NEW YORK CITY
SOIL AND WATER
CONSERVATION DISTRICT

NEW YORK CITY

RECONNAISSANCE SOIL SURVEY

A collaborative project of:

U.S. Dept. of Agriculture, Natural Resources Conservation Service

New York City Soil and Water Conservation District

Cornell University Agricultural Experiment Station

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Major fieldwork for this soil survey was completed in 2004. Soil names and descriptions were approved in 2004. Unless otherwise indicated, statements in this publication refer to conditions in New York City in 2004. This survey was made cooperatively by the United States Department of Agriculture-Natural Resources Conservation Service, the NYC Soil and Water Conservation District, and the Cornell University Agricultural Experimental Station.

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Foreword

The National Cooperative Soil Survey in the U.S. marked its centennial in 1999. The first surveys were intended to help guide agricultural development and improve agricultural practices at a time when farmland in our country was expanding. According to U.S. Census figures, the proportion of our population in urban areas has increased from about 40 percent in 1900 to 75 percent in 1990. Suburban sprawl and loss of open space have now become pressing issues for most of our citizens. With growing public concern about the environment and health, and skyrocketing prices of real estate, land use decisions based on sound soils information are even more critical. A key element in the mission of the Soil Survey program is to keep the survey relevant to ever-changing needs.

New York City was selected as a pilot project for both the NRCS and the Department of Agriculture Urban Initiatives. Community leaders, non-profit organizations, city agencies, and elected officials identified local needs, issues and concerns for NRCS to address. The agency and its partners overwhelmingly agreed that a comprehensive urban soil survey was needed, one that addressed the unique characteristics of urban soils as well as the specialized needs of urban customers.

The New York City Reconnaissance Soil Survey provides a general guide to soil patterns across the city and serves as the foundation for our more detailed, high intensity surveys. It is a key component of the comprehensive urban soil survey, an important element in the assessment of the city's environmental quality, and a source of useful information for making broad-based land use decisions. Even in an area this densely populated, site suitability for redevelopment, restoration, and remediation is still an everyday concern. An inventory of the soil properties of New York City's open space can help identify wetlands and wildlife habitat, and assist in the management of the 28,000 acres of parks. Understanding the soils, drainage, runoff, and stream flow in the urban environment is necessary for long-term improvements in water quality.

Soils perform essential functions in the urban ecosystem. Along with providing the growth medium for landscape plants, community gardens, and urban forests, they support our buildings, roads, and athletic fields. Soils control water flow, remove and treat non-point source pollutants from runoff, cycle and store nutrients. Maintaining soil quality is a fundamental part of the health and well being of the urban environment. Understanding the effects of anthropogenic disturbance on the natural environment is a major new scientific frontier. This document can provide an introduction to urban soils, and serve to increase public awareness and appreciation of a valuable resource.

Almost thirty years ago, our agency issued the Soil Survey of the District of Columbia, a landmark in urban soil mapping, with the belief that the information provided would help the users to "a better environment and a better life." It is with similar intentions that we have prepared the New York City Reconnaissance Soil Survey.

For additional information or assistance in using this document, please contact the USDA-NRCS New York City Soil Survey Office.

Joseph R. DelVecchio
State Conservationist
Natural Resources Conservation Service

New York City Reconnaissance Soil Survey

This is a general soil map of New York City; it was prepared to show broad soil patterns across the city, and serve as a starting point for more intensive surveys. Most of the map units are complexes, two or more components occurring in a regularly repeating pattern, which cannot be separated at the mapping scale. **Please take note that this mapping scale is 1:62,500; about 1 inch to the mile. Map unit boundaries were determined at this scale, and the detail indicated is inadequate upon enlargement of the map to a larger scale.** At this scale, areas smaller than 40 acres are generally not delineated, no matter how different they may be from their surroundings. **Soil survey maps are never intended to replace a site assessment**, and in many urban areas human disturbance has resulted in highly variable soil composition, often at a scale beyond the resolution of this map. For site specific soils information, you may need to hire a soil scientist.

Soils were surveyed by Jack Bricker, Steve Carlisle, Stephen Dadio, Tyrone Goddard, Luis A. Hernandez, Richard Kruzansky, Steve Seifried, Richard K. Shaw, Philip Smith, Robert Tunstead, Olga Vargas, and Yiyi Wong, USDA-NRCS; Joe Anderson and John Galbraith, Cornell University; and Kaled Alamarie, NYC Soil and Water Conservation District.

Soils were sampled by Jack Bricker, Rebecca Burt, Steve Carlisle, Stephen Dadio, Luis A. Hernandez, Steven Indrick, Edwin Muniz, Steve Seifried, Richard K. Shaw, Robert Tunstead and Michael A. Wilson, NRCS; John Galbraith, Kendall Galbraith, and Patricia Gossett, Cornell University; Dean Dizcensa and Richard Kruzansky, Central Park Conservancy; David Diaz, NYC Department of Parks and Recreation, and Kaled Alamarie, NYC Soil and Water Conservation District.

Soils were correlated by Steven W. Fischer, Luis A. Hernandez, and Richard K. Shaw, NRCS. The soil map was digitized by Olga Vargas, with map layout design by Olga Vargas and Philip Smith. The manuscript was written by Richard K. Shaw, Olga Vargas, Philip Smith, Yiyi Wong, and Lindsay Reinhardt. This soil survey publication is a result of joint efforts by the USDA - NRCS and the NYC Soil and Water Conservation District. Specific program leadership, guidance, and support came from Tyrone Goddard, Steven Indrick, and Bruce Thompson of USDA-NRCS. Other agencies and universities that were instrumental in this project include:

- Cornell University
- USDI-National Park Service - Gateway National Recreation Area - Division of Natural Resources
- New York City Department of Parks and Recreation
- New York City Department of Environmental Protection
- Columbia University, Lamont-Doherty Earth Observatory
- USDA-NRCS - National Soil Survey Center (Lincoln, NE) and MO-12 Staff (Amherst, MA)

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The New York City Soil Survey Program

The USDA-NRCS began its New York City Soil Survey Program in 1995. The project first began under the direction of Tyrone Goddard and Jack Bricker in cooperation with the NYC Soil and Water Conservation District and numerous USDA-NRCS and Cornell staff. Field work was initiated by John Galbraith and Luis Hernandez, and continued under those listed above.

The program is dedicated to providing customers in urban areas with useful soils information. Soil surveys are conducted for resource inventory, including identification and protection of important habitat areas; for site suitability for redevelopment, remediation, restoration, for parkland, community gardens, and landscape architecture; and for soil-related water quality issues such as erodible lands, runoff and infiltration, and aquifer recharge. Mapping products range from this general soil map of the city at 1:62,500 to the more intensive surveys of South Latourette Park in Staten Island at 1:6000, Gateway National Recreation Area at 1:4800, and the Bronx River Watershed at 1:6000.

NYC Soil Scientists perform site investigations, hold soils training sessions, and conduct soils-based research projects in the urban environment.

The Survey Area

"The land is the finest for cultivation that I ever in my life set foot upon, and it also abounds in trees of every description." Henry Hudson, 1609

New York City is surrounded by numerous waterways, and four of five boroughs in the city are situated on islands. Extensive suburban areas border the city on the north, east, and west. Parts of three physiographic units are included: the New England Upland on the north and northwest, the Triassic Lowland on the southwest, and the Atlantic Coastal Plain along the southeast.

New York City's complex geology includes layers of crystalline bedrock, sedimentary rocks with associated igneous intrusives, coastal plain sediments, glacial deposits from several episodes, and scattered post-glacial materials. In many places, these natural features are topped off with various human-transported or anthropogenic deposits, more commonly known as fill.

The crystalline basement rocks, known as the Manhattan Prong of the New England Upland physiographic province, consist predominantly of gneiss, schist, and marble from the Precambrian and early Paleozoic. The original sedimentary and igneous rocks were folded, faulted, and, in some places, melted and recrystallized during several cycles of mountain building. Bedrock exposures are common in Manhattan and the Bronx, but for the most part these rocks are buried beneath younger deposits in the rest of the city. Serpentinite, a greenish, metamorphosed, magnesium and iron-rich crystalline rock forms the backbone and the highest point in Staten Island. Triassic and Jurassic sedimentary rocks of the Newark Group overlie the basement rocks in the northwestern part of Staten Island. These are red beds of sandstone, siltstone and shale, a wedge of continental sediments deposited in an elongate basin. Softer and more erodible than the crystalline rocks, outcrops of these strata are rare, but the materials are an important component of the glacial deposits on Staten Island. The red beds are intruded with a band of coarse-grained Palisades Diabase, an igneous rock which is much better exposed along the west bank of the Hudson in northern New Jersey. Similarly, diabase fragments are commonly found in glacial deposits in Staten Island, as well as Manhattan.

Coastal plain materials in New York City consist of unconsolidated deposits of Late Cretaceous age, eroded from the uplifted New England Upland to the west, and deposited in low-lying coastal areas. On Staten Island, these deposits extend from Fort Wadsworth southwestward into New Jersey, overlying the Triassic strata. In Brooklyn and Queens, these materials sit atop the eroded crystalline rock surface. In most of Staten Island and Long Island, however, the Cretaceous materials lie beneath younger glacial deposits.

Most of New York City is blanketed by deposits from the Pleistocene, the ice age which began around 1.6 million years ago. These unconsolidated materials were left behind after several advances and retreats of the ice sheets in the northern hemisphere. Glacial deposits are commonly divided into two types: till and outwash. Glacial till refers to those materials deposited directly by the flowing ice. Because till characteristically exhibits a wide range in particle size, from clay to boulder, it is described as unsorted. Till deposits also lack stratification, or layering, and can be as much as several hundred feet deep, or shallow, in areas where the ice has done more scraping and abrading of the bedrock. The latter is more common with harder, more resistant types of rock. Glacial outwash is deposited by glacial meltwater. Outwash deposits are generally characterized by a narrower range of particle size, related to the energy of the depositional environment, from a fast moving stream at one extreme, to the slow sedimentation in a glacial lake at the other. Stratification, or layering, is common in outwash deposits.

Glaciation of the metropolitan area has not only provided most of our surficial materials, but has shaped the landscape as well. In general, till areas are more rolling and sloping than outwash areas, and are occasionally marked by bedrock outcrops. The southernmost extent of the ice sheet is marked by a ridge, or east-west trending band of rolling hills, called a terminal moraine, formed by the material dropped at the melting edge of the glacier. New York City has two such moraines, forming the spines of the two eastern forks of Long Island. The southernmost, and older of the two is called the Ronkonkoma Moraine. The northernmost, which overrides the Ronkonkoma in north central Long Island, is the Harbor Hill, extending across Queens and Brooklyn and over into Staten Island at Fort Wadsworth. Material in the terminal moraine ranges from unsorted till to local bodies of roughly stratified and sorted sand and gravel. South of the

terminal moraine in Long Island and Staten Island, streams of glacial meltwater flowed south creating a gently sloping outwash plain of stratified and sorted gravel, sand, and silt. Till deposits cover most of Staten Island, whereas Long Island is predominantly outwash.

When the climate warmed approximately 11,000 years ago the Holocene, or post-glacial epoch, began. The ice sheet retreated to its present location, and sea level rose to its current elevation. Erosional forces have since modified the outwash plain to create the present day shoreline. Wave action has created barrier islands, and offshore winds have piled up sand into dunes. Organic materials and tide-carried sediments have accumulated to form tidal marshes.

According to Rosenzweig and Solecki (2001), projected global warming rates may bring about a sea level rise from 9.5 to 42.5 inches by the 2080's, which would have a dramatic effect on low-lying coastal landscapes.

Glacial till and outwash and post-glacial deposits, including marine sediments, eolian, and organic materials, as well as human deposited "fill," all serve as the parent materials for soil formation.

Introduction to Soils

Soil is defined as a natural body; a mixture of mineral and organic materials, which forms on the surface of the earth, and changes, or has changed, in response to climate and organisms. Soil is composed of solid matter and pore space. Mineral material and organic material make up the former, and air and water fill the latter. The proportion of each of these components can vary from one soil to another. An "ideal" agricultural soil contains 50% solid space and 50% pore space.

Why should we know our soils? First and foremost, soils perform important functions in our environment. Furthermore, soils are variable; which means their capability to perform these important functions also varies. Soil distribution is related to geology, and it plays an important role in determining land use. Soils can also be degraded, e.g., through erosion, compaction, and contamination, which can affect their ability to function. Knowledge of soil distribution patterns and soil properties can help us to put our soils to their best use and keep them functioning optimally.

Important environmental functions performed by soil include:

- Sustaining biological activity, diversity, and productivity
- Regulating and partitioning water and solute flow
- Filtering, buffering, degrading, immobilizing and detoxifying organic & inorganic materials
- Storing and cycling nutrients and other elements
- Providing support for socioeconomic structures

Why are soils variable? There are 5 soil forming factors:

- *Parent material*: is the raw material or 'geologic substratum' for soil formation, it influences the physical, chemical and mineralogical properties, and, to a large extent, the rate at which soil formation takes place;
- *Topography* influences erosion and deposition, water movement, as well as micro climate (e.g., north vs south-facing slope);
- *Climate* affects physical, chemical, and biological reactions in soils;
- *Organisms* affect soil through their activity, and in the decomposition of their wastes and residues;
- Soil formation is a function of *Time*.

Upon interaction, these 5 factors set in motion the soil forming processes:

- *Additions* include organic matter accumulation and other surficial inputs.
- *Losses* occur through "leaching" of soluble constituents downward through (and out of) the soil profile by water, and removal of soil material by erosion.
- *Translocations* involve redistribution of constituents within the soil profile (e.g., clay and/or iron).
- *Transformations* are physical and chemical changes (e.g., in minerals or organic compounds)

The soil forming factors and the soil forming processes are expressed in the soil properties: horizonation, texture, color, structure, consistence, mineralogy, pH and nutrient supply. Soils vary in physical and chemical properties.

Soil Properties

A soil profile is a sequence of horizons. Soil horizons form naturally as a result of soil forming processes. Horizon nomenclature reflects the dominant process(es). Horizons may also be the result of natural or anthropogenic deposition. Horizons are separated when there is any difference in the appearance (color, texture, coarse fragments, structure, roots) or feel (texture, consistence) of a soil layer.

Description of Master Horizons

***O** horizons* are dominantly organic soil material. Organic matter is composed of original and decomposed plant, animal, and microbial components. It is very important in soils as it helps aggregate and loosen soil, provides nutrients, and holds water and nutrients.
Definition: Organic horizon
Process: accumulation of slightly to highly decomposed plant & animal residues
ID: surface material, lighter in weight and darker in color than mineral material,
Comment: not found in all soils
O horizons can be found in wooded areas, or in wet areas, as organic material accumulates significantly in very wet or waterlogged conditions, where decomposition is slower. See ***Processes in Saturated Soils*** in the Glossary.

***A** horizons* are mineral layers that formed at the surface or below an O horizon, that show an accumulation of humified organic matter intimately mixed with the mineral fraction.
Definition: organically enriched mineral horizon (topsoil)
Process: incorporation or mixing of organic material into mineral soil
ID: darker mineral horizon at the soil surface

***E** horizons* are layers in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these, leaving a concentration of sand and silt particles.
Definition: horizon characterized by the loss of some component
Process: eluviation (washing out) of iron or clay
ID: paler color or lighter texture than below, just below A
Comments: not found in all soils.

***B** horizons* are layers that formed below an A or E and show one or more of the following:
(1) lighter, brighter, or redder colors than above;
(2) more clay than above;
(3) subangular blocky, prismatic, or columnar structure.
Definition: horizon of accumulation, or development of structure or color
Process: development of structure or color, illuviation (moving in) of iron or clay
ID: noticeable structure, brighter or redder color, more clay or iron than above

***C** horizons* are layers which are not bedrock and are little affected by soil forming processes and lack properties of O, A, E or B horizons.
Definition: parent material
Process: no evidence of soil forming processes (can be weathered)
ID: unconsolidated material below B; no structure

***R** horizons* are layers of hard bedrock.
Definition: bedrock
Process: no soil forming processes, little evidence of weathering
ID: hard, consolidated bedrock
Comment: Not found in all soils

Vertical Subdivisions are used to subdivide a master horizon to denote differences in texture, color, structure, etc., using arabic numerals, e.g., C1, C2, C3; Bt1, Bt2, Bt3.
Transition Horizons are horizons dominated by properties of one horizon, but having subordinate properties of another, e.g., AB or BA. The first letter denotes the dominant process.

Combination Horizons are horizons with two distinct parts, with recognizable properties of two master horizons, e.g., E/B, where E is dominant and surrounds B.
Discontinuities are used to indicate a significant change in particle size distribution or mineralogy that implies a difference in the material from which the horizons have formed (e.g., loess/till), and/or a significant difference in age. The 1 is omitted, e.g., A, B1, 2B2, 2B3, 2BC, 2C.

Kinds of Master Horizons

Lower case letters are used as suffixes to designate specific kinds of master horizons. More than one suffix can be used.

a highly decomposed organic material (*sapric*); used with O
b buried genetic horizon
d physical root restriction, dense
e intermediately decomposed organic material (*hemic*); used with O
g strongly gleyed (from anaerobic conditions), chroma of matrix or ped faces 2 or less
h illuvial accumulation of organic matter; used with B
i slightly decomposed organic material (*fibric*); used with O
p tillage or other disturbance; used with A
r weathered (soft) bedrock that has retained rock structure (saprolite); used with C
s illuvial accumulation of sesquioxides (Fe and Al oxides); used with B
t illuvial accumulation of silicate clay; used with B
w development of color or structure; used with B
x fragipan character; used with B

Soil Color

Important coloring agents in soil include:

1) *Organic matter* darkens the soil, depending on the content, and the extent of decomposition;
2) *Iron* gives soil a brown, yellow, or red color, even shades of blue or green depending upon its amount, oxidation state, and hydration state. When soil is saturated, iron can become soluble and can be removed, leaving the soil with "mottled" brown and gray colors, or complete gray depending on the extent of the wetness. See ***Processes in Saturated Soils*** in the Glossary.

Other factors affecting soil color include:

- Parent material
- Extent of leaching

Why is soil color important?

- It can be an indicator of soil wetness.
- It can be indicative of source, or parent material;
- Color differences in a profile may reflect soil forming processes;

Soil color is described with the Munsell system:
Hue is the dominant spectral wavelength. Pages in the color book are arranged by hue.
Value is the degree of darkness/lightness. Columns range from black, 0, at the bottom of the page, to white 10, at the top.
Chroma is the purity of spectral color. Rows range from neutral, 0, on the left, to bright colors, up to 8, on the right. A low chroma (<2) color can sometimes be indicative of soil wetness.

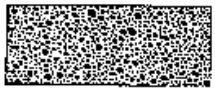
Soil Structure is the combination or arrangement of primary soil particles into secondary units or aggregates. Organic materials and clay are important binding agents, and wetting & drying cycles are important in creating structure. Soil structure influences pore space and water movement in soils.

Types of Soil Structure

	***Granular*** – roughly spherical, like grape nuts. Usually 1-10 mm in diameter. Most common in A horizons, where plant roots, microorganisms, and sticky products of organic matter decomposition bind soil grains into granular aggregates.

	***Platy*** – flat peds that lie horizontally in the soil. Platy structure can be found in A and B horizons. It commonly occurs in an A horizon as the result of compaction.
	***Blocky*** – roughly cube-shaped, with more or less flat surfaces. If edges and corners remain sharp, we call it *angular blocky*. If they are rounded, we call it *subangular blocky*. Sizes commonly range from 5-50 mm across. Blocky structures are typical of B horizons, especially those with a high clay content. They form by repeated expansion and contraction of clay minerals.
	***Prismatic*** – larger, vertically elongated blocks, often with five sides. Sizes are commonly 10-100mm across. Prismatic structures commonly occur in fragipans.

Structureless Soil Types

	***Massive*** – compact, coherent soil not separated into aggregates of any kind. Massive structures in clayey soils usually have very small pores, slow permeability, and poor aeration.
	***Single grain*** – in some very sandy soils, every grain acts independently, and there is no binding agent to hold the grains together into peds. Permeability is rapid, but fertility and water holding capacity are low.

Soil Consistence is the ease with which a lump of soil can be crushed by the fingers. It can also describe the difficulty of excavating the soil. Soil consistence, and its description, depends on soil moisture content. Terms commonly used to describe consistence in a moist soil are:

Loose -noncoherent when dry or moist; does not hold together in a mass; intact specimen not obtainable.

Friable -when moist, crushed easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm -crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Very Firm -needs considerable pressure to crush between thumb and forefinger

Soil pH

The most important effect of pH in the soil is on ion solubility, which in turn affects microbial and plant growth. A pH range of 6.0 to 6.8 is ideal for most crops because it coincides with optimum solubility of the most important plant nutrients. Most of the micronutrients for plant growth, and most heavy metals are more soluble at lower pH. Management of pH is important in controlling movement of heavy metals (and potential groundwater contamination) in soil.
In humid areas such as the eastern US, soils become naturally acidic over time as rainwater replaces basic cations (Ca, K, Mg, Na) with hydrogen. Some types of vegetation, particularly conifers, produce organic acids, which can also contribute to lower soil pH values. Addition of certain fertilizers to soil can also produce hydrogen ions. Liming the soil adds calcium, which replaces exchangeable and solution H^+ and raises soil pH.

Soil Quality

Soil quality is defined as the capacity of a soil to function. Soil quality includes both inherent properties and dynamic properties. Inherent properties, those which are not readily altered, include soil mineralogy and soil texture. Dynamic properties, such as topsoil thickness, organic matter content, soil structure, bulk density, and pH, may change with use and management. These changes can affect a soil's capability to function.

It can take up to 500 years to form an inch of soil – is this a renewable resource? The quality of a soil can be degraded rather quickly by: erosion, contamination, and compaction.

Soils in Urban Areas

Although there are different types of land use in urban areas (e.g., commercial, industrial, residential, recreational), because of the high population density, most of the soils are disturbed in some manner. This disturbance can include:

- cutting and filling or grading of areas to level landscapes (for homes, buildings, ballfields);
- filling of areas that are wet or possess other undesirable soil characteristics;
- filling of areas to dispose of materials such as dredge spoils, coal ash;
- mixing of soil horizons or removal of topsoil;
- adding plant growth media;
- atmospheric deposition of airborne materials.

Fill is any material used to 'fill in' an area. It can be natural soil material (derived locally or not), waste materials (e.g., coal ash, construction debris, dredged spoils) or a mixture of both. Soils in urban areas often contain non-soil materials or human artifacts such as glass, brick, metal, wood, and various waste products.

In mapping soils, a soil scientist will associate a particular soil with a particular landscape. Because of the high chance of disturbance, urban soils are less predictable and more difficult to map. Other potential problems with soils in urban areas include:

- *Greater variability in horizonation*; original horizons may be mixed up or removed; new ones may be added.
- *Little or no addition of natural organic matter*; areas with sparse or no vegetation receive limited amounts of plant material.
- *Presence of artifacts*; human created or altered materials (construction debris, coal ash, garbage, etc.) can affect soil chemical and physical properties; take up rooting volume or water and nutrient storage space.
- *Modified soil temperatures*; studies by the New York City Soil Survey have shown higher average soil temperatures, and a greater range in soil temperatures in bare soil areas such as playgrounds compared to similar soils in wooded vegetation.
- *High probability of compaction and contamination*;
- *Modified soil reaction*. In general, soils in urban areas have been found to have higher pH values than undisturbed natural soils, due to additions of basic cations from road salts, concrete, plaster and other "anthropogenic" materials.

Soil Map Units, New York City Reconnaissance Soil Survey

Most of the map units in this survey are complexes, a mixture of two or more components occurring in a regularly repeating pattern. The components in a complex are listed in order of their areal extent in the map unit, from highest to lowest. There are also four Pavement & buildings consociations, where a single component is dominant. For these units, a substratum phase was added to provide additional information about the area.

The map units, their numerical symbols used in the map, and the acreage for each are included in the following table. This is followed by brief descriptions of the map units, and more detailed information on the map unit components.

Legend, NYC Reconnaissance Soil Survey

Symbol and Map unit	Acres
1. Pavement & buildings, postglacial substratum, 0 to 5 percent slopes	512
2. Pavement & buildings, till substratum, 0 to 5 percent slopes	24301
3. Pavement & buildings, outwash substratum, 0 to 5 percent slopes	8073
4. Pavement & buildings, wet substratum, 0 to 5 percent slopes	4987
5. Beaches	1025
6. Ipswich-Pawcatuck-Matunuck mucky peats	4049
7. Laguardia-Ebbets-Pavement & buildings, wet substratum complex, 0 to 8 percent slopes	7021
8. Laguardia-Ebbets-Pavement & buildings complex, 0 to 8 percent slopes	1359
11. Water, fresh	630
12. Greenbelt-Pavement & buildings, 0 to 8 percent slopes	210
25. Water, salt	160
64. Montauk-Foresthills complex, 0 to 8 percent slopes	1721
67. Pavement & buildings-Foresthills-Montauk complex, 0 to 8 percent slopes	19745
68. Pavement & buildings-Foresthills-Canarsie complex, 8 to 15 percent slopes	2950
69. Montauk-Foresthills complex, 15 to 35 percent slopes	308
77. Flatbush-Riverhead-Pavement & buildings complex, 0 to 8 percent slopes	1720
79. Riverhead-Flatbush complex, 0 to 8 percent slopes	100
92. Pavement & buildings, wet substratum-Bigapple-Verrazano complex, 0 to 8 percent slopes	4549
98. Greatkills-Freshkills complex, 3 to 25 percent slopes	1052
99. Bigapple-Fortress complex, 0 to 8 percent slopes	3125
100. Inwood-Laguardia-Ebbets complex, 0 to 8 percent slopes	3064
101. Pavement & buildings, wet substratum-Laguardia-Ebbets complex, 0 to 8 percent slopes	8443
106. Bigapple-Verrazano-Pavement & buildings complex, 0 to 8 percent slopes, wet subsoil	384
123. Freshkills, geotextile liner substratum-Kleinekill sandy loams, 3 to 25 percent slopes	1739
128. Pavement & buildings-Laguardia-Ebbets complex, 0 to 8 percent slopes	1263
129. Hooksan-Dune land complex, 0 to 25 percent slopes	757
134. Charlton-Greenbelt complex, 0 to 8 percent slopes	248
135. Charlton-Greenbelt-Pavement & buildings complex, 15 to 50 percent slopes	334
137. Charlton-Sutton complex, 0 to 8 percent slopes	718
138. Charlton-Sutton complex, 8 to 15 percent slopes	314
139. Charlton-Sutton complex, 15 to 50 percent slopes	423
165. Montauk-Foresthills complex, 8 to 15 percent slopes	1345
171. Pavement & buildings-Chatfield-Greenbelt complex, 8 to 15 percent slopes	560
175. Centralpark-Canarsie complex, 0 to 8 percent slopes	30
204. Pavement & buildings-Charlton-Greenbelt complex, 0 to 8 percent slopes	5255
206. Pavement & buildings-Chatfield-Greenbelt complex, 15 to 50 percent slopes	871
207. Chatfield-Charlton complex, 15 to 50 percent slopes	673
208. Pavement & buildings-Hooksan-Verrazano complex, 0 to 8 percent slopes	1883
210. Jamaica-Barren sands, 0 to 3 percent slopes	552
211. Pavement & buildings-Flatbush-Riverhead complex, 0 to 8 percent slopes	30889
212. Pavement & buildings-Chatfield-Greenbelt complex, 0 to 8 percent slopes	3670
219. Chatfield-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes	1400
223. Chatfield-Greenbelt-Pavement & buildings complex, 15 to 50 percent slopes	1058
225. Plymouth-Flatbush-Pavement & buildings complex, 0 to 8 percent slopes	695
226. Pavement & buildings-Plymouth-Flatbush complex, 0 to 8 percent slopes	677
228. Foresthills-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes	830
230. Chatfield-Charlton complex, 0 to 8 percent slopes	220

231. Chatfield-Charlton complex, 8 to 15 percent slopes	687
232. Leicester-Sutton complex, 0 to 3 percent slopes	258
234. Pavement & buildings-Canarsie-Greenbelt complex, 15 to 50 percent slopes	340
235. Charlton-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes	1563
236. Shea-Pavement & buildings complex, 0 to 8 percent slopes	681
237. Charlton-Greenbelt-Pavement & buildings complex, 8 to 15 percent slopes	43
238. Windsor-Windsor, loamy substratum-Deerfield loamy sands, 0 to 8 percent slopes	241
240. Windsor-Verrazano-Pavement & buildings complex, 0 to 8 percent slopes	742
242. Hooksan-Verrazano-Pavement & buildings complex, 0 to 8 percent slopes	781
243. Montauk-Foresthills-Pavement & buildings complex, 8 to 15 percent slopes	1010
244. Montauk-Foresthills-Pavement & buildings complex, 0 to 8 percent slopes	2493
245. Deerfield-Wareham-Pavement & buildings complex, 0 to 8 percent slopes	374
246. Wareham-Deerfield complex, 0 to 3 percent slopes	167
247. Riverhead-Flatbush complex, 8 to 15 percent slopes	78
249. Riverhead-Pompton complex, 0 to 8 percent slopes	272
250. Unadilla-Riverhead-Pavement & buildings complex, 0 to 8 percent slopes	456
252. Laguardia-Centralpark-Pavement & buildings complex, 0 to 8 percent slopes	254
254. Greenbelt-Foresthills-Pavement & buildings complex, 0 to 8 percent slopes	243
260. Pavement & buildings-Foresthills-Wethersfield complex, 0 to 8 percent slopes	8134
262. Wethersfield-Ludlow-Wilbraham complex, 0 to 8 percent slopes	3028
264. Wethersfield-Ludlow complex, 8 to 15 percent slopes	506
268. Gravesend and Oldmill coarse sands, 0 to 8 percent slopes	1068
269. Flatland-Fishkill sandy loams, 0 to 3 percent slopes	114
270. Branford-Pompton complex, 0 to 8 percent slopes	214
274. Pavement & buildings-Flatbush-Branford complex, 0 to 8 percent slopes	1779
278. Wethersfield-Foresthills-Pavement & buildings complex, 15 to 25 percent slopes	214
280. Wethersfield-Foresthills-Pavement & buildings complex, 0 to 8 percent slopes	4464
283. Wethersfield-Foresthills complex, 0 to 8 percent slopes	422
284. Wethersfield-Foresthills complex, 8 to 15 percent slopes	79
285. Greenbelt-North Meadow complex, 0 to 8 percent slopes	398
304. Pavement & buildings-Windsor-Verrazano complex, 0 to 8 percent slopes	908
306. Wotalf-Todthill-Cheshire loams, 15 to 50 percent slopes	317
311. Wethersfield-Ludlow complex, 15 to 50 percent slopes	188
314. Greenbelt-Cheshire-Pavement & buildings complex, 0 to 8 percent slopes	476
322. Ludlow-Wilbraham complex, 0 to 8 percent slopes	110
324. Pavement & buildings-Greenbelt-Cheshire complex, 0 to 8 percent slopes	1274
344. Wotalf-Todthill-Pavement & buildings complex, 15 to 50 percent slopes	486
346. Wethersfield-Foresthills-Pavement & buildings complex, 8 to 15 percent slopes	375
348. Pavement & buildings-Wotalf-Todthill complex, 15 to 50 percent slopes	272
364. Haledon-Hasbrouck complex, 0 to 3 percent slopes	648
370. Boonton-Haledon complex, 0 to 8 percent slopes	417

Map Unit Descriptions

1. Pavement & buildings, postglacial substratum, 0 to 5 percent slopes:
Nearly level to gently sloping, highly urbanized areas with more than 80 percent of the surface covered by impervious pavement and buildings, over dunes and dune sand; generally located in urban centers.

2. Pavement & buildings, till substratum, 0 to 5 percent slopes:
Nearly level to gently sloping, highly urbanized areas with more than 80 percent of the surface covered by impervious pavement and buildings, over glacial till; generally located in urban centers.

3. Pavement & buildings, outwash substratum, 0 to 5 percent slopes:
Nearly level to gently sloping, highly urbanized areas with more than 80 percent of the surface covered by impervious pavement and buildings, over glacial outwash; generally located in urban centers.

4. Pavement & buildings, wet substratum, 0 to 5 percent slopes:
Nearly level to gently sloping, highly urbanized areas with more than 80 percent of the surface covered by impervious pavement and buildings, over filled swamp, tidal marsh, or water; generally located in urban centers.

5. Beaches:
Nearly level to gently sloping areas of sand or sand and gravel adjacent to the Atlantic Ocean, inundated by saltwater twice each day at high tide. Frequently reworked by wave and wind action, these areas do not support vegetation.

6. Ipswich-Pawcatuck-Matunuck mucky peats (photo):
Low lying areas of tidal marsh that are inundated by salt water twice each day at high tide, with a mixture of very poorly drained soils which vary in the thickness of organic materials over sand.

7. Laguardia-Ebbets-Pavement & buildings, wet substratum complex, 0 to 8 percent slopes: Nearly level to gently sloping areas filled with a mixture of natural soil materials and construction debris over swamp, tidal marsh, or water; a mixture of anthropogenic soils which vary in coarse fragment content, with more than 15 percent impervious pavement and buildings covering the surface.

8. Laguardia-Ebbets-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas filled with a mixture of natural soil materials and construction debris; a mixture of anthropogenic soils which vary in coarse fragment content, with more than 15 percent impervious pavement and buildings covering the surface.

11. Water, fresh: Fresh water bodies, generally greater than 10 acres.

12. Greenbelt-Pavement & buildings, 0 to 8 percent slopes (photo):
Nearly level to gently sloping areas that have been filled with natural soil materials for athletic fields or roadways; anthropogenic soils with more than 15 percent impervious pavement and buildings covering the surface; located in Van Cortland Park in the Bronx.

25. Water, salt: Salt water bodies, generally greater than 40 acres.

64. Montauk-Foresthills complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and moraines that have been only partially filled with natural soil materials for cemeteries, golf courses, or athletic fields, with some patches of woods; a mixture of gneissic till soils and anthropogenic soils; located in Brooklyn and Queens.

67. Pavement & buildings-Foresthills-Montauk complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of till plains and moraines that have been substantially cut and filled with natural soil materials, mostly for residential use; a mixture of anthropogenic soils and gneissic till soils, with up to 80 percent impervious pavement and buildings covering the surface; located from the terminal moraine northward in Brooklyn and Queens.

68. Pavement & buildings-Foresthills-Canarsie complex, 8 to 15 percent slopes:
Strongly sloping urbanized areas of till plains that have been cut and filled with natural soil materials, mostly for residential use; a mixture of anthropogenic soils which vary in the depth to a

root limiting layer, with up to 80 percent impervious pavement and buildings covering the surface; located from the terminal moraine northward in Brooklyn, Queens, and Staten Island.

69. Montauk-Foresthills complex, 15 to 35 percent slopes:
Moderately steep to steep areas of till plains and moraines that are mostly wooded and have been only partially filled with natural soil materials for roads; a mixture of gneissic till soils and anthropogenic soils; located from the terminal moraine northward in Brooklyn and Queens.

77. Flatbush-Riverhead-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains that have been partially filled with natural soil materials for athletic fields, cemeteries, and low density residential use; a mixture of anthropogenic soils and gneissic outwash soils, with more than 15 percent impervious pavement and buildings covering the surface; located south of the terminal moraine in Brooklyn and Queens.

79. Riverhead-Flatbush complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains that have been only partially filled with natural soil materials for athletic fields and golf courses, with some patches of woods; a mixture of gneissic outwash soils and anthropogenic soils; located south of the terminal moraine in Brooklyn and Queens.

92. Pavement & buildings, wet substratum-Bigapple-Verrazano complex, 0 to 8 percent slopes: Nearly level to gently sloping urbanized areas where sandy dredged materials and loamy fill have been placed over swamp, tidal marsh, or water; a mixture of sandy and loamy-capped anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located along coastal waterways in Staten Island, Brooklyn, and Queens.

98. Greatkills-Freshkills complex, 3 to 25 percent slopes:
Gently sloping to moderately steep areas where household landfill material is capped by loamy fill of variable thickness.

99. Bigapple-Fortress complex, 0 to 8 percent slopes (photo): Nearly level to gently sloping areas that have been filled with sandy dredged materials; a mixture of well drained and moderately well drained anthropogenic soils; located along coastal waterways.

100. Inwood-Laguardia-Ebbets complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas that have been filled with a mixture of natural soil materials and construction debris; a mixture of anthropogenic soils which vary in coarse fragment content.

101. Pavement & buildings, wet substratum-Laguardia-Ebbets complex, 0 to 8 percent slopes: Nearly level to gently sloping urbanized areas filled with a mixture of natural soil materials and construction debris over swamp, tidal marsh, or water; a mixture of anthropogenic soils which vary in coarse fragment content, with up to 80 percent impervious pavement and buildings covering the surface.

106. Bigapple-Verrazano-Pavement & buildings, wet substratum complex, 0 to 8 percent slopes: Nearly level to gently sloping areas where sandy dredged materials and loamy fill have been placed over swamp, tidal marsh, or water; a mixture of sandy and loamy-capped anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located along coastal waterways in Brooklyn and Queens.

123. Freshkills, geotextile liner substratum-Kleinekill sandy loams, 3 to 25 percent slopes:
Gently sloping to moderately steep areas where household landfill material is capped with either a geotextile or a clay liner.

128. Pavement & buildings-Laguardia-Ebbets complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas filled with a mixture of natural soil materials and construction debris; a mixture of anthropogenic soils which vary in coarse fragment content, with up to 80 percent impervious pavement and buildings covering the surface.

129. Hooksan-Dune land complex, 0 to 25 percent slopes (photo):
Nearly level to moderately steep areas of sandy soils formed in eolian and marine deposits, and sand in hills or ridges and intervening troughs, drifted and piled up by the wind, and either actively shifting or so recently stabilized that no soil horizons have developed. Located along coastal waterways in Staten Island, Brooklyn, and Queens.

134. Charlton-Greenbelt complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains that have been only partially filled for cemeteries and golf courses; a mixture of gneissic till soils and anthropogenic soils; located in the Bronx.

135. Charlton-Greenbelt-Pavement & buildings complex, 15 to 50 percent slopes:
Moderately steep to very steep areas of till plains and hills that have been partially filled for parks and cemeteries; a mixture of gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in the Bronx.

137. Charlton-Sutton complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains that are relatively undisturbed and mostly wooded; a mixture of well drained and moderately well drained gneissic till soils; located in the Bronx.

138. Charlton-Sutton complex, 8 to 15 percent slopes:
Strongly sloping areas of till plains and hills that are relatively undisturbed; a mixture of well drained and moderately well drained gneissic till soils; located in the Bronx.

139. Charlton-Sutton complex, 15 to 50 percent slopes:
Moderately steep to very steep areas of till plains and hills that are relatively undisturbed; a mixture of well drained and moderately well drained gneissic till soils; located in Manhattan and the Bronx.

165. Montauk-Foresthills complex, 8 to 15 percent slopes:
Strongly sloping areas of till plains and moraines that have been only partially filled for parks; a mixture of gneissic till soils and anthropogenic soils; located from the terminal moraine northward in Brooklyn and Queens.

171. Pavement & buildings-Chatfield-Greenbelt complex, 8 to 15 percent slopes:
Strongly sloping urbanized areas of bedrock controlled hills and ridges modified by glacial action that have been substantially cut and filled, mostly for residential use; a mixture of moderately deep gneissic till soils and anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located in the Bronx.

175. Centralpark-Canarsie complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains that have been cut and filled with natural soil materials; a mixture of anthropogenic soils which vary in their coarse fragment content; located in Central Park in Manhattan.

204. Pavement & buildings-Charlton-Greenbelt complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of till plains that have been substantially cut and filled, mostly for residential use; a mixture of gneissic till soils and anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located in Manhattan and the Bronx.

206. Pavement & buildings-Chatfield-Greenbelt complex, 15 to 50 percent slopes:
Moderately steep to very steep urbanized areas of bedrock controlled hills and ridges modified by glacial action, that have been substantially cut and filled, mostly for residential use; a mixture of moderately deep gneissic till soils and anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located in Manhattan and the Bronx.

207. Chatfield-Charlton complex, 15 to 50 percent slopes:
Moderately steep to very steep areas of bedrock controlled hills and ridges modified by glacial action that are relatively undisturbed and mostly wooded; a mixture of moderately deep and deep gneissic till soils; located in Manhattan and the Bronx.

208. Pavement & buildings-Hooksan-Verrazano complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of sandy sediments that have been substantially cut and filled mostly for residential use; a mixture of sandy soils and loamy-capped anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located along the southern shorelines of Brooklyn and Queens.

210. Jamaica-Barren sands, 0 to 3 percent slopes:
Nearly level to concave areas that have been filled with sandy dredged materials; a mixture of poorly drained and somewhat poorly drained anthropogenic soils; located along coastal waterways in southern Brooklyn and Queens.

211. Pavement & buildings-Flatbush-Riverhead complex, 0 to 8 percent slopes (photo):
Nearly level to gently sloping urbanized areas of outwash plains that have been substantially cut and filled, mostly for residential use; a mixture of anthropogenic and gneissic outwash soils, with up to 80 percent impervious pavement and buildings covering the surface.

212. Pavement & buildings-Chatfield-Greenbelt complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of bedrock controlled hills and ridges modified by glacial action that have been partially cut and filled with natural soil materials, mostly for residential use; a mixture of moderately deep gneissic till soils and anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface.

219. Chatfield-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of bedrock controlled hills and ridges modified by glacial action that have been partially cut and filled, mostly for parks and low density residential use; a mixture of moderately deep gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in Manhattan and the Bronx.

223. Chatfield-Greenbelt-Pavement & buildings complex, 15 to 50 percent slopes:
Moderately steep to very steep areas of bedrock controlled hills and ridges modified by glacial action that have been partially cut and filled, mostly for parks and low density residential use; a mixture of moderately deep gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in Manhattan and the Bronx.

225. Plymouth-Flatbush-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains that have been partially disturbed, mostly for parks and cemeteries; a mixture of sandy outwash soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located south of the terminal moraine in Queens.

226. Pavement & buildings-Plymouth-Flatbush complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of urbanized outwash plains that have been substantially cut and filled, mostly for residential use; a mixture of sandy outwash soils and anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located south of the terminal moraine in Queens.

228. Foresthills-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas that have been filled with natural soil materials; a mixture of anthropogenic soils that vary in depth of fill, with more than 15 percent impervious pavement and buildings covering the surface.

230. Chatfield-Charlton complex, 0 to 8 percent slopes (photo):
Nearly level to gently sloping areas of bedrock controlled hills and ridges modified by glacial action that are relatively undisturbed and mostly wooded; a mixture of moderately deep and deep gneissic till soils; located in the Bronx.

231. Chatfield-Charlton complex, 8 to 15 percent slopes:
Strongly sloping areas of bedrock controlled hills and ridges modified by glacial action that are relatively undisturbed and mostly wooded; a mixture of moderately deep and deep gneissic till soils; located in the Bronx.

232. Leicester-Sutton complex, 0 to 3 percent slopes:
Nearly level to concave areas on till plains and hills that are relatively undisturbed and mostly wooded; a mixture of poorly drained and moderately well drained gneissic till soils; located in the Bronx.

234. Pavement & buildings-Canarsie-Greenbelt complex, 15 to 50 percent slopes:
Moderately steep to very steep urbanized areas on till plains and hills that have been partially cut and filled, mostly for residential use; a mixture of anthropogenic soils that vary in depth of fill, with up to 80 percent impervious pavement and buildings covering the surface.

235. Charlton-Greenbelt-Pavement & buildings complex, 0 to 8 percent slopes (photo):
Nearly level to gently sloping areas of till plains that have been partially cut and filled for athletic fields, cemeteries, and light residential use; a mixture of gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in the Bronx and Manhattan.

236. Shea-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of impermeable asphalt or concrete that have been covered with a thin mantle of natural fill for parkland; anthropogenic soils with an impermeable layer within 20 inches, and more than 15 percent of the surface still covered by pavement and buildings; located in Flushing Meadows, Queens.

237. Charlton-Greenbelt-Pavement & buildings complex, 8 to 15 percent slopes (photo):
Strongly sloping to moderately steep areas of till plains and hills that have been partially cut and filled for roads, cemeteries, and light residential use; a mixture of gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in Manhattan and the Bronx.

238. Windsor-Windsor, loamy substratum-Deerfield loamy sands, 0 to 8 percent slopes:
Nearly level to gently sloping areas of sandy outwash plains and dunes that are relatively undisturbed and mostly wooded; a mixture of excessively drained and moderately well drained sandy outwash soils; located in western Staten Island.

240. Windsor-Verrazano- Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of sandy outwash plains and dunes that have been partially filled; a mixture of sandy outwash soils and loamy-capped anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in western Staten Island and Brooklyn.

242. Hooksan-Verrazano-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of dunes that have been partially cut and filled, mostly for parkland and light residential use; a mixture of sandy soils and loamy-capped anthropogenic soils with more than 15 percent impervious pavement and buildings covering the surface; located on Coney Island and the Rockaway peninsula.

244. Montauk-Foresthills-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and moraines that have been partially cut and filled, mostly for parks and light residential use; a mixture of gneissic till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located from the terminal moraine northward in Brooklyn and Queens.

245. Deerfield-Wareham-Pavement & buildings complex, 0 to 8 percent slopes (photo):
Nearly level to gently sloping areas of outwash plains that are partially wooded and partially developed; a mixture of moderately well drained and poorly drained sandy outwash soils, with more than 15 percent impervious pavement and buildings covering the surface; located in western Staten Island.

246. Wareham-Deerfield complex, 0 to 3 percent slopes:
Nearly level to concave areas of outwash plains, relatively undisturbed and mostly wooded; a mixture of poorly drained and moderately well drained sandy outwash soils; located in western Staten Island.

247. Riverhead-Flatbush complex, 8 to 15 percent slopes:
Strongly sloping to moderately steep areas of outwash terraces that have been partially filled for parkland; a mixture of gneissic outwash soils and anthropogenic soils; located in Riverdale Park in the Bronx.

249. Riverhead-Pompton complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains that are relatively undisturbed; a mixture of well and moderately well drained gneissic outwash soils.

250. Unadilla-Riverhead-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains that are partially developed for parks, hospitals, and cultural facilities; a mixture of silty and loamy outwash soils, with more than 15 percent impervious pavement and buildings covering the surface.

252. Laguardia-Centralpark-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of urbanized till plains that have been cut and filled with natural soil materials and construction debris; a mixture of anthropogenic soils that vary in artifact content, with more than 15 percent impervious pavement and buildings covering the surface; located in Central Park in Manhattan.

260. Pavement & buildings-Foresthills-Wethersfield complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of urbanized till plains that have been cut and filled for residential use; a mixture of anthropogenic and red till soils, with up to 80 percent impervious pavement and buildings covering the surface; located in Staten Island.

262. Wethersfield-Ludlow-Wilbraham complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains, relatively undisturbed and mostly wooded; a mixture of well drained, moderately well drained, and poorly drained soils developed in red till; located in Staten Island.

264. Wethersfield-Ludlow complex, 8 to 15 percent slopes:
Strongly sloping to moderately steep areas of till plains and hills, relatively undisturbed and mostly wooded; a mixture of well drained and moderately well drained soils developed in red till; located in Staten Island.

268. Gravesend and Oldmill coarse sands, 0 to 8 percent slopes:
Nearly level to gently sloping areas of household landfill materials capped by sandy fill of variable thickness.

269. Flatland-Fishkill sandy loams, 0 to 3 percent slopes:
Nearly level to concave areas that have been filled with fly ash; a mixture of somewhat poorly drained and poorly drained anthropogenic soils; located in Floyd Bennett Field in Brooklyn.

270. Branford-Pompton complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of outwash plains, relatively undisturbed; a mixture of well drained and moderately well drained soils formed in red outwash materials; located in southern Staten Island.

274. Pavement & buildings-Flatbush-Branford complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of outwash plains that have been cut and filled for residential use; a mixture of anthropogenic soils and red outwash soils, with up to 80 percent impervious pavement and buildings covering the surface; located in southern Staten Island.

278. Wethersfield-Foresthills-Pavement & buildings complex, 15 to 25 percent slopes:
Moderately steep to steep areas of till plains and hills that have been partially filled for residential use; a mixture of red till soils and anthropogenic soils, with more than15 percent impervious pavement and buildings covering the surface; located in Staten Island.

280. Wethersfield-Foresthills-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and hills that have been partially filled for cemeteries and residential use; a mixture of red till soils and anthropogenic soils, with more than15 percent impervious pavement and buildings covering the surface; located in Staten Island.

283. Wethersfield-Foresthills complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and hills that have been partially cut and filled for parkland and golf courses; a mixture of red till soils and anthropogenic soils; located in Staten Island.

284. Wethersfield-Foresthills complex, 8 to 15 percent slopes:
Strongly sloping to moderately steep areas of till plains and hills that have been partially cut and filled for golf courses; a mixture of red till soils and anthropogenic soils; located in Staten Island.

285. Greenbelt-North Meadow complex, 0 to 8 percent slopes (photo):
Nearly level to gently sloping areas of urbanized till plains that have been filled with natural soil materials for parkland; a mixture of well drained and moderately well drained anthropogenic soils; located in Central Park in Manhattan.

304. Pavement & buildings-Windsor-Verrazano complex, 0 to 8 percent slopes:
Nearly level to gently sloping urbanized areas of sandy outwash plains and dunes that have been partially filled for residential and commercial use; a mixture of sandy outwash soils and loamy-capped anthropogenic soils, with up to 80 percent impervious pavement and buildings covering the surface; located in Staten Island.

306. Wotalf-Todthill-Cheshire loams, 15 to 50 percent slopes:
Moderately steep to very steep areas of bedrock controlled hills and ridges modified by glacial action, relatively undisturbed and mostly wooded; a mixture of shallow, moderately deep, and deep till soils over serpentinite; located in Staten Island.

311. Wethersfield-Ludlow complex, 15 to 50 percent slopes:
Moderately steep to very steep areas of till plains and hills, relatively undisturbed; a mixture of well drained and moderately well drained soils formed in red till; located in Staten Island.

314. Greenbelt-Cheshire-Pavement & buildings complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and moraines that have been partially filled with natural soil materials, mostly for residential use; a mixture of anthropogenic soils and red till soils, with more than 15 percent impervious pavement and buildings covering the surface; located in eastern Staten Island.

322. Ludlow-Wilbraham complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and moraines that are relatively undisturbed and mostly wooded; a mixture of moderately well drained and poorly drained soils formed in red till; located in Staten island.

324. Pavement & buildings-Greenbelt-Cheshire complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains and moraines that have been partially filled with natural soil materials, mostly for residential use; a mixture of anthropogenic soils and red till soils,

with up to 80 percent impervious pavement and buildings covering the surface; located in eastern Staten Island.

344. Wotalf-Todthill-Pavement & buildings complex, 15 to 50 percent slopes:
Moderately steep to very steep urbanized areas of bedrock controlled hills and ridges modified by glacial action that have been disturbed for residential use; a mixture of shallow and moderately deep serpentinite till soils, with more than 15 percent impervious pavement and buildings covering the surface.

346. Wethersfield-Foresthills-Pavement & buildings complex, 8 to 15 percent slopes:
Strongly sloping areas of till plains and hills that have been partially filled for residential use and cemeteries; a mixture of red till soils and anthropogenic soils, with more than 15 percent impervious pavement and buildings covering the surface; located in Staten Island.

348. Pavement & buildings-Wotalf-Todthill complex, 15 to 50 percent slopes:
Moderately steep to very steep urbanized areas of bedrock controlled hills and ridges modified by glacial action that have been disturbed for residential use; a mixture of shallow and moderately deep serpentinite till soils, with up to 80 percent impervious pavement and buildings covering the surface.

364. Haledon-Hasbrouck complex, 0 to 3 percent slopes:
Nearly level to concave areas of till plains and moraines that are relatively undisturbed and mostly wooded; a mixture of somewhat poorly drained and poorly drained soils formed in red till; located in Staten Island.

370. Boonton-Haledon complex, 0 to 8 percent slopes:
Nearly level to gently sloping areas of till plains that are relatively undisturbed and mostly wooded; a mixture of well drained and somewhat poorly drained soils formed in red till; located in Staten Island.

Map Unit Components

The map unit components include soil series and miscellaneous areas. In general, soils in a series have the same parent material, drainage class, and sequence of major horizons. Soil series can be further separated into phases based on surface texture, slope, and substratum type. Miscellaneous areas have little or no natural soil, are difficult to access for orderly examination, or for other reasons, are difficult to classify. They can be characterized by disturbance, recent deposition, or highly variable composition.

This survey includes impervious surfaces (Pavement & buildings) at the urban core; areas of fill, classified to the series level based on the type of materials; and natural soils, also classified to the series level, which reflect the natural geologic diversity and the soil forming factors.

Soil Series

Barren series

Parent Material: Sandy dredge deposits, greater than 40 inches deep
Landform: Anthropogenic fill areas near coastal waterways
Depth to Bedrock: Very deep
Drainage Class: Somewhat poorly drained
Permeability: Rapid
Soil Texture: Fine sand, sand, or coarse sand throughout
Coarse Fragments: 0 to 20 percent rock fragments (including seashells); less than 10 percent artifacts
Range in Soil pH: Very strongly acid to slightly alkaline
Hydrologic Soil Group: C
Typical Soil Profile:

A 0 to 5 inches – very dark grayish brown (10YR 3/2) sand; weak very fine granular structure; very friable; slightly acid.

Bw 5 to 11 inches – olive brown (2.5Y 4/3) sand; weak very fine and fine subangular blocky structure; very friable; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) redoximorphic features; slightly acid.

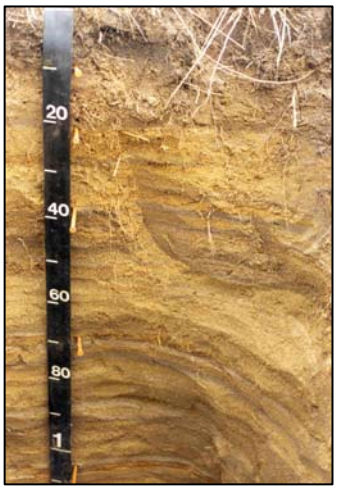
Bg1 11 to 17 inches – light brownish gray (2.5Y 6/2) sand; weak very fine subangular blocky structure; very friable; few medium distinct yellowish brown (10YR 5/6) redoximorphic features; slightly acid.

Bg2 17 to 35 inches – gray (2.5Y 6/1) fine sand; massive; very friable; few medium distinct yellowish brown (10YR 5/6) redoximorphic features; strongly acid.

C 35 to 65 inches – grayish brown (2.5Y 5/2) sand; massive; very friable; strongly acid.

Bigapple series

Parent Material: Sandy dredge deposits, greater than 40 inches deep
Landform: Anthropogenic fill areas near coastal waterways
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Rapid
Soil Texture: Loamy sand or coarser in the surface; fine sand, sand, or coarse sand below
Coarse Fragments: 0 to 20 percent rock fragments (including seashells); less than 10 percent artifacts
Range in Soil pH: Extremely acid to slightly alkaline
Hydrologic Soil Group: A
Typical Soil Profile:



A 0 to 3 inches – dark grayish brown (10YR 4/2) fine sand; single grain; loose; 1 percent gravel; extremely acid.

E 3 to 8 inches – brown (10YR 5/3) fine sand; single grain; loose; 1 percent gravel; extremely acid.

Bw 8 to 20 inches – yellowish brown (10YR 5/4) stratified sand; weak medium subangular blocky structure; very friable; 1 percent gravel; extremely acid.

C1 20 to 28 inches – yellowish brown (10YR 6/4) and grayish brown (10YR 5/2) stratified sand; massive; very friable; 5 percent gravel; very strongly acid.

C2 28 to 60 inches – grayish brown (10YR 5/2) and gray (10YR 5/1) stratified sand; massive; very friable; 2 percent gravel; very strongly acid.

Boonton series

Parent Material: Glacial till derived mainly from red sedimentary rock and basalt
Landform: Till plains and hills
Depth to Bedrock: Deep to very deep
Drainage Class: Well drained and moderately well drained
Permeability: Moderate above the fragipan; very slow throughout the fragipan
Soil Texture: Silt loam, loam, sandy loam in the surface and upper subsoil; loam or sandy loam below
Coarse Fragments: 0 to 35 percent throughout
Range in Soil pH: Strongly acid or very strongly acid in the upper solum; strongly acid through slightly acid in the lower solum; moderately acid through neutral in the substratum
Hydrologic Soil Group: C
Typical Soil Profile:

Ap 0 to 8 inches – brown (10YR 4/3) silt loam; moderate fine and medium granular structure; very friable; 1 percent gravel, 2 percent cobbles, and 3 percent stones; very strongly acid.

BA 8 to 15 inches – dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; 5 percent gravel and 5 percent cobbles; very strongly acid.

Bt1 15 to 23 inches – brown (7.5YR 4/4) gravelly loam; moderate medium subangular blocky structure; friable; 15 percent gravel and 2 percent cobbles; strongly acid.

Bt2 23 to 30 inches – brown (7.5YR 4/4) gravelly fine sandy loam; weak coarse and medium subangular blocky structure; friable; 20 percent gravel and 2 percent cobbles; strongly acid.

Btx 30 to 50 inches – dark reddish brown (5YR 3/4) gravelly sandy loam; strong very thick platy structure; very firm and brittle; 20 percent gravel and 2 percent cobbles; strongly acid.

Cd 50 to 65 inches - dark reddish brown (5YR 3/4) gravelly sandy loam, weak medium and thick platy structure; very firm and brittle; 25 percent gravel and 2 percent cobbles; slightly acid.

Branford series

Parent Material: Loamy over sandy and gravelly outwash deposits, derived mainly from red sedimentary rocks
Landform: Outwash plains and terraces
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately rapid in the solum; moderately rapid or rapid in the substratum
Soil Texture: Silt loam, loam, very fine sandy loam, or fine sandy loam in the surface and subsoil; loamy fine sand or coarser in the substratum
Coarse Fragments: 0 to 30 percent rock fragments in the solum; 10 to 65 percent in the substratum
Range in Soil pH: Strongly acid to slightly acid
Hydrologic Group: B
Typical Soil Profile:

Ap 0 to 8 inches – dark grayish brown (10YR 4/2) loam; weak fine granular structure; very friable; 2 percent gravel; slightly acid.

Bw1 8 to 16 inches – dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; 5 percent gravel; moderately acid.

Bw2 16 to 29 inches – strong brown (7.5YR 4/6) gravelly loam; weak fine and medium subangular blocky structure; friable; 20 percent gravel; moderately acid.

BC 29 to 32 inches – brown (7.5YR 4/4) very gravelly sandy loam; massive; friable; 40 percent gravel; strongly acid.

C 32 to 72 inches – reddish brown (5YR 4/6) stratified sand and gravel; massive; loose; 50 percent gravel; strongly acid.

Canarsie series

Parent Material: Loamy fill, less than 40 inches deep, over a natural glacial till soil which may be truncated; a dense root-limiting layer is present within 40 inches of the surface
Landform: Anthropogenic fill areas on urbanized till plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate to moderately slow in the fill; slow in the compacted subsoil or dense till substratum
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 30 percent rock fragments throughout; less than 10 percent artifacts in the loamy fill mantle
Range in Soil pH: Strongly acid to neutral in the fill, very strongly acid to slightly acid in the till substratum
Hydrologic Soil Group: C
Typical Soil Profile:

A 0 to 2 inches – dark brown (7.5YR 3/2) sandy loam; moderate medium granular structure; very friable; 5 percent gravel; slightly alkaline.

Bw 2 to 5 inches – dark reddish brown (5YR 3/4) sandy loam; fine medium subangular blocky structure; friable; 10 percent gravel and 1 percent cobbles; moderately alkaline.

BC 5 to 10 inches – dark reddish brown (5YR 3/4) fine sandy loam; massive with moderately thick plate-like divisions; firm; 10 percent gravel and 1 percent cobbles; moderately alkaline.

C 10 to 20 inches – dark red (2.5YR 3/6) gravelly sandy loam; massive with very thick plate-like divisions; very firm; 20 percent gravel and 10 percent cobbles; moderately alkaline.

2Cd 20 to 72 inches – dark red (2.5YR 3/6) sandy loam; massive; firm (dense glacial till); 10 percent gravel; moderately alkaline.

Centralpark series

Parent Material: Loamy fill, greater than 40 inches deep, high in rock fragments
Landform: Anthropogenic fill areas
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate, moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 5 to 70 percent rock fragments throughout; less than 10 percent artifacts
Range in Soil pH: Very strongly acid to slightly acid
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 2 inches – dark brown (7.5YR 3/3) gravelly sandy loam; weak medium granular structure; friable; 24 percent gravel and 1 percent cobbles; neutral.

Bw 2 to 11 inches – dark brown (7.5YR 4/3) very gravelly sandy loam; weak medium subangular blocky structure; friable; 34 percent gravel, 10 percent cobbles, and 10 percent stones; neutral.

C1 11 to 19 inches – dark brown (7.5YR 4/3) very stony coarse sandy loam; massive; friable; 20 percent gravel, 10 percent cobbles, and 15 percent stones; slightly alkaline.

C2 19 to 40 inches – dark reddish brown (5YR 4/3) extremely stony sandy loam; massive; firm; 26 percent gravel, 15 percent cobbles, and 20 percent stones; slightly alkaline.

C3 40 to 55 inches – reddish brown (5YR 4/4) very stony sandy loam; massive; friable; 16 percent gravel, 15 percent cobbles, and 20 percent stones; slightly alkaline.

Ab 55 to 56 inches – black (N 2.5/) mucky silt loam (buried soil surface); massive; friable; neutral.

Bwb 56 to 80 inches – brown (7.5YR 4/3) loam; weak medium subangular blocky structure; friable; moderately acid.

Charlton series

Parent Material: Glacial till derived mainly from gneiss and schist
Landform: Till plains and hills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately rapid
Soil Texture: Loam or sandy loam throughout; some soils may have a loamy sand substratum
Coarse Fragments: 5 to 35 percent in the solum; 5 to 50 percent in the substratum
Range in Soil pH: Very strongly acid to moderately acid
Hydrologic Soil Group: B
Typical Soil Profile:

A1 0 to 5 inches – very dark grayish brown (10YR 3/2) loam;
moderate fine granular structure; friable; 5 percent gravel; very strongly acid.

A2 5 to 10 inches – dark brown (10YR 3/3) loam; moderate medium subangular blocky structure; friable; 5 percent gravel; very strongly acid.

AB 10 to 14 inches – dark yellowish brown (10YR 3/4) loam; moderate medium subangular blocky structure; friable; 7 percent gravel; very strongly

acid.

Bw1 14 to 24 inches – strong brown (7.5YR 4/6) sandy loam; weak medium subangular blocky structure; friable; 3 percent gravel, 4 percent cobbles, and 3 percent stones; strongly acid.

Bw2 24 to 33 inches – dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; friable; 3 percent gravel, 4 percent cobbles, and 3 percent stones; strongly acid.

C1 33 to 45 inches – yellowish brown (10YR 5/6) stony loamy sand; massive; 3 percent gravel, 4 percent cobbles, and 8 percent stones; strongly acid.

C2 45 to 72 inches – light olive brown (2.5Y 5/3) stony loamy sand; massive; 3 percent gravel, 4 percent cobbles, and 8 percent stones; strongly acid.

Chatfield series

Parent Material: Glacial till overlying gneiss or schist bedrock
Landform: Bedrock controlled hills and ridges, modified by glacial action
Depth to Bedrock: Moderately deep (between 20 and 40 inches to bedrock)
Drainage Class: Well drained
Permeability: Moderate or moderately rapid
Soil Texture: Silt loam, loam, or sandy loam throughout; pockets or thin lenses of loamy sand may be found in the substratum
Coarse Fragments: 5 to 50 percent rock fragments in the surface; 5 to 35 percent in the subsoil
Range in Soil pH: Very strongly acid to moderately acid
Hydrologic Soil Group: C
Typical Soil Profile:

A 0 to 2 inches – very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable; 5 percent gravel; very strongly acid.

AB 2 to 8 inches – dark brown (10YR 3/3) loam; weak medium subangular blocky structure; friable; 5 percent gravel; very strongly acid.

Bw 8 to 25 inches – brown (7.5YR 4/4) gravelly silt loam; weak fine subangular blocky structure; friable; 20 percent gravel; very strongly acid.

2R 25 inches – fractured gneissic bedrock.

Cheshire series

Parent Material: Glacial till derived mainly from red sedimentary rock and basalt
Landform: Till plains and hills, and moraines
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately rapid
Soil Texture: Silt loam, loam, or sandy loam throughout; pockets or thin lenses of loamy sand may be found in the substratum
Coarse Fragments: 5 to 35 percent rock fragments throughout
Range in Soil pH: Very strongly acid to moderately acid
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 2 inches – dark brown (7.5YR 3/2) loam; moderate fine granular structure; very friable; 8 percent gravel; very strongly acid.

Bw1 2 to 5 inches – reddish brown (5YR 4/3) loam; strong fine granular structure; friable; 6 percent gravel; very strongly acid.

Bw2 5 to 10 inches – yellowish red (5YR 4/6) fine sandy loam; moderate medium subangular blocky and weak fine platy structure; friable; 6 percent gravel and 1 percent cobbles; very strongly acid.

Bw3 10 to 28 inches – reddish brown (2.5YR 4/4) loam; weak coarse platy and moderate medium subangular blocky structure; friable; 7 percent gravel and 1 percent cobbles; very strongly acid.

C 28 to 60 inches – dark reddish brown (2.5YR 3/4) gravelly sandy loam; weak coarse platy and moderate medium subangular blocky structure; 19 percent gravel and 5 percent cobbles; strongly acid.

Deerfield series

Parent Material: Sandy glaciofluvial deposits
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained
Permeability: Moderately rapid to rapid in the solum, rapid to very rapid in the substratum
Soil Texture: Fine sandy loam or coarser in the surface and upper subsoil; loamy fine sand or coarser below
Coarse Fragments: 0 to 15 percent in the solum; 0 to 20 percent in the substratum
Range in Soil pH: Extremely acid to strongly acid
Hydrologic Soil Group: B
Typical Soil Profile:

Oi 0 to 3 inches – black (10YR 2/1) slightly decomposed organic material.

A 3 to 5 inches – very dark grayish black (10YR 3/2) loamy sand; weak fine and medium granular structure; very friable; extremely acid.

Bhs 5 to 10 inches – dark brown (7.5YR 3/3) loamy sand; moderate fine and medium subangular blocky structure; friable; extremely acid.

Bw1 10 to 15 inches – brown (7.5YR 4/4) loamy sand; weak medium and fine subangular blocky structure; friable; very strongly acid.

Bw2 15 to 19 inches – dark yellowish brown (10YR 4/4) loamy sand; weak medium and fine subangular blocky structure; friable; strongly acid.

BC 19 to 25 inches – dark yellowish brown (10YR 4/6) loamy sand; weak medium and coarse subangular blocky structure; friable; many coarse prominent yellowish red (5YR 4/6) and many coarse distinct light yellowish brown (10YR 6/4) redoximorphic features; very strongly acid.

C 37 to 60 inches – olive gray (5Y 5/2) loamy sand; massive; friable; very strongly acid.

Ebbets series

Parent Material: Loamy fill, greater than 40 inches deep, with construction debris
Landform: Anthropogenic urban fill plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate, moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 10 to 34percent, with more than 10 percent artifacts
Range in Soil pH: Very strongly acid to moderately alkaline
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 4 inches – very dark grayish brown (10YR 3/2) loam; weak fine subangular blocky structure; friable; 5 percent gravel-sized artifacts; slightly acid.

Bw 4 to 8 inches – dark yellowish brown (10YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; friable; 25 percent gravel-sized artifacts; moderately alkaline.

C 8 to 60 inches – dark yellowish brown (10YR 4/4) gravelly sandy loam; massive; friable; 30 percent gravel-sized artifacts; moderately alkaline.

Fishkill series

Parent Material: Incinerator fly ash, greater than 40 inches deep
Landform: Anthropogenic fill areas
Depth to Bedrock: Very deep
Drainage Class: Poorly drained
Permeability: Moderate
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: Natural rocks and artifacts combined can range up to 35 percent
Range in Soil pH: Slightly acid to slightly alkaline
Hydrologic Soil Group: D
Typical Soil Profile:

A 0 to 3 inches – very dark gray (10YR 3/1) sandy loam; weak very fine granular structure; very friable; 4 percent gravel-sized artifacts and 1 percent gravel; neutral.

C1 3 to 13 inches – brown (10YR 4/3) coarse sandy loam; massive; friable; few fine distinct yellowish brown (10YR 5/8) redoximorphic concentrations; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C2 13 to 25 inches – gray (10YR 6/1) coarse sandy loam; massive; friable; few coarse prominent yellowish brown (10YR 5/8) redoximorphic concentrations; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C3 25 to 37 inches – grayish brown (10YR 5/2) coarse sandy loam; massive; friable; few fine distinct yellowish brown (10YR 5/8) redoximorphic features; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C4 37 to 65 inches – pale brown (10YR 6/3) coarse sandy loam; common coarse prominent yellowish brown (10YR 5/8) redoximorphic features; 9 percent gravel-sized artifacts and 1 percent gravel; neutral.

Flatbush series

Parent Material: Loamy fill, less than 40 inches deep, over glacial outwash materials
Landform: Anthropogenic urban fill plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately slow in the solum; rapid or very rapid in the substratum
Soil Texture: Silt loam, loam, or sandy loam; loamy sand or sand in the substratum
Coarse Fragments: 0 to 35 percent in the solum; 5 to 60 percent in the substratum
Range in Soil pH: Very strongly acid to slightly alkaline
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 13 inches – very dark grayish brown (10YR 3/2) fine sandy loam; weak fine subangular blocky structure; friable; 5 percent gravel; slightly acid.

Ab 13 to 21 inches – brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; 1 percent gravel; slightly acid.

Bwb 21 to 50 inches – yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; 1 percent gravel; slightly acid.

2C 50 to 79 inches – dark yellowish brown (10YR 4/6) sand; massive; friable; 10 percent gravel; moderately acid.

Flatland series

Parent Material: Incinerator fly ash, greater than 40 inches deep
Landform: Anthropogenic landforms/filled areas
Depth to Bedrock: Very deep

Drainage Class: Somewhat poorly drained
Permeability: Moderate
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: Natural rocks and artifacts combined can range up to 35 percent
Range in Soil pH: Slightly acid to slightly alkaline
Hydrologic Soil Group: D
Typical Soil Profile:

A 0 to 6 inches – brown (10YR 4/3) sandy loam; weak very fine granular structure; very friable; 4 percent gravel-sized artifacts and 1 percent gravel; neutral.

C1 6 to 16 inches – yellowish brown (10YR 5/4) coarse sandy loam; massive; friable; few coarse prominent strong brown (7.5YR 4/6) redoximorphic features; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C2 16 to 30 inches – yellowish brown (10YR 5/4) sandy loam; massive; friable; common fine distinct dark yellowish brown (10YR 4/6) and few fine distinct grayish brown (10YR 5/2) redoximorphic features; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C3 30 to 37 inches – yellowish brown (10YR 5/4) coarse sandy loam; massive; friable; many fine distinct dark yellowish brown (10YR 4/6) and common fine distinct grayish brown (10YR 5/2) redoximorphic features; 8 percent gravel-sized artifacts and 2 percent gravel; neutral.

C4 37 to 65 inches – light brownish gray (10YR 6/2) gravelly coarse sandy loam; massive; friable; few fine distinct dark yellowish brown (10YR 4/6) redoximorphic features 14 percent gravel-sized artifacts and 1 percent gravel; neutral.

Foresthills series

Parent Material: Loamy fill, less than 40 inches deep, over an intact or truncated glacial till soil
Landform: Anthropogenic fill areas on urbanized till plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 20 percent throughout; less than 10 percent artifacts
Range in Soil pH: Very strongly acid to slightly acid in the loamy fill; very strongly acid to neutral in the underlying soil
Hydrologic Group: B
Typical Soil Profile:

A 0 to 2 inches – very dark grayish brown (10YR 3/2) loam; weak coarse subangular blocky structure; very friable; 5 percent gravel, 1 percent cobbles, and 1 percent stones; moderately acid.

Bw 2 to 15 inches – 60 percent brown (7.5YR 4/4) silt loam, 25 percent yellowish red (5YR 4/6) loam, and 15 percent black (10YR 2/1) loam; weak coarse subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.

Ab 15 to 17 inches – black (10YR 2/1) loam; weak medium subangular blocky structure; very friable; 1 percent gravel and 1 percent cobbles; moderately acid.

BAb 17 to 28 inches – brown (7.5YR 4/3) loam; weak medium subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.

Bwb 28 to 42 inches – reddish brown (5YR 4/4) loam; weak medium subangular blocky structure; friable; 5 percent gravel and 1 percent cobbles; strongly acid.

Cd 42 to 60 inches – yellowish red (5YR 4/6) loam; weak coarse platy structure; firm; 5 percent gravel and 1 percent cobbles; strongly acid.

Fortress series

Parent Material: Sandy dredge deposits, more than 40 inches deep
Landform: Anthropogenic fill areas near coastal waterways
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained

Permeability: Rapid
Soil Texture: Loamy fine sand or coarser throughout
Coarse Fragments: 0 to 20 percent rock fragments (including seashells); less than 10 percent artifacts
Range in Soil pH: Strongly acid to slightly alkaline
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 8 inches – grayish brown (2.5Y 5/2) sand; weak very fine granular structure; very friable; neutral.

Bw 8 to 12 inches – light olive brown (2.5Y 5/6) sand; weak very fine subangular blocky structure; very friable; few fine faint brownish yellow (10YR 6/8) redoximorphic features; neutral.

C1 12 to 48 inches – light gray (2.5Y 7/2) sand; massive; friable; many fine distinct brownish yellow (10YR 6/8) redoximorphic features; neutral.

C2 48 to 65 inches – olive gray (5Y 5/2) sand; massive; friable; common medium distinct gray (5Y 5/2) and brownish yellow (10YR 6/8) redoximorphic features; neutral.

Freshkills series

Parent Material: Loamy fill, more than 25 inches deep, over household landfill material
Landform: Anthropogenic landfills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 20 percent in the loamy cap; 35 to 75 percent combined rock fragments and artifacts in the garbage layers
Range in Soil pH: Slightly acid to neutral
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 6 inches – dark brown (10YR 3/3) sandy loam; weak fine subangular blocky structure; friable; 2 percent gravel-sized artifacts, 5 percent gravel, and 1 percent cobbles; neutral.

Bw 6 to 13 inches – dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; 2 percent gravel-sized artifacts, 5 percent gravel, and 1 percent cobbles; neutral.

C 13 to 33 inches – brown (7.5YR 4/4) gravelly sandy loam; massive; friable; 15 percent gravel-sized artifacts, 15 percent gravel, and 2 percent cobbles; neutral.

2C 33 to 80 inches – brown (7.5YR 4/4) extremely cobbly sandy loam; massive; friable; 20 percent cobble-size biodegradable artifacts, 45 percent cobble-sized non-biodegradable artifacts, and 5 percent cobbles; neutral.

Gravesend series

Parent Material: Sandy fill, less than 25 inches deep, over household landfill material
Landform: Anthropogenic landfills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Rapid
Soil Texture: Fine sand, sand, or coarse sand throughout
Coarse Fragments: 1 to 30 percent rock fragments in the sandy cap; 35 to 75 percent combined rock fragments and artifacts in the garbage layers
Range in Soil pH: Extremely acid to slightly alkaline
Hydrologic Soil Group: A
Typical Soil Profile:

A 0 to 2 inches – very dark gray (10YR 3/1) coarse sand; weak fine and medium subangular blocky structure; loose; 5 percent gravel; strongly acid.

Bw 2 to 8 inches – light yellowish brown (2.5Y 6/4) coarse sand; single grain; loose; 5 percent gravel; moderately acid.
C1 8 to 20 inches – grayish brown (2.5Y 5/2) coarse sand; massive; friable; very strongly acid.
2C2 20 to 80 inches – very dark grayish brown (2.5Y 3/2) extremely cobbly coarse sand; massive; loose; 15 percent gravel, 15 percent cobble-sized biodegradable artifacts, and 40 percent cobble-sized non-biodegradable artifacts; neutral.

Greatkills series

Parent Material: Loamy fill, less than 25 inches deep, over household landfill material
Landform: Anthropogenic landfills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 30 percent rock fragments in the loamy cap; 35 to 75 percent combined rock fragments and artifacts in the garbage layers
Range in Soil pH: Strongly acid to moderately alkaline
Hydrologic Soil Group: B
Typical Soil Profile:
A 0 to 2 inches – dark brown (7.5YR 3/2) sandy loam; weak medium granular structure; very friable; 10 percent gravel; slightly acid.
Bw 2 to 7 inches – dark reddish brown (5YR 3/4) gravelly sandy loam; weak medium subangular blocky and platy structure; friable; 20 percent gravel; neutral.
C1 7 to 12 inches – dark reddish brown (5YR 3/4) gravelly sandy loam; weak medium platy structure; firm; 5 percent gravel-sized artifacts and 20 percent gravel; moderately alkaline.
2C2 12 to 80 inches – brown (7.5YR 4/4) extremely cobbly sandy loam; massive; friable; 15 percent cobble-sized biodegradable artifacts, 40 percent cobble-sized non-biodegradable artifacts, and 5 percent cobbles; neutral.

Greenbelt series

Parent Material: Loamy fill, greater than 40 inches deep
Landform: Anthropogenic fill areas on urbanized till plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 20 percent rock fragments throughout; less than 10 percent artifacts
Range in Soil pH: Extremely acid to moderately alkaline
Hydrologic Soil Group: B
Typical Soil Profile:
A 0 to 3 inches – brown (7.5YR 4/4) loam; medium subangular blocky structure; very friable; 5 percent gravel, 2 percent cobbles, and 2 percent stones; very strongly acid.
Bw 3 to 13 inches – yellowish red (5YR 4/6) loam; moderate medium subangular blocky and platy structure; friable; 2 percent gravel, 1 percent cobbles, and 1 percent stones; moderately acid.
C 13 to 57 inches – reddish brown (2.5YR 4/4) gravelly loam; massive; firm; 15 percent gravel, 5 percent cobbles, and 2 percent stones; moderately acid.
Ab 57 to 58 inches – dark brown (7.5YR 3/2) loam; weak medium granular structure; very friable; 5 percent gravel and 5 percent cobbles; extremely acid.
Bwb 58 to 65 inches – yellowish red (5YR 4/6) loam; moderate medium subangular blocky structure; very friable; 5 percent gravel and 5 percent cobbles; very strongly acid.

Haledon series

Parent Material: Glacial till derived mainly from red sedimentary rock and basalt; often eroded glacial materials that have been redeposited
Landform: Low positions on undulating till plains
Depth to Bedrock: Very deep
Drainage Class: Somewhat poorly
Permeability: Moderately rapid to moderate above the fragipan, slow to very slow within the fragipan
Coarse Fragments: 5 to 15 percent rock fragments in the solum, 15 to 35 percent in the substratum
Soil Texture: Silt loam or loam in the surface; silt loam, loam, or sandy loam in the upper subsoil; loam or sandy loam in the lower subsoil (fragipan) and substratum
Range in Soil pH: Extremely acid to slightly acid in the solum and moderately acid to neutral in the substratum
Hydrologic Soil Group: D
Typical Soil Profile:

A 0 to 3 inches – black (10YR 2/1) loam; moderate fine granular structure; very friable; 5 percent gravel; extremely acid.

BE 3 to 11 inches – yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; common fine faint brownish yellow (10YR 5/8) and few fine faint pale brown (10YR 6/3) redoximorphic features; 5 percent gravel; extremely acid.

Bt1 11 to 17 inches – brownish yellow (10YR 5/8) loam; moderate coarse subangular blocky structure; friable; few faint patchy clay films on ped faces and coarse fragments; many medium distinct light brownish gray (10YR 6/2) redoximorphic features; 5 percent gravel; extremely acid.

Bt2 17 to 27 inches – brownish yellow (10YR 6/8) silt loam; moderate medium subangular blocky structure; friable; few faint patchy clay films on ped faces and coarse fragments; many medium distinct light brownish gray (10YR 6/2) and common medium distinct brownish yellow (10YR 5/8) redoximorphic features; 5 percent gravel; very strongly acid.

2Btx 27 to 38 inches – yellowish red (5YR 4/6) loam; moderate coarse prismatic structure; firm and brittle; few faint patchy clay films on ped faces and coarse fragments; common medium distinct yellowish red and (5YR 5/8) and light gray (10YR 7/1) redoximorphic features; 15 percent gravel and 1 percent cobbles; very strongly acid.

2Cd 38 to 65 inches – yellowish red (5YR 4/6) loam; massive; firm and brittle; 20 percent gravel and 1 percent cobbles; very strongly acid.

Hooksan series

Parent Material: Eolian sands and marine deposits
Landform: Dunes adjoining coastal beaches
Drainage Class: Excessively drained
Permeability: Very rapid
Soil Texture: Fine sand, sand, or coarse sand throughout
Coarse Fragments*:* 0 to 10 percent rock fragments throughout; mostly seashells
Range in Soil pH*:* Strongly acid to slightly alkaline
Hydrologic Soil Group*:* A
Typical Soil Profile:

A 0 to 3 inches – olive brown (2.5Y 4/4) fine sand; single grain; loose; extremely acid.

C1 3 to 29 inches – light olive brown (2.5Y 5/3) fine sand; single grain; loose; very strongly acid.

C2 29 to 80 inches – light olive brown (2.5Y 5/3) fine sand; single grain; loose; moderately acid.

Inwood series

Parent Material: Construction debris and rubble mixed with natural soil; greater than 75 percent coarse fragments
Landform: Anthropogenic urban cut and fill plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderately rapid
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: Greater than 75 percent (average)
Range in Soil pH: Strongly acid to neutral.
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 6 inches – yellowish brown (10YR 5/4) gravelly sandy loam; weak fine platy structure; friable; 10 percent gravel-sized artifacts and 5 percent gneissic gravel; neutral.

Bw 6 to 12 inches – yellowish brown (10YR 5/4) very gravelly sandy loam; weak fine subangular blocky structure; friable; 35 percent gravel-sized artifacts and 5 percent gneissic gravel; neutral.

C1 12 to 16 inches – yellowish brown (10YR 5/6) very gravelly sandy loam; massive; friable; 35 percent gravel-sized artifacts and 10 percent gneissic gravel; neutral.

C2 16 to 65 inches – yellowish brown (10YR 5/6) extremely stony sandy loam; massive; friable; 80 percent stone-sized artifacts (concrete, asphalt, wood, metal) and 10 percent gneissic stones; neutral.

Ipswich series

Parent Material: Organic deposits
Landform: Tidal marsh
Depth to Bedrock: Very deep
Drainage Class: Very poorly drained
Permeability: Moderate to rapid
Thickness of organic material: Greater than 51 inches
Salt Content: 5000 to 35000 ppm
Range in Soil pH*:* Strongly acid to slightly alkaline
Hydrologic Soil Group*:* D
Typical Soil Profile:

Oe1 0 to 20 inches –brown (10YR 4/3) mucky peat; 85 percent fibers, 30 percent after rubbed; 5 percent mineral material; neutral.

Oe2 20 to 40 inches – very dark grayish brown (2.5Y 3/2) mucky peat; 70 percent fibers, 20 percent after rubbed; 10 percent mineral material; neutral.

Oa 40 to 72 inches – dark gray (5Y 4/1) mucky peat; 70 percent fibers, 25 percent after rubbed; 25 percent mineral material; slightly alkaline.

Jamaica series

Parent Material: Sandy dredge or eolian sand
Landform: Anthropogenic fill areas near coastal waterways
Depth to Bedrock: Very deep
Drainage Class: Poorly drained
Permeability: Rapid
Soil Texture: Fine sand, sand, or coarse sand throughout
Coarse Fragments: Generally absent, some seashells may be present

Range in Soil pH*:* Extremely acid to neutral
Hydrologic Soil Group*:* D
Typical Soil Profile:

A 0 to 3 inches – black (10YR 2/1) sand; moderate fine granular structure; friable; strongly acid.

C1 3 to 11 inches – gray (2.5Y 6/1) sand; massive; friable; few fine distinct brown (7.5YR 4/4) redoximorphic features; strongly acid.

C2 11 to 27 inches – grayish brown (2.5Y 5/2) fine sand; massive; friable; common coarse distinct brown (7.5YR 4/4) redoximorphic features; slightly acid.

C3 27 to 65 inches – light gray (2.5Y 7/1) fine sand; massive; friable; many fine distinct brown (10YR 5/3) redoximorphic features; moderately acid.

Kleinekill series

Parent Material: Loamy fill over a clay liner above household landfill material
Landform: Anthropogenic landfills
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained
Permeability: Moderate or moderately slow in the loamy material; impermeable in the clay
Soil Texture: Silt loam, loam, or sandy loam in the cap; silty clay, or clay, sandy clay in the liner
Coarse Fragments: 1 to 30 percent in the loamy cap; less than 15% in the clay liner; 35 to 75 percent combined rock fragments and artifacts in the garbage layers
Range in Soil pH: Extremely acid to neutral
Hydrologic Soil Group: C
Typical Soil Profile:

A 0 to 3 inches – dark grayish brown (10YR 4/2) sandy loam; weak very fine granular and weak very fine subangular blocky structure; very friable; 10 percent gravel; slightly acid.

CA 3 to 9 inches – dark grayish brown (10YR 4/2) gravelly sandy loam; weak very fine subangular blocky structure; friable; 25 percent gravel; neutral.

2C1 9 to 24 inches – yellowish brown (10YR 5/4) gravelly sandy loam; weak very fine subangular blocky structure; massive: firm; 15 percent gravel; moderately alkaline.

3C2 24 to 40 inches – dark greenish gray (10Y 3/1) clay; massive; firm; neutral.

4C3 40 to 65 inches - brown (10YR 5/3) extremely cobbly sandy loam, 15 percent cobble-size biodegradable artifacts, 40 percent cobble-sized non-biodegradable artifacts, 5 percent cobbles, and 2 percent stone-sized non-biodegradable artifacts; neutral.

Laguardia series

Parent Material: Loamy fill, greater than 40 inches deep, with construction debris
Landform: Anthropogenic urban fill plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 35 to 75 percent (average)
Range in Soil pH*:* Very strongly acid to neutral
Hydrologic Soil Group*:* B

Typical Soil Profile:

Ap 0 to 8 inches – brown (10YR 4/3) gravelly sandy loam, weak very fine subangular blocky structure; friable; 25 percent gravel-sized artifacts and 5 percent cobbles; neutral.

Bw 8 to 26 inches – brown (10YR 4/3) very gravelly coarse sandy loam; weak very fine subangular blocky structure; friable; 40 percent gravel-sized artifacts and 5 percent cobbles; neutral.

C 26 to 79 inches – brown (10YR 4/3) very gravelly coarse sandy loam; moderate thick platy structure; friable; 50 percent gravel-sized artifacts and 7 percent cobbles; neutral.

Leicester series

Parent Material: Glacial till derived mainly from gneiss and schist
Depth to Bedrock: Very deep
Drainage Class: Poorly drained
Permeability: Moderate or moderately rapid in the solum; moderate to rapid in the substratum
Soil Texture: Loam or sandy loam in the solum; sandy loam in the substratum where pockets or thin lenses of loamy sand may be found
Coarse Fragments*:* 5 to 35 percent in the upper 40 inches; 5 to 50 percent below 40 inches
Range in Soil pH*:* Very strongly acid to moderately acid
Hydrologic Soil Group*:* C
Typical Soil Profile:

A 0 to 7 inches – black (10YR 2/1) fine sandy loam; moderate medium granular structure; friable; 5 percent gravel and 5 percent cobbles; strongly acid.

Bg1 7 to 10 inches – grayish brown (2.5Y 5/2) fine sandy loam; weak medium subangular blocky structure; friable; 5 percent gravel and 5 percent cobbles; common medium prominent yellowish red (5YR 5/6) redoximorphic features; strongly acid.

Bg2 10 to 18 inches; light brownish gray (2.5Y 6/2) fine sandy loam; weak medium subangular blocky structure; friable; 5 percent gravel and 5 percent cobbles; common fine prominent yellowish brown (10YR 5/6) redoximorphic features; strongly acid.

BC 17 to 23 inches; pale brown (10YR 6/3) fine sandy loam; massive; friable; 5 percent gravel and 5 percent cobbles; many medium distinct yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) redoximorphic features; strongly acid.

C1 23 to 42 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; massive; friable; 10 percent gravel and 5 percent cobbles; many medium distinct yellowish brown (10YR 5/6) and many medium prominent pinkish gray (7.5YR 6/2) redoximorphic features; strongly acid.

C2 42 to 65 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; massive; friable; 10 percent gravel and 5 percent cobbles; few fine distinct yellowish brown (10YR 5/6) redoximorphic features; strongly acid.

Ludlow series

Parent Material: Dense basal till derived mainly from red sedimentary rocks and basalt
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained
Permeability*:* Moderate in the solum; slow or very slow in the substratum
Soil Texture: Loam or sandy loam in the solum; sandy loam in the substratum where pockets or thin lenses of loamy sand may be found
Coarse Fragments*:* 5 to 25 percent in the solum; 5 to 35 percent in the substratum
Range in Soil pH*:* Very strongly acid to moderately acid
Hydrologic Soil Group*:* C
Typical Soil Profile:

Ap 0 to 8 inches; dark brown (7.5YR 3/2) silt loam; weak coarse granular structure; friable; 8 percent gravel; strongly acid.

Bw1 8 to 20 inches – reddish brown (5YR 4/4) silt loam; weak coarse subangular blocky structure; friable; 10 percent gravel; strongly acid.

Bw2 20 to 26 inches – dark reddish brown (5YR 3/4) silt loam; weak coarse subangular blocky structure; friable; 12 percent gravel; common medium distinct pinkish gray (5YR 6/2) and common medium prominent strong brown (7.5YR 5/8) redoximorphic features; strongly acid.

Cd 26 to 65 inches – dark reddish brown (2.5YR 3/4) gravelly loam; weak thick platy structure; very firm and brittle; thin patchy silt films and black (10YR 2/1) manganese coatings on some plates; 15 percent gravel and 5 percent cobbles; few fine distinct reddish gray (5YR 5/2) redoximorphic features; strongly acid.

Matunuck series

Parent Material: Organic deposits overlying sandy marine sediments
Landform: Tidal marsh
Depth to Bedrock: Very deep
Drainage Class: Very poorly drained
Permeability*:* Rapid in the organic surface to very rapid in the substratum
Thickness of organic material: 8 to 16 inches; loamy sand or coarser beneath
Salt Content: 1000 to 40000 ppm
Range in Soil pH*:* Strongly acid to slightly alkaline
Hydrologic Soil Group*:* D
Physical and Chemical Properties:
Typical Soil Profile:

Oe 0 to 8 inches – black (10YR 2/1) mucky peat; 80 percent fibers, 20 percent after rubbed; neutral.

C1 8 to 72 inches – dark gray (2.5Y 4/1) sand; single grain; loose; neutral.

Montauk series

Parent Material: Glacial till derived mainly from granitic materials
Landform: Till plains and moraines
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability: Moderate or moderately rapid in the solum; slow or moderately slow in the substratum
Soil Texture: Silt loam, loam, or sandy loam in the solum; fine sandy loam or coarser in the substratum
Coarse Fragments*:* 3 to 35 percent in the solum; 5 to 50 percent in the substratum
Range in Soil pH*:* Extremely acid to moderately acid
Hydrologic Soil Group*:* C
Typical Soil Profile:

A 0 to 2 inches – brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; strongly acid.

Bw 2 to 27 inches – yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure becoming weak medium platy in lower two inches; friable; 5 percent gravel; strongly acid.

2Cd1 27 to 40 inches – brown (7.5YR 4/4) sandy loam; weak thick platy structure; firm and brittle; 10 percent gravel; strongly acid.

3Cd2 40 to 65 inches - reddish brown (5YR 4/4) loamy sand; massive; firm and brittle; 10 percent gravel; strongly acid.

North Meadow series

Parent Material: Loamy fill, less than 40 inches deep
Landform: Anthropogenic fill areas on urbanized till plains
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained
Permeability: Moderate; moderately slow where the surface has been compacted
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments: 1 to 20 percent rock fragments throughout; less than 10 percent artifacts
Range in Soil pH: Extremely acid to moderately alkaline
Hydrologic Soil Group: B
Typical Soil Profile:

A 0 to 6 inches –dark grayish brown (10YR 3/2) loam; weak very fine granular structure; friable; slightly acid.
C1 6 to 12 inches – dark brown (10YR 3/3) and dark yellowish brown (10YR 4/4) loam; massive; friable; moderately acid.
C2 12 to 18 inches – brown (7.5YR 5/4) loam; few very dark grayish brown (10YR 3/2) organic stains and few pockets of brown (10YR 4/3); massive; friable; moderately acid.
Ab 18 to 24 inches – pale brown (10YR 6/3) silt loam; massive; firm; few fine faint light brownish gray (10YR 6/2) redoximorphic features; 5 percent gravel; slightly acid.
C3 24 to 40 inches – pale brown (10YR 6/3) loam; massive; friable; many fine faint light brownish gray (10YR 6/2) redoximorphic features; slightly acid.

Oldmill series

Parent Material: Sandy fill, greater than 25 inches deep, over household landfill material
Landform: Anthropogenic landfills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Rapid to moderately rapid
Soil Texture: Fine sand, sand, or coarse sand throughout
Coarse Fragments*:* 1 to 30 percent in the sandy cap; 35 to 75 percent in the garbage horizons
Range in Soil pH*:* Extremely acid to slightly alkaline
Hydrologic Soil Group*:* A
Typical Soil Profile:

A 0 to 2 inches – very dark grayish brown (2.5Y 3/2) gravelly fine sand; weak very fine subangular blocky structure; very friable; 15 percent gravel-sized non-biodegradable artifacts; strongly acid.
Bw 2 to 11 inches – light olive brown (2.5Y 5/3) gravelly fine sand; single grain; loose; 20 percent gravel-sized non-biodegradable artifacts; moderately acid.
C1 11 to 18 inches – light yellowish brown (2.5Y 6/4) gravelly fine sand; single grain; loose; 20 percent gravel-sized non-biodegradable artifacts; moderately acid.
C2 18 to 33 inches – yellow (2.5Y 7/6) gravelly fine sand; single grain; loose, few coarse prominent strong brown (7.5YR 5/6) redoximorphic features; 20 percent gravel-sized non-biodegradable artifacts; moderately acid.
2C3 33 to 65 inches – black (10YR 2/1) extremely cobbly fine sand; single grain; loose, common coarse prominent strong brown (7.5YR 5/6) redoximorphic features; 20 percent cobble-sized biodegradable artifacts and 40 percent cobble-sized non-biodegradable artifacts; neutral.

Pawcatuck series

Parent Material: Organic deposits overlying sandy marine sediments
Landform: Tidal marsh
Depth to Bedrock: Very deep
Drainage Class: Very poorly drained
Permeability*:* Moderate to rapid in the organic layers; very rapid in the underlying sandy sediments

Thickness of organic material: 16 to 51 inches; with predominantly loamy sand or coarser beneath
Salt Content: 1000 to 40000 ppm
Range in Soil pH*:* Strongly acid to slightly alkaline
Hydrologic Group*:* D
Typical Soil Profile:

Oe1 0 to 8 inches – very dark gray (5Y 3/1) mucky peat; 80 percent fibers, 30 percent after rubbed; neutral.

Oe2 8 to 24 inches – dark gray (2.5Y 4/1) mucky peat; 50 percent fibers, 20 percent after rubbed; neutral.

2C 24 to 72 inches – dark gray (N 4/) loamy sand; single grain; loose; neutral.

Plymouth series

Parent Material: Sandy glacial outwash deposits
Landform: Outwash plains
Depth to Bedrock: Very deep
Drainage Class: Excessively drained
Permeability*:* Rapid in the solum; very rapid in the substratum
Soil Texture: Sandy loam or loamy sand in the surface; loamy fine sand or coarser in the subsoil; sand or coarse sand in the substratum
Coarse Fragments*:* 2 to 30 percent in the solum; 15 to 50 percent in the substratum
Hydrologic Soil Group*:* A
Range in Soil pH*:* Extremely acid to strongly acid
Typical Soil Profile:

A 0 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand; very weak medium granular structure; very friable; 5 percent fine gravel; very strongly acid.

Bw1 4 to 17 inches – yellowish brown (10YR 5/6) loamy sand; single grain; loose; 5 percent fine gravel; very strongly acid.

Bw2 17 to 27 inches – brown (7.5YR 5/4) loamy sand; massive; very friable; 10 percent fine gravel; very strongly acid.

2C 27 to 70 inches – yellowish brown (10YR 5/6) gravelly coarse sand; single grain; loose; 30 percent gravel; very strongly acid.

Pompton series

Parent Material: Glacial outwash
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained and somewhat poorly drained
Soil Texture: Silt loam, loam, or sandy loam in the surface; sandy loam in the subsoil; sandy loam or coarser in the substratum
Coarse Fragments*:* 0 to 35 percent in the solum; 0 to 75 percent in the substratum
Permeability Class*:* Moderately rapid in the solum; rapid or very rapid in the substratum
Hydrologic Soil Group*:* B
Range in Soil pH*:* Very strongly acid to moderately acid
Typical Soil Profile:

Ap 0 to 10 inches - very dark grayish brown (10YR 3/2) loam; weak fine granular parting to weak fine subangular blocky structure; very friable; 3 percent gravel; moderately acid.

Bw1 10 to 20 inches - brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; very friable; common medium faint strong brown (7.5YR 5/6) and few medium distinct yellowish brown (10YR 5/8) redoximorphic features; 3 percent gravel; moderately acid.

Bw2 20 to 40 inches; strong brown (7.5YR 4/6) loam; moderate medium and coarse subangular blocky structure; very friable; common fine and medium faint brown (7.5YR 5/4) and few fine distinct pinkish gray (7.5YR 6/2) redoximorphic features; 5 percent gravel; moderately acid.

C 40 to 72 inches; strong brown (7.5YR 4/6) sandy loam; weak medium subangular blocky structure; very friable; few fine distinct light gray (10YR 7/2) silt lenses; common fine faint strong brown (7.5YR 5/6) redoximorphic features; moderately acid.

Riverhead series

Parent Material: Glacial outwash derived mainly from granitic materials
Landform: Outwash plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Moderately rapid in the solum; very rapid in the substratum
Soil Texture: Loam or sandy loam in the surface; sandy loam or loamy sand in the subsoil; loamy sand or coarser in the substratum
Coarse Fragments*:* 0 to 35 percent in the solum; 5 to 40 percent in the substratum
Range in Soil pH*:* Extremely acid to moderately acid
Hydrologic Soil Group*:* B
Typical Soil Profile:

Ap 0 to 12 inches - brown (10YR 4/3) sandy loam; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.
Bw 12 to 27 inches - strong brown (7.5YR 5/6) sandy loam; very weak medium subangular blocky structure parting to weak fine granular; friable; 5 percent gravel; strongly acid.
BC1 27 to 32 inches - yellowish brown (10YR 5/4) loamy sand; very weak fine granular structure; very friable; 10 percent gravel; strongly acid.
2BC2 32 to 35 inches - yellowish brown (10YR 5/4) gravelly loamy sand; massive; friable; 30 percent gravel; strongly acid.
2C1 35 to 40 inches - brown (7.5YR 4/4) sand; single grain; loose; 10 percent gravel; strongly acid; abrupt smooth boundary.
2C2 40 to 65 inches - very pale brown (10YR 7/4) coarse and medium sand stratified with 2-inch layers of gravel, 8 to 24 inches apart; single grain; loose; strongly acid.

Shea series

Parent Material: Loamy fill overlying an asphalt or concrete layer
Landform: Anthropogenic urban fill plains
Depth to Bedrock: Very deep to bedrock, but shallow to the paved layer
Drainage Class: Well drained
Permeability*:* Moderately rapid in the in the loamy cap, impermeable in the paved layer
Soil Texture*:* Silt loam, loam, or sandy loam throughout
Coarse Fragments*:* 0 to 25 percent
Range in Soil pH*:* Strongly acid to slightly alkaline
Hydrologic Soil Group*:* D
Typical Soil Profile:

A 0 to 3 inches - dark yellowish brown (10YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; 1 percent gravel; strongly acid.
Bw 3 to 11 inches - dark yellowish brown (10YR 4/4) sandy loam; weak very fine subangular blocky structure; very friable; 1 percent gravel; moderately acid.
C 11 to 16 inches - dark yellowish brown (10YR 4/6) sandy loam; massive; very friable; 6 percent gravel-sized artifacts and 3 percent gravel; moderately acid.
2R 16 to 24 inches - unweathered impermeable asphalt; massive; rigid.
3C 24 to 65 inches - dark yellowish brown (10YR 4/4) sandy loam; massive; friable; moderately acid.

Sutton series

Parent Material: Glacial till derived mainly from gneiss and schist
Landform: Till plains and hills
Depth to Bedrock: Very deep
Drainage Class: Moderately well drained
Permeability*:* Moderate or moderately rapid

Soil Texture: Loam or sandy loam throughout
Coarse Fragments*:* 5 to 35 percent in the solum; 5 to 50 percent in the substratum
Range in Soil pH*:* Very strongly acid to moderately acid
Hydrologic Soil Group*:* B
Typical Soil Profile:

A 1 to 6 inches - very dark brown (10YR 2/2) fine sandy loam; weak medium granular structure; very friable; 5 percent gravel; strongly acid.

Bw1 6 to 12 inches - brown (7.5YR 4/4) fine sandy loam; weak fine and medium subangular blocky structure; friable; 7 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

Bw2 12 to 24 inches - yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; common fine and medium prominent light brownish gray (2.5Y 6/2) and yellowish red (5YR 5/6) redoximorphic features; 7 percent gravel and 3 percent cobbles; moderately acid.

Bw3 24 to 28 inches - yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; common medium prominent light brownish gray (2.5Y 6/2), reddish brown (5YR 4/4), and strong brown (7.5YR 5/6) redoximorphic features; 7 percent gravel and 3 percent cobbles; moderately acid.

C1 28 to 36 inches - brown (10YR 5/3) gravelly fine sandy loam; weak thick platy structure; firm; common medium distinct light brownish gray (2.5Y 6/2) and common medium prominent strong brown (7.5YR 5/6) redoximorphic features; 12 percent gravel and 3 percent cobbles; moderately acid.

C2 36 to 65 inches - light olive brown (2.5Y 5/4) gravelly sandy loam; massive; friable; 20 percent gravel and 5 percent cobbles; moderately acid.

Todthill series

Parent Material: Glacial till overlying serpentinite bedrock
Landform: Bedrock controlled hills and ridges, modified by glacial action
Depth to Bedrock: Moderately deep
Drainage Class: Well drained
Permeability*:* Moderate
Soil Texture*:* Loam or sandy loam throughout
Coarse Fragments*:* 0 to 30 percent in the solum; 5 to 40 percent in the substratum
Range in Soil pH*:* Moderately acid to slightly alkaline
Hydrologic Soil Group*: C*
Typical Soil Profile:

A 0 to 7 inches - very dark gray (10YR 3/1) loam; strong fine granular structure; very friable; 7 percent gravel and 1 percent cobbles; slightly acid.

AB 7 to 12 inches - dark reddish brown (5YR 3/3) loam; moderate medium subangular blocky structure; very friable; 4 percent gravel and 1 percent cobbles; neutral.

Bw 12 to 30 inches - dark reddish brown (5YR 3/4) very gravelly fine sandy loam; moderate medium subangular blocky structure; friable; 30 percent gravel and 5 percent cobbles; neutral.

2R 30 inches - greenish gray (10YR 6/1) serpentinite bedrock**.**

Unadilla series

Parent Material: Silty glacio-lacustrine sediments or old alluvial deposits
Landform: Valley terraces and lacustrine plains
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Moderate in the solum; moderately rapid or rapid in the substratum
Soil Texture: Silt loam or very fine sandy loam in the surface and subsoil; silt loam, very fine sandy loam, or loamy very fine sand to 40 inches; fine sandy loam or coarser below
Coarse Fragments*:* 0 to 5 percent in the solum; 0 to 60 percent in the substratum
Range in Soil pH*:* Very strongly acid to slightly alkaline
Hydrologic Soil Group*:* B

Typical Soil Profile:

Ap 0 to 8 inches - brown (10YR 4/3) silt loam; moderate fine and very fine granular structure; very friable; slightly acid.

Bw1 8 to 12 inches - light yellowish brown (10YR 6/4) silt loam; weak medium subangular blocky structure; friable; moderately acid.

Bw2 12 to 18 inches - yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure - firm; strongly acid.

Bw3 18 to 31 inches - light yellowish brown (10YR 6/4) silt loam; moderate medium subangular blocky structure; firm; strongly acid.

BC 31 to 42 inches - yellowish brown (10YR 5/4) very fine sandy loam; weak medium and coarse subangular blocky structure; firm; strongly acid.

2C 42 to 65 inches - dark grayish brown (10YR 4/2) stratified very gravelly sand; single grain; loose; neutral.

Verrazano series

Parent Material: Loamy fill over sandy sediments
Landform: Anthropogenic fill areas near coastal waterways
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Moderate in the loamy fill; very rapid in the sandy substratum
Soil Texture: Loam or sandy loam in the fill; fine sand or coarser below
Coarse Fragments*:* 0 to 5 percent in the solum and 0 to 60 percent in the substratum
Range in Soil pH*:* Extremely acid to slightly acid in the loamy fill; very strongly acid to slightly alkaline in the sandy substratum
Hydrologic Soil Group*:* B
Typical Soil Profile:

A 0 to 3 inches - very dark gray (10YR 3/1) sandy loam; moderate medium subangular blocky structure; very friable; 6 percent gravel; extremely acid.

Bw 3 to 17 inches - very dark grayish brown (10YR 3/2) sandy loam; moderate medium subangular blocky structure; friable; 6 percent gravel; very strongly acid.

BC 17 to 24 inches - very dark grayish brown (10YR 3/2) loam; moderate medium subangular blocky structure; friable; 6 percent gravel; moderately alkaline.

2C1 24 to 60 inches - 95 percent light yellowish brown (2.5Y 6/3) and 5 percent reddish gray (5YR 5/2) sand; massive; very friable; 5 percent gravel; moderately acid.

2C2 60 to 80 inches - light olive brown (2.5Y 5/3) sand; massive; very friable; 5 percent gravel; slightly acid.

Wareham series

Parent Material: Sandy glacial outwash deposits
Landform: Outwash plains
Depth to Bedrock: Very deep
Drainage Class: Poorly drained
Permeability*:* Rapid
Soil Texture: Loamy sand or sand throughout
Coarse Fragments*:* 0 to 15 percent to a depth of 40 inches; 0 to 60 percent below
Range in Soil pH*:* Extremely acid to strongly acid throughout
Hydrologic Soil Group*:* D
Typical Soil Profile:

Oa 0 to 1 inches - black (10YR 2/2) highly decomposed (sapric) plant material.
A 1 to 7 inches - very dark grayish brown (10YR 3/2) loamy sand; weak medium granular structure; very friable; very strongly acid.
Bw 7 to 17 inches - yellowish brown (10YR 5/4) loamy coarse sand; single grain; loose; common medium prominent yellowish red (5YR 5/6) and common medium distinct light brownish gray (10YR 6/2) redoximorphic features; very strongly acid.
Cg1 17 to 37 inches - light brownish gray (2.5Y 6/2) loamy coarse sand; single grain; loose; common medium and coarse prominent strong brown (7.5YR 5/6) and common medium and coarse faint light brownish gray (10YR 6/2) redoximorphic features; very strongly acid.
Cg2 37 to 60 inches - pale olive (5Y 6/3) coarse sand; single grain; loose; many medium and coarse prominent light olive brown (2.5Y 5/6) and brown (7.5YR 5/2) redoximorphic features; strongly acid.

Wethersfield series

Parent Material: Dense basal till derived mainly from red sedimentary rocks
Landform: Till plains and hills
Depth to Bedrock: Very deep
Drainage Class: Well drained
Permeability*:* Moderately rapid or moderate in the solum; slow or very slow in the dense substratum
Soil Texture: Silt loam, loam, or sandy loam throughout
Coarse Fragments*:* 5 to 25 percent rock fragments in the solum; 5 to 35 percent in the substratum
Range in Soil pH*:* Extremely acid to mildly alkaline
Hydrologic Soil Group*:* C
Typical Soil Profile:
A 0 to 3 inches - dark brown (7.5YR 3/2) loam; moderate medium granular structure; friable; 10 percent gravel; strongly acid.
Bw1 3 to 13 inches - reddish brown (5YR 4/4) loam; weak medium subangular blocky structure; friable; 10 percent gravel; strongly acid.
Bw2 13 to 27 inches - dark reddish brown (5YR 3/3) gravelly loam; weak medium subangular blocky structure; friable; 10 percent gravel and 5 percent cobbles; strongly acid.
Cd 27 to 65 inches - reddish brown (2.5YR 4/4) gravelly loam; weak thick platy structure; very firm and brittle; few silt films and black coatings on some plates; 15 percent gravel and 5 percent cobbles; strongly acid.

Wilbraham series

Parent Material: Dense basal till derived mainly from red sedimentary rocks
Landform: Till plains and hills
Depth to Bedrock: Very deep
Drainage Class: Poorly drained
Permeability*:* Moderate in the solum; slow or very slow in the dense substratum
Soil Texture: Silt loam or loam in the surface; silt loam, loam, or fine sandy loam in the subsoil and substratum
Coarse Fragments*:* 5 to 25 percent rock fragments in the solum; 5 to 35 percent in the substratum
Range in Soil pH*:* Very strongly acid to moderately acid
Hydrologic Soil Group*:* D

Typical Soil Profile:

A 0 to 4 inches - very dark gray (10YR 3/1) silt loam; weak medium granular structure; very friable; 5 percent gravel; strongly acid.

Bw1 4 to 8 inches - dark reddish brown (5YR 3/3) silt loam; weak coarse subangular blocky structure; very friable; common medium prominent pinkish gray (7.5YR 6/2) redoximorphic features; 10 percent gravel; strongly acid.

Bw2 8 to 20 inches - reddish brown (5YR 4/4) silt loam; weak coarse subangular blocky structure; friable; common medium prominent reddish gray (5YR 5/2) redoximorphic features; 10 percent gravel and 3 percent cobbles; strongly acid.

Cd 20 to 65 inches - dark reddish brown (5YR 3/3) gravelly loam; weak thick platy structure; very firm and brittle; silt films and black (10YR 2/1) coatings on some plates; many medium distinct brown (7.5YR 5/2) and dark brown (7.5YR 4/4) redoximorphic features; 20 percent gravel and 5 percent cobbles; strongly acid.

Windsor series

Parent Material: Sandy glacial outwash
Landform: Outwash plains
Depth to Bedrock: Very deep
Drainage Class: Excessively drained
Permeability*:* Rapid to very rapid
Soil Texture: Loamy fine sand or loamy sand in the surface; loamy fine sand, loamy sand, fine sand or sand in the subsoil; loamy fine sand, loamy sand, fine sand, or sand in the substratum. The loamy substratum has textures of sandy loam through sandy clay loam beginning at a depth between 40 to 60 inches.
Coarse Fragments*:* 0 to 10 percent rock fragments in the solum; 0 to 15 percent in the substratum
Range in Soil pH*:* Very strongly acid to slightly acid
Hydrologic Soil Group*:* A
Typical Soil Profile:

Oi 0 to 2 inches – black (10YR 2/1) slightly decomposed plant material.

A 2 to 3 inches - black (10YR 2/1) loamy sand; weak fine granular structure; very friable; strongly acid.

Bw1 3 to 8 inches - brown (10YR 4/3).loamy sand; weak medium subangular blocky structure; very friable; strongly acid.

Bw2 8 to 13 inches - yellowish brown (10YR 5/6).loamy sand; weak medium subangular blocky structure; friable; strongly acid.

Bw3 13 to 27 inches - strong brown (7.5YR 5/6) loamy sand; weak medium subangular blocky structure; friable; strongly acid.

C 27 to 60 inches - strong brown (7.5YR 4/6) loamy sand, single grain; friable; 2 percent gravel in pockets; strongly acid.

Woltalf series

Parent Material: Glacial till overlying serpentinite bedrock
Landform: Bedrock controlled hills and ridges, modified by glacial action
Depth to Bedrock: Shallow
Drainage Class: Well drained
Permeability*:* Moderately rapid
Soil Texture: Loam or sandy loam throughout
Coarse Fragments*:* 35 to 70 percent (average)
Range in Soil pH*:* Moderately acid to slightly alkaline
Hydrologic Soil Group*: C*
Typical Soil Profile:

A 0 to 3 inches – very dark grayish brown (10YR 3/2) loam; strong medium granular structure; very friable; 4 percent gravel and 1 percent cobbles; moderately acid.

AB 3 to 8 inches – dark brown (7.5YR 3/2) gravelly loam; weak medium subangular blocky structure; friable; 15 percent gravel and 5 percent cobbles; slightly acid.

Bw 8 to 17 inches – reddish brown (5YR 4/4) very gravelly loam; weak medium subangular blocky structure; friable; 50 percent gravel and 10 percent cobbles; neutral.
2R 17 inches – greenish gray (10Y 6/1) serpentinite bedrock.

Miscellaneous Areas

Beaches consist of nearly level to gently sloping areas of sand or sand and gravel adjacent to the Atlantic Ocean. The sand may be underlain by muck and other non soil material. These areas are inundated twice each day with saltwater at high tide. Beaches are not considered soil because they do not support vegetation, and are frequently reworked by wave and wind action. Beaches can be observed along shorelines; the width and shape of Beaches can change during each major storm.

Dune land consists of sand in hills or ridges and intervening troughs, drifted and piled up by the wind, and either actively shifting or so recently stabilized that no soil horizons have developed.

Pavement & buildings consist of those areas in which 80% or more of the surface is covered by asphalt, concrete, buildings or other impervious materials. Substratum phases are added to provide additional information on the type of surficial materials present before development.
The postglacial substratum refers to various types of materials (e.g., beach, stream) deposited since the retreat of the last glacier.
The till substratum phase refers to unsorted and unstratified glacial till deposits.
The outwash substratum phase refers to sorted or stratified glacial meltwater deposits.
The wet substratum and wet subsoil phases refer to areas of tidal marsh, swamp, or water which were filled for development.

Relationship Between Parent Material and Drainage Class

Soil Characteristics and Parent Material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Soils Formed in Glacial Till							
)ense Basal Till or Fragipan (firm substratum)							
Dense basal till from granite, gneiss, schist; sandy substratum			Montauk				
Dense basal till from red sedimentary material			Wethersfield	Ludlow		Wilbraham	
Fragipan & argillic horizon in till from red sedimentary material			Boonton	Boonton	Haledon	Hasbrouck	
Ablation Till (friable substratum)							
Moderately deep (20-40") till over granite, gneiss or schist bedrock		Chatfield	Chatfield				
Friable till from granite, gneiss, or schist			Charlton	Sutton		Leicester	
Shallow (10-20") till over serpentinite bedrock			Woltalf				
Moderately deep (20-40") till over serpentinite bedrock			Todthill				
Friable till from red sedimentary material			Cheshire				

Soil Characteristics and Parent Material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Soils Formed in Glacial Outwash							
Glacio-Fluvial							
Granite, gneiss or schist; loamy with sandy substratum			Riverhead	Pompton			
Granite, gneiss or schist; sandy with mixed mineralogy	Windsor			Deerfield		Wareham	
Granite, gneiss or schist; sandy, predominantly quartz	Plymouth						
Red sedimentary; loamy over sandy			Branford				
Glacio-Lacustrine or Old Alluvium							
Variable lithology; silty			Unadilla				
Soil Formed on Marshes or Beaches							
>51" of organic matter in tidal marshes							Ipswich
16-51” of organic matter over sandy sediments in tidal marshes							Pawcatuck
8-16” of organic matter over sandy sediments in tidal marshes							Matunuck
Sandy marine or eolian deposits	Hooksan						

Soil Characteristics and Parent Material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Soil Formed on Human Constructed Landforms							
Clean Fill (<10% human artifacts)							
10 to 20" of loamy fill over paved layer			Shea				
10 to 40" of loamy fill over truncated soil; dense till within 40 inches			Canarsie				
10 to 40" of loamy fill over intact soil; dense till > 40"			Foresthills	North Meadow			
10 to 40" of loamy filll over outwash			Flatbush				
10 to 40" of loamy fill over sandy material			Verrazano				
>40" of loamy fill			Greenbelt				
>40" of loamy fill with >35% coarse fragments			Central Park				
Fill with Construction Debris							
>40” of loamy fill with construction debris			Ebbets				
>40” of loamy fill with construction debris; >35% coarse fragments			Laguardia				
>40” of loamy fill with construction debris; ≥90% coarse fragments			Inwood				

Soil Characteristics and Parent Material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Soil Formed on Human Constructed Landforms							
Dredge Materials							
>40" of sandy dredge			Bigapple	Fortress	Barren	Jamaica	
Fly Ash							
>40" of fly ash					Flatland	Fishkill	
Solid Waste Landfill							
Sandy cap 10 to 24" thick			Gravesend				
Sandy cap 24 to 40" thick			Oldmill				
Loamy cap 10 to 24" thick			Greatkills				
Loamy cap 24 to 40" thick			Freshkills				
Loamy cap over clay liner; 36 to 48" combined thickness				Kleinekill			

Classification of the Soils

According to *Keys to Soil Taxonomy, Ninth Edition* (2003), the soils are classified as follows:

Barren	Mixed, mesic Typic Psammaquents
Bigapple	Mixed, mesic Typic Udipsamments
Boonton	Coarse-loamy, mixed, active, mesic Typic Fragiudalfs
Branford	Coarse-loamy over sandy or sandy-skeletal, mixed, active, mesic Typic Dystrudepts
Canarsie	Coarse-loamy, mixed, superactive, nonacid, mesic Typic Udorthents
Centralpark	Loamy-skeletal, mixed, superactive, mesic Typic Dystrudepts
Charlton	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Chatfield	Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts
Cheshire	Coarse-loamy, mixed, semiactive, mesic Typic Dystrudepts
Deerfield	Mixed, mesic Aquic Udipsamments
Ebbets	Coarse-loamy, mixed, superactive, nonacid, mesic Typic Udorthents
Fishkill	Coarse-loamy, mixed, active, nonacid, mesic Typic Endoaquents
Flatbush	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Flatland	Coarse-loamy, mixed, active, nonacid, mesic Typic Endoaquents
Foresthills	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Fortress	Mixed, mesic Aquic Udipsamments
Freshkills	Coarse-loamy, mixed, active, hyperthermic Typic Dystrudepts
Gravesend	Sandy-skeletal, mixed, hyperthermic Typic Udorthents
Greatkills	Loamy-skeletal, mixed, superactive, nonacid, hyperthermic Typic Udorthents
Greenbelt	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Haledon	Coarse-loamy, mixed, active, mesic Aquic Fragiudalfs
Hooksan	Mesic, uncoated Typic Quartzipsamments
Inwood	Fragmental, mixed, mesic Typic Udorthents
Ipswich	Euic, mesic Typic Sulfihemists
Jamaica	Mixed, mesic Typic Psammaquents
Kleinekill	Coarse-loamy over clayey, mixed, active, nonacid, hyperthermic Aquic Udorthents
Laguardia	Loamy-skeletal, mixed, active, nonacid, mesic Typic Udorthents
Leicester	Coarse-loamy, mixed, active, acid, mesic Aeric Endoaquepts
Ludlow	Coarse-loamy, mixed, semiactive, mesic Aquic Dystrudepts
Matunuck	Sandy, mixed, mesic Typic Sulfaquents
North Meadow	Coarse-loamy, mixed, active, nonacid, mesic Aquic Udorthents
Oldmill	Sandy, mixed, hyperthermic Typic Udorthents
Pawcatuck	Sandy or sandy-skeletal, mixed, euic, mesic Terric Sulfihemists
Plymouth	Mesic, coated Typic Quartzipsamments
Pompton	Coarse-loamy, mixed, active, mesic Aquic Dystrudepts
Riverhead	Coarse-loamy, mixed, active, mesic Typic Dystrudepts
Shea	Coarse-loamy, mixed, active, nonacid, mesic Typic Udorthents
Sutton	Coarse-loamy, mixed, active, mesic Aquic Dystrudepts
Todthill	Coarse-loamy, mixed, superactive, mesic Dystric Eutrudepts
Unadilla	Coarse-silty, mixed, active, mesic Typic Dystrudepts
Verrazano	Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, nonacid, mesic Typic Udorthents
Wareham	Mixed, mesic Humaqueptic Psammaquents
Wethersfield	Coarse-loamy, mixed, active, mesic Oxyaquic Dystrudepts
Wilbraham	Coarse-loamy, mixed, active, mesic Aquic Dystrudepts
Windsor	Mixed, mesic Typic Udipsamments
Wotalf	Loamy-skeltal, mixed, superactive, mesic Lithic Eutrudepts

Soils Information Available Online: NRCS Soils website (http://soils.usda.gov)
Under the *Soil Survey* link*:* Soil Surveys available online, status maps, lab and research data on selected soil series.
Under *Soil Use:* Information on *Hydric Soils* and *Soil Quality,* the latter includes *Soil Quality Assessment*, the *Soil Biology Primer*, and, under *Land Management and Soil Quality*, Urban Soil Quality Technical Notes on compaction, heavy metal contamination, and erosion and sedimentation from construction sites. Also information on Urban Soil Issues, and the *Urban Soil Primer*, an introduction to urban soils.
Under *Soil Education:* Soil Facts, a Glossary, and information for students and teachers.
Under *Technical References*: Books, manuals, guides, etc. for mapping, describing, analyzing, and investigating soils, Information on *Classification*, including Official Series Descriptions, the *Field Book for Describing and Sampling Soils*, policies and procedures for Soil Survey, a lab methods manual.

GLOSSARY

Artifacts are human altered materials such as coal ash, iron ore slag, asphalt; human refuse such as garbage or sewage sludge; human processed natural materials such as lumber; and human manufactured material such as plastic, fiberglass, brick, cinder block, concrete, iron and steel, organic byproducts, and other building debris. Garbage or refuse fragments include food and household cooking waste, soiled rags and paper cleaning products, broken household objects, empty glass, paper, and plastic containers and bags, mail, magazines, and newspapers, and simple household construction materials normally disposed of by homeowners and transported to dumps and landfills. They are generally described in the coarse fragment size range (>2mm).

Coarse Fragments are those particles in mineral soil material greater than 2mm. USDA recognizes the following:

Gravel	2 to 76mm (3 inches)
Cobbles	76 to 250mm (10 inches)
Stones	250 to 600mm (24 inches)
Boulders	> 600mm

Coarse fragments are described / estimated in the field on a percent volume basis.
Textural modifiers are used when the volume exceeds 15 percent as follows:

15 to < 35	Use adjective for appropriate size; e.g., *gravelly.*
35 to <60	Use “very” with the appropriate size adjective; e.g., *very gravelly.*
60 to <90	Use “extremely” with the appropriate size adjective; e.g., *extremely gravelly.*
≥90	Use the appropriate noun for the dominant size class without an adjective or modifier; gravel.

Drainage Class refers to the frequency and duration of wet periods under conditions similar to those under which the soil developed. Classes include:
Excessively and somewhat excessively drained: The seasonal high water table is rarely higher than 60 to 72 inches from the surface for any significant period during the growing season. Most of these soils are sandy or sandy skeletal.
Well drained: The seasonal high water table is rarely higher than 40 inches from the surface for any significant period during the growing season.
Moderately well drained: The seasonal high water table is between 18 and 40 inches below the surface for a significant period during the growing season.
Somewhat poorly drained: The seasonal high water table is between 6 and 18 inches below the surface for a significant period during the growing season.
Poorly drained: The seasonal high water is at, or within 6 inches below the surface for a significant period during the growing season. These soils may be ponded for brief periods outside of the growing season.
Very poorly drained: The seasonal water table is at, or ponded above, the surface for a significant period during the growing season.

Dense basal till is unconsolidated material deposited and compacted beneath a glacier, having a relatively high bulk density.

Dredge or dredged material is accumulated sediment removed from a subaqueous environment, usually to facilitate shipping, and redeposited by mechanical activities.

Eluvial refers to the process by which soil material is removed in suspension or solution from a layer, also described as leaching.

Eolian refers to earth material transported and deposited by the wind including dune sands, sand sheets, and loess deposits.

Fragipan is a natural subsurface soil horizon with very low organic matter, high bulk density and/or high mechanical strength relative to overlying and underlying horizons; has hard or very hard consistence (seemingly cemented) when dry, but shows a moderate to weak brittleness when moist. The layer is typically slowly or very slowly permeable to water and is root restrictive.

Gleyed refers to a soil condition resulting from prolonged soil saturation, manifested by the presence of bluish, greenish, or gray colors through the soil mass, brought about by the reduction of iron to the ferrous state. See ***Processes in Saturated Soils*** in the Glossary.

Hydrologic Soil Group is a soil interpretation or rating system for runoff potential. The chief consideration is the inherent capacity of the bare soil to permit infiltration. The soil properties that influence this potential are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. Slope and type of plant cover are not considered, but are separate factors in predicting runoff. The classes are:
A – Soils with low runoff potential and high infiltration rates even when thoroughly wet. Deep, well to excessively drained sand or gravel with very rapid and rapid permeability.
B – Soils with moderate infiltration rates when thoroughly wet; moderately deep to deep, moderately well drained to well drained soils with moderately fine to moderately coarse textures, and moderately rapid to moderate permeability.
C – Soils with low infiltration rates when thoroughly wet; soils with a layer that impedes downward movement of water and soils with moderately fine to fine textures and moderately slow and slow permeability.
D – Soils with high runoff potential and very low infiltration rates when thoroughly wet. Clayey soils with a high swelling potential, soils with a high water table, soils with a claypan or clay layer near the surface, and shallow soils over nearly impermeable materials.

Illuvial refers to a process in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. An illuvial horizon is a horizon of accumulation.

Muck is highly decomposed organic soil material in which the original plant parts are not recognizable. Usually darker in color, higher in bulk density, and lower in water holding capacity than peat.

Mucky is a textural modifier that indicates a high organic matter content (>10 % by weight) in a mineral soil.

Mucky peat is organic soil material of an intermediate stage of decomposition, in which a significant part of the original plant parts are recognizable and a significant part is not.

Particle size separates (USDA) for mineral soil include:
sand - 2 to 0.05 millimeters - gritty feel - can be seen with the eye
silt - 0.05 to .002 millimeters - smooth feel - can be seen with a light microscope
clay - less than .002 millimeters -sticky feel - can be seen with an electron microscope

Sand and silt, mostly quartz, are relatively inert; they form the 'soil skeleton.' Clay particles (layer silicates & oxides) are the active portion of the mineral soil, they have an electrical charge and a high surface area resulting in a high attraction for water, nutrients, other clay particles.

Peat is slightly decomposed organic soil material in which the original plant parts are recognizable.

Permeability describes the ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. The permeability classes are:

	in hr^{-1}	μms^{-1}
Very rapid	≥20	≥141
Rapid	6-<20	42-141
Moderately rapid	2-<6	14-42
Moderate	0.6-<2	4-14
Moderately slow	0.2-<0.6	1.4-4
Slow	0.06-<0.2	0.42-1.4
Very Slow	0.0015-<0.06	0.01-0.42
Impermeable	0.00-<0.0015	0.00-0.01

Processes in Saturated Soils

Hydric soils are defined as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic (in the absence of oxygen) conditions in the upper part of the soil. Prolonged saturation during the growing season results in a depletion of oxygen by plants and microorganisms in the soil. This lack of oxygen restricts aerobic root respiration and aerobic microbial reactions, and promotes the following biogeochemical processes: 1) a transformation of several elements from oxidized to reduced chemical forms; and 2) an accumulation of organic matter. Evidence of these processes is useful in identifying hydric soils.

The microbial breakdown of soil organic matter is an oxidation-reduction process. Under aerobic conditions, organic matter is oxidized (looses electrons), and oxygen (O_2) is reduced (gains electrons) and combines with hydrogen to form water. The ultimate products of aerobic degradation are water and CO_2. When the soil is flooded, the amount of oxygen is decreased; with continued breakdown of organic matter the oxygen can be all used up, and the soil becomes anaerobic. Biodegradation of organic matter now continues under different conditions; different groups of microbes go to work using different electron acceptors instead of oxygen. The decomposition processes are not as efficient or as complete as the aerobic one. A sequence of oxidation-reduction (electron transfer) reactions takes place. Nitrates, manganese oxides, iron oxides, sulfates, and carbon dioxide in soil are used as electron acceptors in anaerobic microbial reactions, in that specific order. After the removal of oxygen, nitrate is the first soil component to be reduced, then manganese, then iron, and eventually sulfate and CO_2. These transformations bring about the translocation and/or accumulation of these elements, which can result in morphological features useful in the identification of saturated zones in soil.

Nitrogen transformations in hydric soils can make the nutrient less available for plant uptake. However, excessive amounts of nitrate, the mobile form of nitrogen, can be reduced to prevent leaching losses.

Iron is one of the most important coloring agents in soil. Oxidized, or ferric (Fe^{+3}), iron compounds are responsible for the brown, yellow, and red colors in soil. When iron is reduced to the ferrous (Fe^{+2}) form, it becomes mobile, and can be removed from certain areas of the soil. When the iron is removed, a gray color remains, or the reduced iron color persists in shades of green or blue. Upon aeration, reduced iron can be re-oxidized and re-deposited, sometimes in the same horizon, resulting in a variegated or mottled color pattern. These soil color patterns resulting from saturation, or ***redoximorphic features***, can indicate the duration of the anaerobic state, ranging from brown with a few mottles, to complete gray or ***gleization*** of the soil. Soils that are dominantly gray with brown or yellow mottles immediately below the surface horizon are usually hydric.

Manganese transformations are similar to iron in that manganic (Mn^{+4}) compounds are reduced to more soluble manganous (Mn^{+2}) forms. Re-oxidized and re-deposited manganic oxides appear as black films or coats on soil particles.

Sulfates in soils are reduced to sulfides when soils are nearly permanently saturated. The presence of hydrogen sulfide can be detected by the "rotten egg" odor, which is used as a hydric soil indicator. Sulfides can be toxic to microbes and plants, and upon re-oxidation, can lead to extremely acid conditions in soils when sulfuric acid is formed. Sulfides are more common in coastal wetlands than freshwater because of higher amounts of sulfate in seawater.

Certain bacteria can use CO_2 as an electron acceptor, resulting in the formation of methane (CH_4), or "swamp gas." Methane production is generally higher in freshwater environments.

As the decomposition of organic residues proceeds in a very inefficient and slow manner when the soil surface is saturated, eventually the amount of organic matter can accumulate significantly. Nearly all soils have some organic matter, but when the content exceeds 20 to 35% (on a dry weight basis), it is considered organic soil material. Organic soil materials have a lower bulk density and a higher water and nutrient holding capacity than mineral soils. The term ***peat*** (or fibric organic material) has been used to refer to organic material in which the plant parts are still recognizable, and ***muck*** (sapric organic material) for that which is more decomposed, with no recognizable plant parts. ***Mucky peat*** (or hemic organic material) is intermediate between the two. As decomposition increases, organic material decreases in water holding capacity and bulk density, and becomes darker in color. If 16 inches or more of the upper 32 inches of a soil is organic material, the soil is considered an organic soil or ***histosol***. Wet mineral soils that do not have a sufficient thickness of organic materials to be classified as histosols can have an organic surface horizon 8 inches or more thick called a ***histic epipedon***.

Soil wetness can result from either a perched or a regional water table. A ***perched water table*** is caused by a hydraulically restrictive horizon, usually underlain by a more permeable horizon. A ***regional water table*** extends vertically without interruption, and is usually located in a low-lying area of the landscape.

Redoximorphic features are soil properties associated with wetness that result from the reduction and oxidation of iron and manganese compounds in the soil after saturation with water and desaturation, respectively. See ***Processes in Saturated Soils*** in the Glossary.

Soil Depth Classes denote the depth to bedrock:

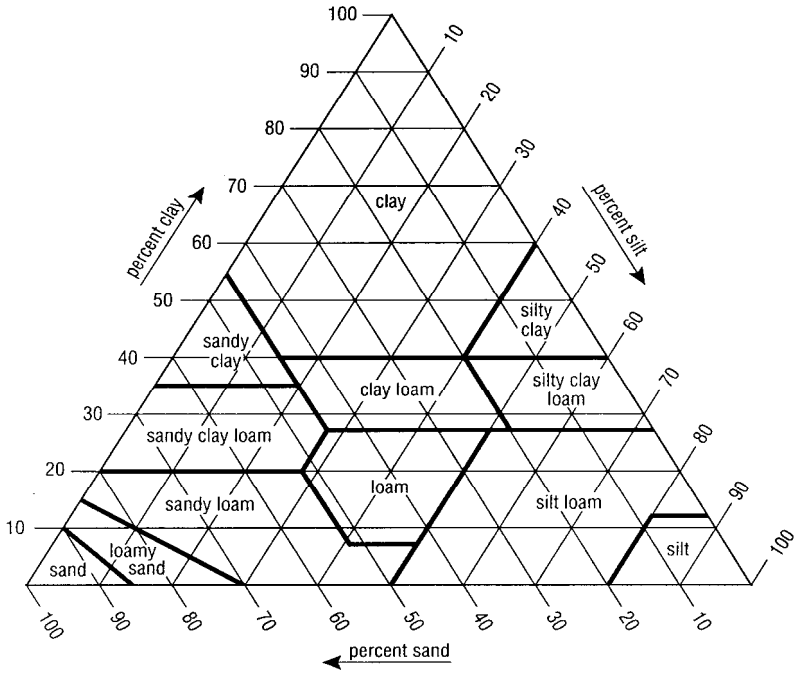
Very Deep	≥ 150cm	≥60 inches
Deep	100 to 150cm	40 to 60 inches
Moderately Deep	50 to 100cm	20 to 40 inches
Shallow	25 to 50cm	10 to 20 inches
Very Shallow	<25cm	<10 inches

Soil pH or reaction is a measure of acidity or alkalinity of a soil, expressed in pH values. The reaction classes are:

Extremely acid	< 4.5
Very Strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	≥ 9.1

Structure (soil) is the combination or arrangement of primary soil particles into secondary units or peds. The size, shape, and grade are all used to describe soil structure.

Soil texture refers to the relative amounts of the three particle size separates in mineral soil material. Varying proportions of each size give the soil a 'texture.' Soil scientists use 12 textural classes (see triangle below):



There are 12 subclasses, based on sand size distribution, which subdivide the sand, loamy sand, and sandy loam classes as follows:

***Coarse sand*:** A total of 25 percent or more very coarse and coarse sand and less than 50 percent of any other single grade of sand.

***Sand*:** A total of 25 percent or more very coarse, coarse, and medium sand, a total of less than 25 percent very coarse and coarse sand, and less than 50 percent fine sand and less than 50 percent very fine sand.

***Fine sand*:** 50 percent or more fine sand; or a total of less than 25 percent very coarse, coarse, and medium sand and less than 50 percent very fine sand.

***Very fine sand*:** 50 percent or more very fine sand.

***Loamy coarse sand*:** A total of 25 percent or more very coarse and coarse sand and less than 50 percent of any other single grade of sand.

***Loamy sand*:** A total of 25 percent or more very coarse, coarse, and medium sand and a total of less than 25 percent very coarse and coarse sand, and less than 50 percent fine sand and less than 50 percent very fine sand.

***Loamy fine sand*:** 50 percent or more fine sand; or less than 50 percent very fine sand and a total of less than 25 percent very coarse, coarse, and medium sand.

***Loamy very fine sand*:** 50 percent or more very fine sand.

***Coarse sandy loam*:** A total of 25 percent or more very coarse and coarse sand and less than 50 percent of any other single grade of sand.

Sandy loam: A total of 30 percent or more very coarse, coarse, and medium sand, but a total of less than 25 percent very coarse and coarse sand and less than 30 percent fine sand and less than 30 percent very fine sand; or a total of 15 percent or less very coarse, coarse, and medium sand, less than 30 percent fine sand and less than 30 percent very fine sand with a total of 40 percent or less fine and very fine sand.

Fine sandy loam: 30 percent or more fine sand and less than 30 percent very fine sand; or a total of 15 to 30 percent very coarse, coarse, and medium sand; or a total of more than 40

percent fine and very fine sand, one half or more of which is fine sand, and a total of 15 percent or less very coarse, coarse, and medium sand.
Very fine sandy loam: 30 percent or more very fine sand and a total of less than 15 percent very coarse, coarse, and medium sand; or more than 40 percent fine and very fine sand, more than one half or which is very fine sand, and a total of less than 15 percent very coarse, coarse, and medium sand.

Redoximorphic features are concentrations or depletions of iron or manganese which form in response to extended periods of saturation during the growing season. They are often used to interpret depth to water table in soil.

Sand size separates include the following:

***Very coarse sand*:**	2.0 to 1.0mm
***Coarse sand*:**	1.0 to 0.5mm
***Medium sand*:**	0.5 to 0.25mm
***Fine sand*:**	0.25 to 0.10mm
***Very fine sand*:**	0.10 to 0.05mm

Solum is the upper part of a soil profile, including the A, E, and B horizons, in which the processes of soil formation are active.

Subsoil is that portion of the soil profile below the topsoil and above the parent material. It includes the E and B soil horizons.

Substratum includes the C horizons and R layers below the depth of noticeable soil development; often the parent material of the soil above.

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