



GOVE ENVIRONMENTAL SERVICES, INC.

Memorandum

Date: Monday, December 07, 2020

Re: Green Meadow Golf Course, Hudson, NH
Subject: Soil Mapping

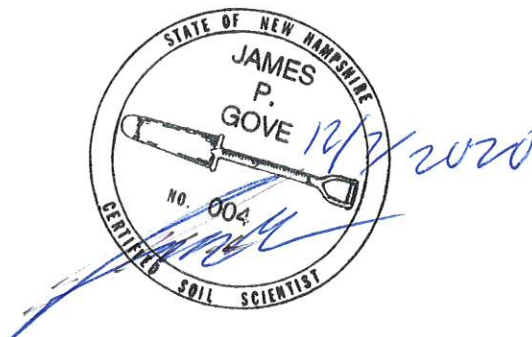
A question has been raised regarding the site-specific soil map prepared for the site. The question involves the NRCS soil map, which shows much of the site as a Windsor loamy sand. This soil would have a hydrologic group of A.

The site-specific soil map identified similar areas as Agawam fine sandy loam. This soil would have a hydrologic group of B. Soil descriptions for each of the soils are attached.

The typical profile of Windsor loamy sand is 25 inches of loamy sand over sand. The typical profile is Agawam is 26 inches of fine sandy loam over loamy fine sand and loamy sand.

Of the 12 soil profiles dug in the Agawam fine sandy loam map units, all had a fine sandy loam A horizon and B horizon. The fine sandy loam cap ranged from 21 inches to 30 inches. The soil profiles met the range in characteristics for the Agawam Series, and did not meet the range in characteristics for the Windsor Series (see attached).

For this reason, Agawam fine sandy loam was mapped over much of the site.



Hillsborough County, New Hampshire, Eastern Part

WdB—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf

Elevation: 0 to 1,210 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Farmland of local importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Deltas, outwash terraces, dunes, outwash plains

Landform position (three-dimensional): Riser, tread

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: loamy sand

Bw - 3 to 25 inches: loamy sand

C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water

(Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Kames, deltas, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Hillsborough County, New Hampshire, Eastern Part
Survey Area Data: Version 22, May 29, 2020

Hillsborough County, New Hampshire, Eastern Part

AgA—Agawam fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqw
Elevation: 0 to 1,040 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Agawam and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Agawam

Setting

Landform: Kames, kame terraces, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, riser, rise, dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 11 inches: fine sandy loam
Bw1 - 11 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C1 - 26 to 39 inches: loamy fine sand
2C2 - 39 to 55 inches: loamy fine sand
2C3 - 55 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Ninigret

Percent of map unit: 5 percent
Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Windsor

Percent of map unit: 4 percent
Landform: Deltas, outwash terraces, dunes, outwash plains
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Walpole

Percent of map unit: 3 percent
Landform: Depressions, depressions, deltas, outwash terraces,
outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Hinckley

Percent of map unit: 3 percent
Landform: Kames, deltas, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope,
crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Hillsborough County, New Hampshire, Eastern Part
Survey Area Data: Version 22, May 29, 2020

LOCATION WINDSOR

CT+MA NH NY RI VT

Established Series
Rev. MFF-SMF-DCP
03/2014

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
U.S.A.

LOCATION AGAWAM

MA+CT NH NY RI VT

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.

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