in permanent pasture. Special crops such as blueberries, cucumbers, and melons are important crops on this soil. Many areas are in various stages of reforestation. Natural forests are American basswood, eastern cottonwood, northern red oak, bitternut hickory, white ash, swamp white oak, and red maple.

DISTRIBUTION AND EXTENT: MLRAs 96, 97, 98, 99, 142, 144A, 149B in southern Michigan, northeastern Indiana, Connecticut, Massachusetts, New Hampshire and New York.

The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: AMHERST,
MASSACHUSETTS

SERIES ESTABLISHED: Gratiot County, Michigan, 1975.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon: from the surface to a depth of 28 cm (11 inches) (Ap and E horizons).
Albic horizon: from a depth of 20 to 28 cm (8 to 11 inches) (E horizon).
Spodic horizon: from a depth of 28 to 38 cm (11 to 15 inches) (Bhs horizon).

ADDITIONAL DATA: Soil Interpretation Record: MI0257.

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Established Series
Rev. MFF-SMF-GS
01/2013

POOTATUCK SERIES

The Pootatuck series consists of very deep, moderately well drained loamy soils formed in alluvial sediments. They are nearly level soils on floodplains subject to frequent to occasional flooding. Slope ranges from 0 to 3 percent. Saturated hydraulic conductivity is moderately high or high in the loamy upper layers and high or very high in the sandy substratum. Mean annual temperature is about 10 degrees Celsius, and mean annual precipitation is about 1190 millimeters.

TAXONOMIC CLASS: Coarse-loamy, mixed, active, mesic Fluvaquentic Dystrudepts

TYPICAL PEDON: Pootatuck fine sandy loam - cutover woodland. (Colors are for moist soil.)

A-- 0 to 10 centimeters; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; friable; common fine and medium roots; strongly acid; clear wavy boundary. (7 to 23 centimeters thick)

Bw1-- 10 to 41 centimeters; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; strongly acid; clear wavy boundary.

Bw2-- 41 to 53 centimeters; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; moderately acid; few medium prominent strong brown (7.5YR 5/6) masses of iron concentration and few medium faint grayish brown (10YR 5/2) iron depletions; gradual wavy boundary.

Bw3-- 53 to 74 centimeters; dark brown (10YR 3/3) sandy loam; weak medium subangular blocky structure; friable; common medium faint grayish brown (10YR 5/2) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; common fine roots; moderately acid; clear wavy boundary. (Combined thickness of the Bw horizons is 36 to 94 centimeters.)

C1-- 74 to 89 centimeters; brown (10YR 4/3) sand; single grain; loose; few fine roots; common medium faint grayish brown (10YR 5/2) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron concentration; moderately acid; clear wavy boundary.

C2-- 89 to 100 centimeters; grayish brown (2.5Y 5/2) sand; single grain; loose; 5 percent gravel; few fine faint pale brown (10YR 6/3) masses of iron concentrations; moderately acid; clear wavy

boundary.

C3-- 100 to 165 centimeters; grayish brown (10YR 5/2) gravelly sand; single grain; loose; 25 percent gravel; moderately acid.

TYPE LOCATION: Fairfield County, Connecticut; town of Easton, 800 feet northwest along Connecticut Route 58 from the intersection with Silver Hill Road, 200 feet east Route 58, and 80 feet west of the Aspetuck River; USGS Botsford topographic quadrangle, latitude 41 degrees 16 minutes 40 seconds N., longitude 73 degrees 19 minutes 32 seconds W, NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the coarse-textured substratum range from 50 to 100 centimeters. Gravel ranges from 0 to 15 percent by volume in the solum and from 0 to 40 percent in the substratum. Some pedons have up to 15 percent cobbles in the substratum. Unless limed, reaction ranges very strongly acid to slightly acid.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 4. Texture is loam, very fine sandy loam, fine sandy loam, or sandy loam. It has weak or moderate granular structure and is friable or very friable.

The Bw horizon has hue of 10YR to 5Y and value and chroma of 3 to 6. Iron depletions occur above a depth of 60 centimeters. The Bw horizon is dominantly fine sandy loam or sandy loam, but includes thin strata of loam, very fine sandy loam, or silt loam. It has granular or subangular blocky structure, or the horizon is massive. Consistence is friable or very friable.

Some pedons have thin Ab horizon strata.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6. It is typically has redoximorphic features in some subhorizon. Texture of individual layers ranges from loamy fine sand to coarse sand in the fine-earth fraction. Included in some pedons are thin loamy and/or extremely gravelly strata. Also, some pedons have a loamy C horizon layer just below the Bw horizon. The C horizon is single grain and loose in the sandy part. The loamy part is typically massive and friable or very friable. The thickness and number of subhorizons is variable and corresponds to the thickness and variability of the alluvial deposits.

COMPETING SERIES: The [Basher](#), [Iotla](#), [Issue](#), and [Philo](#) series are currently in the same family. Iotla and Issue series are from outside LRRs L, R and S. Basher soils have hue of 7.5YR or redder in the B horizon. Philo soils formed in alluvium derived from sandstone and shale. Iotla soils have redoximorphic features in the upper part of the B horizon. Issue soils are somewhat poorly drained. Iotla and Issue soils also have mean summer temperatures more than 3 degrees Celsius warmer than Pootatuck soils.

GEOGRAPHIC SETTING: Pootatuck soils are nearly level soils on floodplains and along rivers and streams. Slope ranges from 0 to 3 percent. The soils formed in recent alluvium derived mostly from granite, gneiss, and schist. Mean annual temperature ranges from 7 to 13 degrees Celsius, mean annual precipitation ranges from 890 to 1270 millimeters, but the range includes as low as 660 millimeters in some places east of Adirondack Mountains in the Champlain Valley

of New York. The growing season ranges from 115 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Ellington](#), [Ninigret](#), [Occum](#), [Rippowam](#), [Tisbury](#), and [Winooski](#) soils and the [Agawam](#), [Enfield](#), [Hadley](#), [Haven](#), [Hinckley](#), [Lim](#), [Limerick](#), [Merrimac](#), [Saco](#), [Suncook](#), and [Windsor](#) soils on nearby landscapes. The well drained Occum and the poorly drained Rippowam soils are associated in a drainage sequence. Agawam, Enfield, Haven, Hinckley, Merrimac, and Windsor soils are better drained and are on nearby outwash terraces. Hadley, Lim, Limerick, and Saco soils are silty floodplain associates. Suncook soils are sandy, excessively drained soils on floodplains.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. Surface runoff is slow. Saturated hydraulic conductivity moderately is moderately high or high in the loamy upper layers and high or very high in the sandy substratum. Most areas of these soils flood for short periods each year. Soils on higher positions flood occasionally.

USE AND VEGETATION: Cleared areas are used for cultivated crops, hay, or pasture. Common trees in wooded areas are white pine, white, yellow, and gray birch, red maple, elm, alder, and hemlock.

DISTRIBUTION AND EXTENT: Floodplains in Connecticut, Massachusetts, New Hampshire, eastern New York, Rhode Island, and Vermont; MLRAs 142, 144A and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Fairfield County, Connecticut, 1979.

REMARKS: Cation exchange activity class placement determined from a review of limited lab data and similar or associated soils.

Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon - the zone from 0 to 10 centimeters (A horizon).
2. Cambic horizon - the zone from 10 to 74 centimeters (Bw horizons).
3. Fluvaquentic subgroup - irregular decrease in organic carbon with depth and organic carbon is greater than 0.2 percent within 1.25 meters; aquic conditions and low chroma redoximorphic depletions with chroma 2 or less are within a depth of 60 centimeters from the surface.
4. Particle-size class - averages coarse-loamy in the control section from 25 to 100 centimeters.

National Cooperative Soil Survey
U.S.A.

LOCATION RIPPOWAM
Established Series
Rev. MFF-RAS-SMF
05/2005

CT +MA NH NY RI VT

RIPPOWAM SERIES

The Rippowam series consists of very deep, poorly drained loamy soils formed in alluvial sediments. They are nearly level soils on flood plains subject to frequent flooding. Slope ranges from 0 to 3 percent. Saturated hydraulic conductivity ranges from moderately high or high in the loamy upper part and high or very high in the underlying sandy materials. Mean annual temperature is about 50 degrees F., and mean annual precipitation is about 47 inches.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, nonacid, mesic Fluvaquentic Endoaquepts

TYPICAL PEDON: Rippowam fine sandy loam in woodland at an elevation of about 435 feet. (Colors are for moist soil.)

A--0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary. (3 to 9 inches thick)

Bg1--5 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear wavy boundary.

Bg2--12 to 19 inches; dark gray (10YR 4/1) fine sandy loam; weak medium subangular blocky structure; friable; few fine and medium roots; many medium prominent yellowish red (5YR 4/6) masses of iron accumulation; strongly acid; clear wavy boundary. (Combined thickness of the Bg horizons is 6 to 27 inches.)

BCg1--19 to 24 inches; grayish brown (10YR 5/2) sandy loam; massive; friable; few fine and medium roots; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

BCg2--24 to 27 inches; very dark gray (10YR 3/1) sandy loam; massive; friable; few fine and medium roots; moderately acid; clear wavy boundary. (Combined thickness of the BCg horizons is 0 to 8 inches.)

Cg1--27 to 31 inches; dark gray (10YR 4/1) loamy sand; single grain; loose; moderately acid; clear wavy boundary.

Cg2--31 to 65 inches; grayish brown (10YR 5/2) very gravelly sand; single grain; loose; 35 percent gravel; moderately acid.

TYPE LOCATION: Fairfield County, Connecticut; town of Redding, 100 feet south of Cross Highway and 100 feet east of Little River. USGS Botsford Quadrangle; latitude 41 degrees 18 minutes 32 seconds N. and longitude 73 degrees 21 minutes 57 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 40 inches. The difference between mean summer soil temperature and mean winter soil temperature is at least 25 degrees F. or more. Depth to the coarse-textured substratum layers commonly is from 20 to 40 inches but can range to a depth of 45 inches. Gravel ranges from 0 to 15 percent by volume in the solum and from 0 to 40 percent in the sandy substratum. Some pedons have up to 10 percent cobbles in the coarse-textured substratum. Reaction ranges from very strongly acid to neutral with some subhorizon being moderately acid, slightly acid, or neutral within a depth of 40 inches.

Some pedons have an O horizon that is highly decomposed, moderately decomposed, or slightly decomposed plant material. It has hue of 5YR to 10YR and value and chroma of 3 or less.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. Texture is very fine sandy loam, fine sandy loam, or sandy loam. It typically has weak or moderate granular structure but some pedons have subangular blocky structure. Consistence is friable or very friable.

The Bg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2 and typically has redoximorphic features. Texture of the Bg horizon is dominantly fine sandy loam or sandy loam. The Bg horizon is massive or has weak granular or subangular blocky structure. Consistence is friable or very friable.

The BCg horizon, where present, has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 or 4 and typically has redoximorphic features. Texture of the BCg horizon is dominantly fine sandy loam or sandy loam. The BCg horizon is massive or has weak granular or subangular blocky structure. Consistence is friable or very friable.

Included in some pedons are thin Ab horizons with characteristics similar to the A horizon.

The C horizon or layer has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. Texture ranges from loamy fine sand to coarse sand in the fine-earth fraction. The C horizon is typically single grain and loose. Some pedons have thin loamy strata and/or extremely gravelly strata in the lower part of the C horizon.

COMPETING SERIES: There are no soils currently in the same family. [Briscot](#), [Holderton](#), and [Lim](#) soils are in related families. Briscot soils are from outside LRR R.

[Briscot](#) soils are dominantly fine sandy loam or finer to a 60-inch depth and the difference between mean summer soil temperature and mean winter soil temperature is less than 25 degrees

F. [Holderton](#) soils have an active cation exchange activity class and have textures finer than loamy fine sand in the substratum. [Lim](#) soils have a texture to a depth of at least 18 inches that is commonly silt loam or very fine sandy loam but includes loam with more than 65 percent silt plus very fine sand.

GEOGRAPHIC SETTING: Rippowam soils are nearly level soils on flood plains along rivers and streams. They are in low areas. Slope ranges from 0 to 3 percent. The soils formed in recent alluvium derived mostly from granite, gneiss, and schist. Mean annual temperature ranges from 45 to 54 degrees F., mean annual precipitation ranges from 35 to 50 inches, and the growing season ranges from 115 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Agawam](#), [Enfield](#), [Hadley](#), [Haven](#), [Hinckley](#), [Lim](#), [Limerick](#), [Merrimac](#), [Ninigret](#), [Occum](#), [Pootatuck](#), [Saco](#), [Suncook](#), [Tisbury](#), [Windsor](#), and [Winooski](#) soils on nearby landscapes. The well drained Occum and the moderately well drained Pootatuck soils are associated in a drainage sequence. Agawam, Haven, Enfield, Hinckley, Merrimac, Ninigret, Tisbury, and Windsor soils are better drained soils on outwash terraces. Hadley soils are well drained silty floodplain associates. Suncook soils are excessively drained sandy soils on floodplains.

DRAINAGE AND PERMEABILITY: Poorly drained. Surface runoff is negligible to low. Saturated hydraulic conductivity ranges from moderately high or high in the loamy upper part and high or very high in the underlying sandy materials. These soils typically flood in the spring of each year. Rippowam soils have a water table at or near the surface much of this year.

USE AND VEGETATION: Most areas are in brushy woodland. Common trees are red maple, willow, and alder. A few areas are cleared and used for pasture or hay.

DISTRIBUTION AND EXTENT: Floodplains in Connecticut, Massachusetts, New Hampshire, eastern New York, Rhode Island, and Vermont; MLRAs 142, 144A, 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Fairfield County, Connecticut, 1979.

REMARKS: This revision reflects conformance to a change in soil taxonomy based on a revision to the definition of the cambic horizon made in 1999. Cation exchange activity class placement determined from a review of limited lab data and similar or associated soils.

Diagnostic horizons and features recognized in this pedon are:

1. Ochric epipedon - the zone from 0 to 5 inches (A horizon).
2. Cambic horizon - the zone from 5 to 27 inches (Bg1, Bg2, BCg1, and BCg2 horizons). Evidence of alteration is in the form of description of subangular blocky structure and inferred

absence of rock structure to a depth of 27 inches.

3. Particle-size class - averages coarse-loamy in the control section from 10 to 40 inches.

National Cooperative Soil Survey

U.S.A.

LOCATION SACO
Established Series
Rev. MFF-SMF
05/1999

CT+MA NH NY VT

SACO SERIES

The Saco series consists of very deep, very poorly drained soils formed in silty alluvial deposits. They are nearly level soils on flood plains, subject to frequent flooding. Slope ranges from 0 to 2 percent. Permeability is moderate in the silty layers and rapid or very rapid in the underlying sandy materials. Mean annual temperature is about 50 degrees F. and mean annual precipitation is about 47 inches.

TAXONOMIC CLASS: Coarse-silty, mixed, active, nonacid, mesic Fluvaquentic Humaquepts

TYPICAL PEDON: Saco silt loam - grass field. (Colors are for moist soil unless otherwise noted.)

A--0 to 12 inches; very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) dry; weak coarse granular structure; very friable; many fine roots; moderately acid; clear wavy boundary. (10 to 15 inches thick)

Cg1--12 to 32 inches; gray (10YR 5/1) silt loam; massive; friable; few fine roots; common medium faint light brownish gray (10YR 6/2) iron depletions and common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid; clear wavy boundary.

Cg2--32 to 48 inches; gray (5Y 5/1) silt loam with thin strata of very dark gray (10YR 3/1) silt loam; massive; friable; moderately acid; clear wavy boundary. (Combined thickness of the silty C horizon layers is 30 to 50 inches)

2Cg3--48 to 60 inches; gray (10YR 6/1 and 5/1) stratified coarse sand and medium sand; single grain; loose; moderately acid.

TYPE LOCATION: Hartford County, Connecticut; town of South Windsor, 1200 feet west along Newbury Road from the intersection with Ter Street and 270 feet south of Newbury Road. USGS Manchester quadrangle; latitude 41 degrees 49 minutes 49 seconds N., Longitude 72 degrees 37 minutes 23 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Depth to the coarse-textured substratum layers is more than 40 inches. Gravel ranges from 0 to 5 percent to 40 inches and from 0 to 40 percent below. The soil is strongly acid to neutral to a depth of about 30 inches and moderately acid to neutral below.

Some pedons have O horizons up to 5 inches thick.

The A or Ap horizon has hue of 7.5YR through 2.5Y, value of 2 or 3 and chroma of 1 through 3. Texture is silt loam, mucky silt loam, very fine sandy loam or mucky very fine sandy loam. It has weak granular structure or the horizon is massive. Consistence is friable or very friable.

Individual layers of the C horizon are neutral or have hue of 10YR through 5Y, value of 3 through 6 and chroma of 0 through 2. Layers within a 30 inch depth commonly have value of 5 or 6 and chroma of 1 or 2 and have redoximorphic features. Included in some pedons are thin, Ab horizon strata. Texture of the C horizon to a depth of 40 inches or more is silt loam or very fine sandy loam. Below 40 inches texture ranges to include loamy fine sand through very gravelly coarse sand. Some pedons have subhorizons with texture of fine sandy loam. The upper silty layers are massive or have weak structure. Consistence is friable or very friable. The underlying sandy layers are single grain and loose. The thickness and number of horizons below the A horizon is variable and corresponds to the thickness and variability of the alluvial deposits.

COMPETING SERIES: There are no other series currently in the same family.

The [Birdsall](#), [Mansfield](#), [Rippowam](#), [Wayland](#) and [Whitman](#) soils are similar soils in related families.

[Birdsall](#), [Mansfield](#) and [Whitman](#) soils have a regular decrease in organic-carbon with depth. In addition, Mansfield and Whitman soils are coarse-loamy. [Wayland](#) soils have a dark A horizon less than 10 inches thick and are fine-silty. [Rippowam](#) soils are coarse-loamy and poorly drained.

GEOGRAPHIC SETTING: Saco soils are nearly level soils on flood plains, along rivers and streams. They are in depressed areas. Slope ranges from 0 to 2 percent. The soils formed in recent silty alluvium derived mostly from granite, gneiss, schist, shale and sandstone. Mean annual temperature is 45 to 54 degrees F., mean annual precipitation is 32 to 50 inches and the growing season is 120 to 195 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Agawam](#), [Bash](#), [Enfield](#), [Hadley](#), [Haven](#), [Hinckley](#), [Limerick](#), [Merrimac](#), [Ninigret](#), [Occum](#), [Pootatuck](#), [Rippowam](#), [Suncook](#), [Tisbury](#), [Windsor](#) and [Winooski](#) soils on nearby landscapes. The well drained Hadley, moderately well drained Winooski and poorly drained Limerick soils are associated in a drainage sequence. Agawam, Enfield, Haven, Hinckley, Merrimac, Ninigret, Tisbury, and Windsor soils are better drained soils on nearby outwash terraces. Bash, Occum, Pootatuck and Suncook soils are coarser textured flood plain associates.

DRAINAGE AND PERMEABILITY: Very poorly drained. Surface runoff is slow or very slow. In places water is ponded on the surface from late fall through early spring. Permeability is moderate in the silty layers and rapid or very rapid in the underlying sandy materials. These soils flood in the spring and after periods of heavy rainfall.

USE AND VEGETATION: Most areas are in brushy woodland. Common trees are red maple, elm, willow, pin oak, and alder. Fir and spruce are common in the northern areas. A few areas are in low quality pasture.

DISTRIBUTION AND EXTENT: Floodplains in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and eastern New York; MLRAs 101, 142, 144A, and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Cumberland County, Maine, 1915.

REMARKS: This revision reflects change in soil taxonomy and general updating. Cation exchange activity class placement determined from a review of limited lab data and similar or associated soils. Saco soils were previously used in Maine but soil temperature studies have resulted in the mesic soil temperature regime not being used currently.

Diagnostic horizons and features recognized in this pedon are:

1. Umbric epipedon - the zone from 0 to 12 inches (A);
2. Fluvaquentic subgroup - an irregular decrease in organic-carbon content between a depth of 25 cm. and 125 cm. and slope less than 25 percent;
3. Particle size class - averages coarse-silty in the control section 10 to 40 inches.

National Cooperative Soil Survey
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SCARBORO SERIES

The Scarboro series consists of very deep, very poorly drained soils in sandy glaciofluvial deposits on outwash plains, deltas, and terraces. They are nearly level soils in depressions. Slope ranges from 0 through 3 percent. Saturated hydraulic conductivity is high or very high. Mean annual temperature is about 49 degrees F. (9 degrees C.) and the mean annual precipitation is about 44 inches (1118 millimeters).

TAXONOMIC CLASS: Sandy, mixed, mesic Histic Humaquepts

TYPICAL PEDON: Scarboro mucky fine sandy loam woodland; in an area of Scarboro mucky fine sandy loam at an elevation of about 212 meters. (Colors are for moist soil.)

Oi-- 0 to 1 inch (0 to 3 centimeters); slightly decomposed maple leaves and other plant material

Oa-- 1 to 8 inches (3 to 20 centimeters); dark brown (10YR3/3) mucky peat; thin platy structure; friable; common fine roots; very strongly acid; abrupt wavy boundary. (Combined thickness of Oi, Oe, and Oa horizons is 8 to 13 inches (20 to 33 centimeters).)

A-- 8 to 14 inches (20 to 36 centimeters); black (N 2/0) mucky fine sandy loam; weak medium granular structure; friable; common fine roots; very strongly acid; abrupt smooth boundary. (0 to 14 inches (0 to 36 centimeters) thick.)

Cg1-- 14 to 19 inches (36 to 48 centimeters); grayish brown (2.5Y 5/2) loamy sand; massive; friable; many fine roots; very strongly acid; abrupt irregular boundary.

Cg2-- 19 to 22 inches (48 to 56 centimeters); grayish brown (2.5Y 5/2) sand; massive; friable; few fine roots; 10 percent rock fragments; common medium prominent dark brown (7.5YR 3/2) areas of iron depletion and common medium prominent yellowish red (5YR 4/6) masses of iron; very strongly acid; clear wavy boundary.

Cg3-- 22 to 65 inches (56 to 165 centimeters); grayish brown (2.5Y 5/2) gravelly sand; single grain; loose; 15 percent rock fragments; strongly acid.

TYPE LOCATION: 60 feet north of Electric Avenue near the south edge of Forest Hill Cemetery in the City of Fitchburg, Massachusetts. USGS Fitchburg, MA topographic quadrangle, Latitude 42 degrees, 34 minutes, 0.3 seconds N., and Longitude 71 degrees, 48 minutes, 33.3 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Stones range from 0 through 5 percent by volume in the A horizon and upper part of the C horizon and are absent in the lower part of the C horizon. Cobbles range from 0 through 10 percent in the A horizon, 0 through 5 percent in the upper part of the C horizon, and are absent in the lower part of the C horizon. Gravel ranges from 0 through 10 percent by volume in the A horizon, 0 through 20 percent in the upper part of the C horizon to a depth of 30 inches (76 centimeters), and 0 through 50 percent in the C horizon below a depth of 30 inches (76 centimeters). Reaction ranges from very strongly acid through moderately acid in the A horizon and upper part of the C horizon, and from very strongly acid through neutral in the lower part of the C horizon.

The O horizon is commonly mucky peat or muck, but the range includes thin layers of peat at the surface. The O horizon is neutral or has hue 5YR through 10YR, value of 2 or 3, and chroma of 0 through 3.

The A horizon where present is neutral or has hue of 5YR through 2.5Y, value of 2 through 3, and chroma of 0 through 2. It is fine sandy loam, sandy loam, loamy fine sand, loamy sand, fine sand, sand or their mucky analogues in the fine-earth fraction. This horizon commonly is 5 through 14 inches (13 through 36 centimeters) thick, but in some places may be less than 5 inches (13 centimeters) thick or absent.

The upper part of the Cg horizon is neutral or has hue of 10YR through 5Y, value of 3 through 7, and chroma of 0 through 3. Some pedons have few or common fine through coarse redoximorphic features. Texture is fine sandy loam, sandy loam, loamy fine sand, loamy coarse sand, loamy sand, fine sand, or sand in the fine-earth fraction.

The lower part of the C horizon is neutral or has hue of 10YR through 5Y or 5GY, value of 3 through 6, and chroma of 0 through 4. Redoximorphic features range from none through many and are fine through coarse. Texture is loamy fine sand, loamy sand, fine sand, sand, loamy coarse sand, or coarse sand in the fine-earth fraction. The C horizon is structureless and loose, very friable, or friable. It is often stratified.

COMPETING SERIES: These are the [Ackerman](#) and [Antung](#) series. These soils are from outside LRR R and S. Ackerman soils are more alkaline in the organic horizons and the upper part of the C horizon. They also contain coprogenous material. Antung soils are more alkaline and effervesce in the C horizon.

GEOGRAPHIC SETTING: Scarboro soils are in level or nearly level depressions on outwash plains, deltas, and terraces. Slope is less than 3 percent. The soils formed in sandy glaciofluvial deposits. Mean annual temperature ranges from 46 through 57 degrees F. (8 through 14 degrees C.) and mean annual precipitation ranges from 38 through 55 inches (965 through 1397 millimeters).

GEOGRAPHICALLY ASSOCIATED SOILS: The excessively drained [Hinckley](#), [Windsor](#) and [Penwood](#) soils, somewhat excessively drained [Merrimac](#) soils, moderately well drained [Sudbury](#) and [Deerfield](#) soils, poorly drained Mashpee(T) and Massasoit(T) soils, somewhat poorly and poorly drained [Walpole](#) and [Wareham](#) soils are on higher positions on associated

glaciofluvial landforms. The poorly drained [Rippowam](#) soils and very poorly drained [Saco](#) soils are on nearby flood plains. The very poorly drained [Rainberry](#) soils lack a Histic epipedon and have Spodic horizons.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Very poorly drained. Saturated hydraulic conductivity is high or very high. Surface runoff is high or very high. The water table is at or near the surface for 6 to 12 months of the year, and many areas are ponded for short periods.

USE AND VEGETATION: Shrub and brush land or woodland. Common shrubs are speckled alder, smooth alder, rhoda azalea, steeplebush spirea, leatherleaf, labrador-tea, winterberry, highbush blueberry, large cranberry, black huckleberry, poison sumac, and sheep laurel. Common trees are red maple, slippery elm, Atlantic white cedar, tamarack, eastern white pine, willow, and gray birch.

DISTRIBUTION AND EXTENT: Glaciofluvial landforms in Connecticut, Massachusetts, New Hampshire, Rhode Island, eastern New York, and Vermont. MLRAs 142, 144A, 145, and 149B. Scarboro soils are extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Cumberland County, Maine; 1915.

REMARKS: 1. Geographical location (latitude and longitude) determined from the published soil survey.

2. The use of the Scarboro series in Maine, and in MLRA 144B, is relict to before temperature classes. These have been removed from the SC file.

Diagnostic horizons and features recognized in this pedon are:

1. Histic epipedon - the zone from the soil surface to a depth of 8 inches (20 centimeters), (Oi and Oa horizons).
2. Thickness of organic soil materials is 8 inches (20 centimeters).
3. Aquic conditions - Histic epipedon or the zone from 19 to 22 inches (48 to 56 centimeters) has 50 percent or more 2 chroma with redox concentrations (Cg2 horizon).

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. JDV-WEH-DAS
03/2013

SCIO SERIES

The Scio series consists of very deep, moderately well drained soils formed in eolian, lacustrine, or alluvial sediments dominated by silt and very fine sand. They are on terraces, old alluvial fans, lake plains, outwash plains and lakebeds. Saturated hydraulic conductivity is moderately high or high to a depth of 100 centimeters and ranges from moderately low through very high below 100 centimeters. Slope ranges from 0 through 25 percent. Mean annual temperature is 9 degrees C., and mean annual precipitation is 940 millimeters.

TAXONOMIC CLASS: Coarse-silty, mixed, active, mesic Aquic Dystrudepts

TYPICAL PEDON: Scio silt loam, on a 2 percent slope in a pasture. (Colors are for moist soil.)

Ap -- 0 to 23 centimeters; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; many fine roots; moderately acid; limed; abrupt smooth boundary. (10 to 33 centimeters thick.)

Bw1 -- 23 to 48 centimeters; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; common medium and fine pores; strongly acid; clear wavy boundary.

Bw2 -- 48 to 79 centimeters; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; common medium and fine pores; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation and light brownish gray (10YR 6/2) areas of iron depletion in the matrix; strongly acid; clear smooth boundary. (Combined thickness of the Bw horizon is 38 to 135 centimeters.)

C -- 79 to 102 centimeters; brown (10YR 5/3) silt loam; very weak thick plate like divisions; friable; common medium and fine pores; many medium prominent yellowish brown (10YR 5/8) masses of iron accumulation and distinct gray (10YR 6/1) areas of iron depletion in the matrix; 3 percent rock fragments; strongly acid; abrupt smooth boundary. (20 to 102 centimeters thick.)

2Cg -- 102 to 183 centimeters; grayish brown (2.5Y 5/2) very gravelly loamy sand; single grain; loose; common medium prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; 35 percent gravel; moderately acid.

TYPE LOCATION: Wyoming County, New York; town of Pike, 2 miles north of village of Pike on west side of Campbell Road, 0.7 mile north of junction of Campbell Road and Safford

Road. USGS Pike, NY topographic quadrangle; Latitude 42 degrees, 35 minutes, 17 seconds N. and Longitude 78 degrees, 09 minutes, 26 seconds W., NAD 1927.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 50 through 168 centimeters. Depth to material contrasting with solum texture is 100 centimeters or more. Depth to bedrock is greater than 1.5 meters. Depth to free carbonates is greater than 2 meters. Rock fragments, mainly gravel and cobbles, range from 0 through 5 percent above 100 centimeters and from 0 through 60 percent below 100 centimeters. Stones cover 0 through 10 percent of the surface in some areas.

Some pedons have an O horizon.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 through 5, and chroma of 2 or 3. It is silt loam, very fine sandy loam, or fine sandy loam. Undisturbed pedons have an A horizon with colors similar to the Ap, but also include value of 2. They are 2 through 5 inches thick. Reaction ranges from extremely acid through strongly acid, unless limed.

The B horizon has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 3 through 6. Redox depletions and accumulations are within a depth of 24 inches (61 centimeters). It is silt loam or very fine sandy loam. Reaction ranges from extremely acid through strongly acid to a depth of 76 centimeters and very strongly through moderately acid below 76 centimeters. Some pedons have a BC horizon.

The C horizon has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 1 through 6. Texture is silt loam to fine sandy loam. It may contain strata of gravel and sand. It is massive or single grain, and may have plate-like divisions. Reaction ranges from very strongly acid through slightly alkaline.

The 2C horizon, if present, has hue of 7.5YR through 5Y, value of 3 through 6, and chroma of 1 through 4. It is silt loam, very fine sandy loam, or loamy very fine sand in the fine earth fraction. In addition, below a depth of 40 inches (100 centimeters) it can range from fine sandy loam through very gravelly sand. Reaction ranges from very strongly acid through slightly alkaline.

COMPETING SERIES: The [Dartmouth](#) series is the only other series in the same family. Dartmouth soils have a gravel content of 0 through 5 percent throughout, and have below a depth of 40 inches (100 centimeters) textures limited to silt, silt loam, very fine sandy loam, or loamy very fine sand and saturated hydraulic conductivity ranges from moderately low through moderately high.

GEOGRAPHIC SETTING: Scio soils are most commonly on terraces or old alluvial fans, but are also on lake plains, outwash plains, lakebeds, and lacustrine mantled uplands. The solum is formed entirely in eolian, lacustrine, or alluvial sediments which may extend to a depth of many centimeters or may be underlain by loamy, sandy, or gravelly material at depths greater than 40 inches (100 centimeters). Slope ranges from 0 through 25 percent. Mean annual temperature ranges from 8 through 10 degrees C., mean annual precipitation ranges from 710 through 1270 millimeters, and mean annual frost-free days ranges from 120 through 180 days. Elevation

ranges from 31 through 457 meters above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: The Scio series is in a drainage sequence with the well drained [Unadilla](#) soils, the well drained and moderately well drained [Bridgehampton](#) soils, the poorly drained [Raynham](#) soils, and the very poorly drained [Birdsall](#) soils. [Pope](#), [Tioga](#), and [Hadley](#) soils, and their wetter associated soils are on adjacent floodplains. [Alton](#), [Chenango](#), [Copake](#), and [Howard](#) soils, and their wetter associated soils are on adjacent gravelly outwash terraces, kames, and outwash plains.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. The potential for surface runoff is very low to high. Saturated hydraulic conductivity is moderately high or high to a depth of 100 centimeters and ranges from moderately low through very high below 40 inches 100 centimeters.

USE AND VEGETATION: Most of the soil has been cleared and is used for growing hay, corn, vegetables, fruit, and small grain. Native vegetation is northern red oak, white ash, sugar maple, black cherry, eastern hemlock, and eastern white pine.

DISTRIBUTION AND EXTENT: Massachusetts, Maine, New Hampshire, New York, Pennsylvania, and Rhode Island. MLRAs 101, 139, 140, 143, 144A, 144B, 145, and 149B. The series is moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Allegany County, New York, 1946.

REMARKS: This revision reflects changes to the range in characteristics as well as general updating to metric units. Scio soils have been mapped in frigid areas in the past, but have a Mesic temperature regime. The series will not be used in MLRAs 143 and 144B, or the state of Maine, when older soil surveys in these MLRAs are updated.

Diagnostic horizons and features recognized in this pedon are:

- 1) Ochric epipedon - the zone from 0 to 23 centimeters (Ap horizon).
- 2) Cambic horizon - the zone from 23 to 79 centimeters (Bw horizons).
- 3) Aquic subgroup - Redox depletions with chroma of 2 or less are within 60 centimeters of the mineral soil surface (Bw2 horizon).
- 4) Particle-size control section - the zone from 23 through 100 centimeters (Bw1, Bw2, C horizons).
- 5) Lithologic discontinuity - at a depth of 102 centimeters.

ADDITIONAL DATA: Full characterization data for sample no.91MA023009. Pedon analyzed by the NSSL, Lincoln, NE.

National Cooperative Soil Survey
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Established Series
Rev. MFF-SMF-DCP
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SUNCOOK SERIES

The Suncook series consists of very deep, excessively drained sandy soils formed in alluvial sediments. They are nearly level soils on flood plains, subject to frequent or occasional flooding. Slope ranges from 0 to 3 percent. Saturated hydraulic conductivity is high or very high in the surface layer and underlying strata. Mean annual temperature is about 10 degrees Celsius, and mean annual precipitation is about 1090 millimeters.

TAXONOMIC CLASS: Mixed, mesic Typic Udipsamments

TYPICAL PEDON: Suncook loamy fine sand in a woodland at an elevation of about 60 meters. (Colors are for moist soil.)

Ap-- 0 to 18 centimeters; very dark grayish brown (10YR 3/2) loamy fine sand; very weak coarse granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary. (15 to 25 centimeters thick)

C1-- 18 to 38 centimeters; dark grayish brown (10YR 4/2) and brown (10YR 5/3) coarse sand; single grain; loose; few fine roots; 2 percent fine gravel; strongly acid; abrupt smooth boundary.

C2-- 38 to 56 centimeters; dark brown (10YR 3/3) loamy fine sand with lenses of coarse sand; single grain; loose; few fine roots; strongly acid; abrupt smooth boundary.

C3-- 56 to 81 centimeters; pale brown (10YR 6/3) medium and coarse sand; single grain; loose; strongly acid; abrupt smooth boundary.

C4-- 81 to 107 centimeters; dark grayish brown (10YR 4/2) fine and medium sand; single grain; loose; strongly acid; abrupt smooth boundary.

C5-- 107 to 165 centimeters; dark grayish brown (10YR 4/2) stratified sand; single grain; loose; 10 percent gravel; strongly acid. (Combined thickness of the C horizons is 140 to 150 cm within a depth of 165 cm).

TYPE LOCATION: Hartford County, Connecticut; Town of Granby, 1000 feet east along Mechanicsville Road from the intersection with Connecticut Route 189, 1200 feet north of Mechanicsville Road, and 50 feet east of the East Branch Salmon Brook; USGS Tariffville topographic quadrangle, latitude 41 degrees 58 minutes 26 seconds N., longitude 72 degrees 48 minutes 12 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Most pedons are essentially gravel free, but the range includes as much as 10 percent gravel by volume to a 50 centimeter-depth, up to 20 percent gravel from 50 to 100 centimeters, and as much as 40 percent below a depth of 100 centimeters. Unless limed, reaction ranges from very strongly acid to slightly acid.

The Ap or A horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 to 3. Texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. The horizon commonly has weak or moderate granular structure or it is single grain. Some pedons have subangular blocky structure. Consistence is friable, very friable or loose. A horizons may be less than 15 centimeters thick in some places.

Individual layers of the C horizon have hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 6. Texture ranges from loamy fine sand to coarse sand in the fine-earth fraction. Some pedons have thin buried sandy A horizons that are very dark grayish brown to black.

COMPETING SERIES: These are the [Acquango](#), [Aldo](#), [Bigapple](#), [Biltmore](#), [Boplain](#), [Breeze](#), [Caesar](#), [Chute](#), [Dabney](#), [Gardiner](#), [Hodge](#), [Oakville](#), [Osolo](#), [Pahuk](#), [Penwood](#), [Perks](#), [Pinegrove](#), [Plainfield](#), [Poquonock](#), [Ronda](#), [Samoa](#), [Sardak](#), [Sarpy](#), [Scotah](#), [Spessard](#), [Tyner](#), [Wapanucket](#), and [Windsor](#) soils.

[Acquango](#), [Biltmore](#), [Gardiner](#), [Pahuk](#), [Samoa](#), [Sardak](#), and [Sarpy](#) soils are from outside LRR R and S. [Acquango](#) soils are very slightly to moderately saline. [Aldo](#) soils have a water table and saturation within the series control section for as much as 1 month per year in 6 or more out of 10 years. [Bigapple](#) and [Breeze](#) soils formed in anthrotransported materials. [Biltmore](#) and [Spessard](#) soils are well drained. [Boplain](#) soils have a paralithic contact within the control section. [Caesar](#), [Oakville](#), [Penwood](#), [Plainfield](#), [Tyner](#), and [Windsor](#) soils have B horizons. [Chute](#), [Hodge](#), and [Sarpy](#) soils are neutral to moderately alkaline throughout. [Dabney](#) and [Westport](#) soils receive more than 1500 centimeters of precipitation. [Osolo](#) soils have sola thicker than 150 centimeters. [Pahuk](#) soils formed in old alluvium and outwash and are not subject to flooding. [Perks](#) soils have high chroma mottles within a depth of 100 centimeters. [Pinegrove](#) soils formed in acid regolith from surface mine operations. [Poquonock](#) soils have densic horizons within 100 centimeters. [Samoa](#) soils formed in eolian materials. [Sardak](#) soils are calcareous. [Scotah](#) soils have redoximorphic features at depths of 100 to 150 centimeters and saturation for 1 month or less per year in 6 out of 10 years. [Ronda](#) soils formed on floodplains of the mesic [Piedmont](#) region of North Carolina. [Wapanucket](#) soils formed in sandy glaciofluvial or eolian deposits underlain by loamy glaciolacustrine deposits.

GEOGRAPHIC SETTING: Suncook soils are nearly level soils on flood plains. Slope ranges from 0 to 3 percent. The soils formed in recent sandy alluvium derived mainly from granite, gneiss, schist, and quartzite. Mean annual temperature ranges from 7 to 12 degrees Celsius., mean annual precipitation ranges from 1000 to 1270 millimeters, and the growing season ranges from 120 to 180 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the the [Agawam](#), [Hadley](#), [Haven](#), [Hinckley](#), [Lim](#), [Limerick](#), [Merrimac](#), [Occum](#), [Pootatuck](#), [Rippowam](#), [Saco](#), [Windsor](#), and [Winooski](#) soils on nearby landscapes. The well drained [Occum](#), moderately well drained

Pootatuck, and poorly drained Rippowam soils are associated in a drainage sequence. Other floodplain associates include the Hadley, Winooski, Lim, Limerick, and Saco soils, all of which have higher silt content. Agawam, Haven, Hinckley, and Merrimac soils are on nearby outwash terraces and are underlain by stratified sand and gravel.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Excessively drained. Surface runoff is negligible. Saturated hydraulic conductivity is high or very high throughout. Flooding varies from once a year to once in ten years, but typically does not occur in the growing season.

USE AND VEGETATION: Most areas are wooded or in brushy unimproved pasture. Cleared areas are in hay or pasture, but a few scattered areas are in cultivated crops. Common trees are sycamore, aspen, cotton wood white and black oak, silver maple red maple, white pine, and ironwood. Understory plants include bayberry, ground cedar, lowbush blueberry, pipsissewa, and hairy moss.

DISTRIBUTION AND EXTENT: Flood plains in Connecticut, Massachusetts, New Hampshire, New York, and Rhode Island; MLRAs 140, 144A, 145, 149A, and 149B. The series is of small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: Hartford County, Connecticut, 1959.

REMARKS: This revision reflects general updating.

Diagnostic horizons and features recognized in this pedon include:

1. Ochric epipedon the zone from 0 to 18 centimeters (Ap horizon)
2. Particle-size class - the control section from 25 to 100 centimeters averages sandy (C1, C2, C3, and C4 horizons).
3. Entisols - no diagnostic horizons present.
4. Udic moisture regime and the mean summer and mean winter soil temperatures at a depth of 50 centimeters differ by 5 degrees Celsius or more.

National Cooperative Soil Survey
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Established Series
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SWANSEA SERIES

The Swansea series consists of very poorly drained organic soils. They formed in 40 to 130 centimeters of highly decomposed organic material over sandy mineral. These soils are in depressions or on flat level areas on uplands and outwash plains. Saturated hydraulic conductivity is moderately high or high in the organic material and very high in the substratum. The mean annual temperature is about 9 degrees Celsius and the mean annual precipitation is about 1143 millimeters.

TAXONOMIC CLASS: Sandy or sandy-skeletal, mixed, dysic, mesic Terric Haplosaprists

TYPICAL PEDON: Swansea muck - on a 0 percent slope in a wooded area. When described the soil was wet and the depth to the water table was 4 inches. (Colors are for moist soils.)

Oa1--0 to 5 cm.; dark reddish brown (5YR 2/2) broken face and rubbed muck (sapric material); 15 percent fiber, 2 percent rubbed; weak medium granular structure; very friable; many medium roots; less than 5 percent mineral; extremely acid; abrupt wavy boundary.

Oa2--5 to 23 cm.; black (5YR 2/1) broken face and rubbed sapric material; 10 percent fiber, 2 percent rubbed; weak medium granular structure; very friable; common medium roots; less than 5 percent mineral; extremely acid; abrupt wavy boundary.

Oa3--23 to 33 cm.; black (N 2/) broken face and rubbed sapric material; 10 percent fiber, 2 percent rubbed; massive; very friable; few fine roots; contains 5 percent brown (7.5YR 4/4) woody fragments 1 to 4 inches in diameter; less than 5 percent mineral; extremely acid; abrupt wavy boundary.

Oa4--33 to 66 cm.; black (N 2/) broken face and rubbed sapric material; 5 percent fiber, 0 percent rubbed; massive; very friable; few fine roots; less than 5 percent mineral; extremely acid; abrupt wavy boundary.

Cg1--66 to 81 cm.; light olive gray (5Y 6/2) loamy coarse sand; single grain; loose; very strongly acid; abrupt wavy boundary.

Cg2--81 to 165 cm.; light olive gray (5Y 6/2) gravelly loamy coarse sand; single grain; loose; 30 percent gravel; very strongly acid.

TYPE LOCATION: Bristol County, Massachusetts, Town of Swansea, 1,000 feet east of Old

Fall River Road, 1,000 feet south of Interstate 295, and 80 feet north of the telephone line. Latitude 41 degrees 45 minutes 57 seconds N. and longitude 71 degrees 14 minutes 49 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: The depth to the Cg horizon is 40 to 130 centimeters. Cumulative layers of hemic materials comprise less than 25 centimeters and fibric materials less than 12 centimeters of the subsurface and bottom tiers. Woody fragments are in some part of the organic material in most pedons and comprise up to 25 percent of some horizons. Fragments consist of twigs, branches, logs, or stumps and are 2 centimeters to more than 30 centimeters in diameter. Woody fragments are firm but break abruptly under pressure. Reaction is less than 4.5 in 0.01 molar calcium chloride throughout the organic material.

The surface tier has hue of 5YR through 10YR, value of 2 or 3, and chroma of 0 to 2. In some pedons the chroma ranges to 4. It is dominantly sapric material; however, in some pedons it has various proportions of both sapric and hemic materials or has fibric materials. It has weak or moderate, fine or medium, granular or subangular blocky structure or it is massive. Some pedons have a mineral surface layer of sand or coarse sand that is 10 to 25 centimeters thick.

The subsurface and bottom tiers, above the C horizon, have hue of 5YR through 10YR, value of 2 to 3, and chroma of 0 to 3. Chroma or value or both may change from 0.5 to 2 units upon rubbing. Broken faces become darker upon brief exposure to air. The subsurface tier is dominated by sapric material with a rubbed fiber content of less than 16 percent of the organic volume. The subsurface and bottom tiers have platy structure or are massive. They are very friable or friable. Unrubbed organic material resembles herbaceous and woody plant tissues.

The C or Cg horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. Redoximorphic features are present in some pedons. It ranges from coarse sand to loamy fine sand and their gravelly analogs but may include some finer-textured lenses or horizons in some pedons. Rock fragment content ranges from 0 to 45 percent and is commonly gravel but includes cobbles in some pedons. Reaction ranges from extremely acid to strongly acid.

COMPETING SERIES: This is the [Makinen](#) series which are from outside LRR R and S. The Makinen soils receive less than 813 millimeters of mean annual precipitation and have less gravel in the substratum.

[Freetown](#) and [Paupack](#) are similar soils in related families. Freetown soils have organic layers greater than 130 centimeters. Paupack soils are underlain by loamy skeletal or clayey skeletal mineral material.

GEOGRAPHIC SETTING: Swansea soils are in swamps and bogs that range from small enclosed depressions to areas of several hundred acres in size. They are on outwash plains, till plains and moraines. Slope ranges from 0 to 1 percent. Mean annual temperature is 7 to 10 degrees Celsius and mean annual precipitation is 1016 to 1270 millimeters. The frost-free period is 120 to 180 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Freetown](#), [Hinckley](#), [Windsor](#),

[Ridgebury](#), [Whitman](#), and [Scarboro](#) soils on nearby landscapes. Freetown soils are on similar landscapes and have more than 130 centimeters of organic material. The excessively drained Hinckley and Windsor soils are on nearby outwash landforms. The somewhat poorly and poorly drained Ridgebury soils and the very poorly drained Whitman and Scarboro soils formed in glacial till are adjacent to areas of Swansea soils.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Very poorly drained. Saturated Hydraulic Conductivity is moderately high or high in the organic material and very high in the substratum.

USE AND VEGETATION: Mostly forested. Native vegetation includes red maple, American elm, green ash, eastern hemlock, Atlantic white cedar, buttonbush, winterberry, swamp azalea, and leatherleaf. Some acreage has been cleared and is used for truck crops. The main crop is cranberries.

DISTRIBUTION AND EXTENT: Swamps and bogs in Massachusetts and Rhode Island; MLRAs 144A, 145, 149B. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Bristol County, Massachusetts, 1979

REMARKS: These soils were previously mapped in Massachusetts as Cranberry bog, Medisaprist, and Muck and in some areas as Adrian soils. The Type Location is pedon T1MA603018, also the typical pedon for the soil survey of Bristol County, MA, Southern Part.

Diagnostic horizons and features in this pedon include:

1. Terric feature - mineral soil from a depth of 66 to 165 centimeters (2Cg horizons).
2. Lithic discontinuity - there is a significant change in particle size at a depth of 66 centimeters (Cg1 horizon).
3. Sapric material from 0 to 66 centimeters (Oa horizons)
4. Histic epipedon from 0 to 33 centimeters
5. Aquic conditions 0 to 165 centimeters
6. Endosaturation 0 to 165 centimeters

National Cooperative Soil Survey
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Established Series
Rev. MFF-SMF-DCP
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WINDSOR SERIES

The Windsor series consists of very deep, excessively drained soils formed in sandy outwash or eolian deposits. They are nearly level through very steep soils on glaciofluvial landforms. Slope ranges from 0 through 60 percent. Saturated hydraulic conductivity is high or very high. Mean annual temperature is about 10 degrees C and mean annual precipitation is about 1092 mm.

TAXONOMIC CLASS: Mixed, mesic Typic Udipsamments

TYPICAL PEDON: Windsor loamy sand - forested, 3 percent slope, at an elevation of about 24 meters. (Colors are for moist soil.)

Oe--0 to 3 cm; black (10YR 2/1) moderately decomposed forest plant material; many very fine and fine roots; very strongly acid; abrupt smooth boundary. (0 to 8 cm thick.)

A--3 to 8 cm; very dark grayish brown (10YR 3/2) loamy sand; weak medium granular structure; very friable; many very fine and fine roots; strongly acid; abrupt wavy boundary. (3 to 25 cm thick.)

Bw1--8 to 23 cm; strong brown (7.5YR 5/6) loamy sand; very weak fine granular structure; very friable; many fine and medium roots; strongly acid; gradual wavy boundary.

Bw2--23 to 53 cm; yellowish brown (10YR 5/6) loamy sand; very weak fine granular structure; very friable; common fine and medium roots; strongly acid; gradual wavy boundary.

Bw3--53 to 64 cm; light yellowish brown (10YR 6/4) sand; single grain; loose; few coarse roots; strongly acid; clear wavy boundary. (Combined thickness of the Bw horizons is 23 to 86 cm.)

C--64 to 165 cm; pale brown (10YR 6/3) and light brownish gray (10YR 6/2) sand; single grain; loose; few coarse roots; strongly acid.

TYPE LOCATION: Hartford County, Connecticut; town of South Windsor, 1100 feet northwest along Chapel Road from the intersection of Chapel Road and Ellington Road and 100 feet due south of Chapel Road. USGS Manchester, CT topographic quadrangle, Latitude 41 degrees, 48 minutes, 35 seconds N., Longitude 72 degrees, 36 minutes, 22 seconds W., NAD 1983

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 25 to 92 cm. Rock

fragments, dominantly fine gravel, range from 0 through 10 percent by volume in the solum and from 0 to 15 percent in the substratum. Thin strata of gravel or thin subhorizons of coarse sand or loamy coarse sand are present in some pedons. Unless limed, reaction in the solum commonly is extremely acid to moderately acid, but the range includes slightly acid. Unless limed, reaction in the substratum commonly is very strongly acid to slightly acid, but the range includes neutral.

O horizons are present in some pedons.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Many pedons have an Ap horizon up to 12 inches thick with value of 3 or 4 and chroma of 2 to 4. The A or Ap horizon is loamy fine sand, loamy sand, fine sand, or sand. It has weak or moderate granular structure and is very friable, friable, or loose.

Some pedons have a thin E horizon with hue 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2.

The upper part of the Bw horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. The lower part of Bw horizon has hue of 7.5YR to 5Y, value of 4 to 7, and chroma of 3 to 6. The Bw horizon is loamy sand or loamy fine sand in the upper part and loamy fine sand, loamy sand, fine sand, or sand in the lower part. The Bw horizon has weak granular or weak subangular blocky structure, or it is massive or single grain. Consistence is very friable or loose.

Some pedons have a BC horizon similar to the lower part of the Bw horizon.

The C horizon has hue of 5YR to 5Y, value of 4 to 7, and chroma of 1 to 6. It is fine sand, sand, coarse sand, loamy fine sand, or loamy sand. The horizon is massive or single grain and consistence is very friable or loose.

COMPETING SERIES: These are the [Acquango](#), [Aldo](#), [Bigapple](#), [Biltmore](#), [Boplain](#), [Breeze](#), [Caesar](#), [Chute](#), [Dabney](#), [Hodge](#), [Oakville](#), [Osolo](#), [Pahuk](#), [Penwood](#), [Perks](#), [Pinegrove](#), [Plainfield](#), [Poquonock](#), [Ronda](#), [Samoa](#), [Sardak](#), [Sarpy](#), [Scotah](#), [Spessard](#), [Suncook](#), [Tyner](#), and [Wapanucket](#) series. Acquango, Aldo, Biltmore, Boplain, Chute, Dabney, Hodge, Osolo, Pahuk, Perks, Ronda, Samoa, Sardak, Spessard, and Tyner soils are from outside of LRRs L, R, and S. Acquango soils are very slightly to moderately saline within the soil profile. Aldo soils have a water table and saturation within the series control section for as much as one month per year in 6 out of 10 years. Bigapple soils formed in human transported soil material from dredging activities. Biltmore and Spessard soils are well drained. Breeze soils formed in human transported sandy soil materials intermingled with construction debris. Caesar soils contain more coarse sand. Chute, Hodge, and Sarpy soils contain free carbonates and do not have a B horizon. Dabney soils do not have a B horizon and receive more than 152 cm of precipitation annually. Oakville soils typically average 50 percent or more fine sand in the subsoil. Osolo soils have a solum thicker than 1.5 m. Penwood soils have hue of 5YR or redder in the B horizon. Pahuk, Perks, Samoa, and Suncook soils do not have a B horizon. Plainfield soils are less moist in all parts of the control section for the 120 days following the summer solstice. Poquonock soils have a densic contact with in 1 m. Ronda soils formed in alluvium from residuum sources. Sardak soils formed in alluvium and are calcareous. Tyner soils have a thicker solum. Wapanucket soils are underlain

by glaciolacustrine deposits with in the series control section.

GEOGRAPHIC SETTING: Windsor soils are nearly level through very steep soils typically on glaciofluvial landforms but include late-Wisconsin-aged dunes. The steeper slopes are typically on terrace escarpments. Slope ranges from 0 to 60 percent. The soils formed in outwash or eolian deposits of poorly graded sands and loamy sands derived mainly from crystalline rocks. Mean annual temperature ranges from 7 to 12 degrees C, and the mean annual precipitation typically ranges from 965 to 1270 mm, but the range includes as low as 660 mm in some places east of Adirondack Mountains in the Champlain Valley of New York. The growing season ranges from 120 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Deerfield](#), [Hinckley](#), [Merrimac](#), [Quonset](#), [Suncook](#), [Agawam](#), [Hadley](#), [Haven](#), [Occum](#), [Pootatuck](#), [Scarboro](#), [Sudbury](#), [Walpole](#), [Wareham](#), and [Winooski](#) soils on nearby landscapes. The moderately well drained Deerfield and Sudbury, the somewhat poorly drained and poorly drained Walpole and Wareham, and the very poorly drained Scarboro soils are common drainage associates. Agawam and Haven soils are coarse-loamy over sandy or sandy-skeletal or coarse-loamy terrace associates, respectively. Hadley, Occum, Pootatuck, and Winooski soils are on nearby flood plains.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Excessively drained. Surface runoff is negligible to medium. Saturated hydraulic conductivity is high or very high.

USE AND VEGETATION: Most areas are forested or in low growing brushy vegetation. Some areas are used for silage corn, hay, and pasture. Small areas, mostly irrigated, are used for shade tobacco, vegetables and nursery stock. Some areas are in community development. Common trees are white, black, and northern red oak, eastern white pine, pitch pine, gray birch, poplar, red maple, and sugar maple.

DISTRIBUTION AND EXTENT: Late Wisconsin glaciofluvial or eolian landforms in Connecticut, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont; MLRAs 101, 142, 144A, and 145. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Connecticut Valley Area, 1899.

REMARKS: The use of the Windsor series in Maine, and in MLRAs 141, 144B, and 143 is relict to before temperature classes in soil taxonomy. These have been removed from the SC file.

Diagnostic horizons and features recognized in this pedon include:

1. Ochric epipedon - the zone from 0 to 8 cm (Oe and A horizons).
2. Particle-size class - averages sandy in the control section from 25 to 100 cm.
3. No cambic horizon and development of color - the zone from 8 to 64 cm demonstrates development of color with no illuvial accumulation of material (Bw horizons).

ADDITIONAL DATA: Reference samples from pedons 54MA023005, 63VT011001, 63VT011002, 64NH017003, 64NH017004, 70CT003003, 70MA011003, 70VT017002, 73MA005003, 73MA005004, 91MA023006, 95NH013001, 96NH013004, 98NY045002, 98NY085002, S07VT011004.

National Cooperative Soil Survey
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Established Series
Rev. DGG-SMF-DCP
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WINOOSKI SERIES

The Winooski series consists of very deep, moderately well drained soils formed in alluvial material. These soils are on nearly level flood plains. Slope ranges from 0 through 3 percent. Saturated hydraulic conductivity is moderately low through high. Mean annual precipitation is about 45 inches (1143 millimeters) and the mean annual temperature is about 49 degrees F (7 degrees C).

TAXONOMIC CLASS: Coarse-silty, mixed, superactive, mesic Fluvaquentic Dystrudepts

TYPICAL PEDON: Winooski very fine sandy loam on a 1 percent slope in a cultivated field at an elevation of about 69 meters. (Colors are for moist soil unless otherwise stated.)

Ap -- 0 to 8 inches (0 to 20 centimeters); very dark grayish brown (10YR 3/2) very fine sandy loam; weak fine granular structure; very friable; many fine roots; moderately acid; abrupt smooth boundary. (4 to 18 inches (10 to 46 centimeters thick).

Bw1 -- 8 to 18 inches (20 to 46 centimeters); brown (10YR 4/3) very fine sandy loam; massive; friable; many fine roots; strongly acid; abrupt smooth boundary.

Bw2 -- 18 to 26 inches (46 to 66 centimeters); olive brown (2.5Y 4/4) very fine sandy loam, common medium prominent pinkish gray (5YR 7/2) and faint brown (10YR 5/3) areas of iron depletion; massive; friable; few fine roots; strongly acid; abrupt smooth boundary. (Combined thickness of the Bw horizons is 6 to 30 inches (15 to 76 centimeters).

BC -- 26 to 43 inches (66 to 109 centimeters); olive gray (5Y 5/2) very fine sandy loam; massive; friable; common medium faint light gray (5Y 7/2) areas of iron depletion and faint brown (10YR 5/3) masses of iron accumulation; moderately acid; clear smooth boundary. (0 to 20 inches (0 to 51 centimeters thick).

C -- 43 to 65 inches (109 to 165 centimeters); olive (5Y 5/3) loamy very fine sand; massive; friable; common medium distinct light brownish gray (10YR 6/2) iron depletions and prominent strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid.

TYPE LOCATION: Worcester County, Massachusetts, Town of Lancaster, 100 feet north of Massachusetts Route 117, 900 feet west of the Bolton town line. USGS Hudson, MA topographic quadrangle, Latitude 42 degrees, 27 minutes, 35 seconds N., Longitude 71 degrees, 39 minutes, 7 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 18 through 43 inches (46 through 110 centimeters). Gravel ranges from 0 through 5 percent by volume throughout the soil. Reaction ranges from extremely acid through neutral. Depth to iron depletions with chroma of 2 or less ranges from 14 through 20 inches (35 through 50 centimeters).

The O horizon where present ranges in thickness from 1 or 2 inches (3 through 6 centimeters). The O has hue 7.5YR, value 2.5 or 3, and chroma of 2 or 3. Decomposition of the plant material ranges from fibric through sapric.

The A or Ap horizon has hue of 7.5YR through 5Y, value of 2 through 4, and chroma of 1 through 3. Texture is silt loam, silt, very fine sandy loam, or loamy very fine sand. Structure is subangular blocky, platy, or granular. Consistence is very friable or friable.

Some pedons have Ab and/or AB horizons similar in characteristic to the A or Ap horizon.

The Bw horizon has hue of 7.5 YR through 5Y, value of 2 through 5, and chroma of 2 through 6. Matrix chroma of 2 is below a depth of 20 inches (50 centimeters). Texture is silt loam, silt or very fine sandy loam. Structure is granular or subangular blocky, or it is massive. Consistence is very friable or friable.

The BC horizon, where present, has hue of 10YR through 5Y, value of 2 through 5, and chroma of 2 through 4. Matrix chroma of 2 is below a depth of 20 inches (50 centimeters). Texture is silt loam, silt, very fine sandy loam, or loamy very fine sand. Structure is granular or subangular blocky, or it is massive. Consistence is very friable or friable.

The C horizon has hue of 10YR through 5Y, value of 3 through 6, and chroma of 2 through 4. Matrix chroma of 2 is below a depth of 20 inches (50 centimeters). Texture is silt loam, silt, very fine sandy loam, or loamy very fine sand. Some pedons have thin strata of very fine sand, fine sand, sand, or coarse sand below a depth of 40 inches (100 centimeters). The C horizon is massive or has fine stratification. Consistence is firm through very friable.

The thickness and number of horizons below the A horizon is variable and corresponds to the thickness and variability of the alluvial deposits.

COMPETING SERIES: The [Otego](#) soil is the only other soil currently in the same family. Otego soils are formed in alluvium from sandstone, siltstone, and shale. Otego soils do not allow for loamy very fine sand textures in their A, BC, or C horizons.

GEOGRAPHIC SETTING: Winooski soils are nearly level soils on flood plains. They are typically in broad depressions. Slope ranges from 0 through 3 percent. The soils formed in recent alluvial deposits of very fine sand and silt. The source of the alluvium is from igneous and meta-igneous geology, with additions of limestone and dolomite for areas in the Lake Champlain valley, and their resultant glacial materials. Mean annual precipitation ranges from 40 through 50 inches (1016 through 1270 millimeters) and mean annual air temperature from 45 degrees through 52 degrees F. (7 through 11 degrees C.). Mean annual growing season ranges from 120

through 200 days.

GEOGRAPHICALLY ASSOCIATED SOILS: Winooski soils are the moderately well drained member of a drainage sequence which includes the well drained [Hadley](#) soils, the poorly drained [Limerick](#) soils and the very poorly drained [Saco](#) soils on nearby landscapes.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. Saturated hydraulic conductivity is moderately low through high. Flooding frequency varies from twice a year to once in 10 years. Stream overflow generally occurs during late winter or spring and during periods of high rainfall.

USE AND VEGETATION: Used mainly for growing hay, silage corn and pasture in support of dairying and to some extent for truck crops, potatoes, and tobacco. Native vegetation is forest composed mainly of red maple, silver maple, elm, willow, northern hardwoods, and eastern white pine. Balsam fir and spruce are in the northerly range of the series.

DISTRIBUTION AND EXTENT: New Hampshire, Massachusetts, Connecticut, and Vermont. MLRA's 142, 144A, and 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Chittenden County, Vermont, 1938.

REMARKS: The Winooski soils mapped in Maine, and in MLRA 144B and 143, are now considered to be in the frigid temperature regime and are relict.

Diagnostic horizons and features recognized in this pedon include:

1. Ochric epipedon - the zone from the surface to a depth of about 8 inches (20 centimeters) (Ap horizon).
2. Coarse-silty particle size - less than 10 percent of the material in the 10 through 40 inch (25 through 100 centimeter) zone is fine sand or coarser, including gravel, and clay averages about 7 percent.
3. Cambic horizon the zone from 8 to 43 inches (20 to 109 centimeters) (Bw1, Bw2, and BC horizons) has evidence of alteration in the form of absence of rock structure or some degree of soil structure.
4. Aquic feature - the zone from 18 to 26 inches has redox depletions and aquic conditions at some time during the year. (Bw2 horizon)

Additional NSSL data: numerous full characterization pedons sampled in CT, MA, NH and VT

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