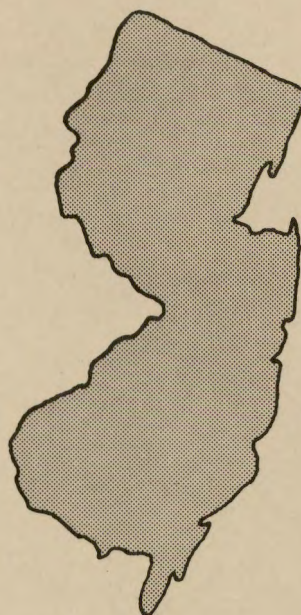


Productive Capacity of New Jersey Soils



A Soils Guide for Use in Connection With
the Valuation, Assessment, and Taxation
of Land Under the
FARMLAND ASSESSMENT ACT OF 1964
Chapter 48, Laws of 1964
(N. J. S. A. 54:4-23.1 et seq.)

New Jersey Agricultural Experiment Station
College of Agriculture
Rutgers - The State University
New Brunswick

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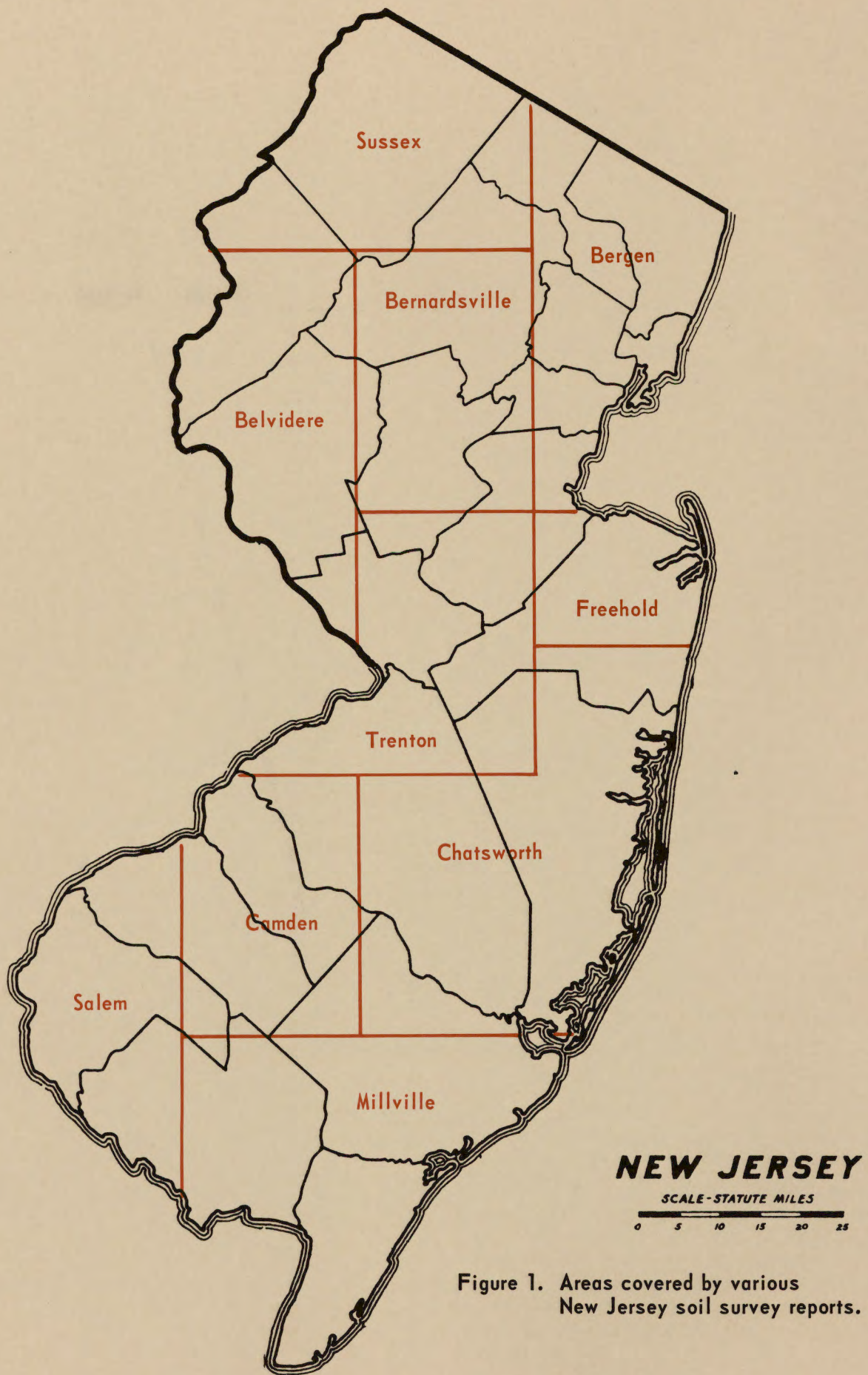


Figure 1. Areas covered by various New Jersey soil survey reports.

Productive Capacity of New Jersey Soils

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This guide has been compiled as an aid to assessors in connection with evaluating farmland in New Jersey under the Farmland Assessment Act of 1964. The guide is largely based on information from the soil survey reports published jointly by the U. S. Department of Agriculture and the New Jersey Agricultural Experiment Station.

The first soil survey report in New Jersey appeared in 1911, and by 1927 the surveys were completed. The list of the New Jersey soil surveys follows:

- Soil Survey of the Sussex Area, New Jersey -- 1911
H. Jennings, et al.
- Soil Survey of the Belvidere Area, New Jersey -- 1917
Austin L. Patrick, et al.
- Soil Survey of the Millville Area, New Jersey -- 1917
C. C. Engle, et al.
- Soil Survey of the Bernardsville Area, New Jersey -- 1919
Austin L. Patrick, et al.
- Soil Survey of the Chatsworth Area, New Jersey -- 1919
L. L. Lee, et al.
- Soil Survey of the Trenton Area, New Jersey -- 1921
L. L. Lee, et al.
- Soil Survey of the Salem Area, New Jersey -- 1923
R. T. Avon Burke, et al.
- Soil Survey of the Bergen Area, New Jersey -- 1925
L. L. Lee, et al.
- Soil Survey of the Camden Area, New Jersey -- 1926
R. T. Avon Burke and L. L. Lee
- Soil Survey of the Freehold Area, New Jersey -- 1927
L. L. Lee and J. E. Tine

Areas covered by the above surveys are shown in figure 1. In this guide the 215 soils of New Jersey are briefly described in nontechnical terms, and a few pertinent statements are made concerning their agricultural potential, adaptations, and limitations. Further, all kinds of soils have been placed into one of six groups as to their suitability for agriculture. These are as follows:

Group A -- Very productive farmland; suitable for permanent cultivation; with proper management yields tend to be high. Usually the most desirable soil in the area.

Group B -- Good farmland; suitable for permanent cultivation. Generally yields are good.

Group C -- Fair farmland; suitable for permanent cultivation but yields tend to be lower than those in group A or B. The limiting factors are usually shallowness, droughtiness, excessive moisture, or some other factor.

Group D -- Rather poor farmland; usually wet, stony, droughty, or otherwise unsuitable for permanent cultivation.

Group E -- Very poor farmland for tillage because of excessive water, shallowness, stoniness, droughtiness, or some other factor.

Group F -- Land unsuitable for agriculture. This consists of rock outcrop, rough stony land, coastal beaches, and clay pits.

In arriving at a realistic classification (placing each soil into one of six groups), the following factors were primarily used: general suitability of the soil for farming, mechanical composition, depth of the soil, drainage, stoniness, and other related properties. This grouping, however, does not take into consideration improved roads, highways, power-lines, water supply and related conditions, nearness to markets, topography, soil erosion, degree of slope, the general tilth of the soil that the farmer maintains, individual farming skills, or the size and condition of farm buildings.

Many wet soils have been assigned to one of two groups -- one if the soils are in their natural state and another if the soils have been artificially drained.

In using this report it is suggested that the assessor first consult the respective soil map to learn the names of the soils on the farm in question. A brief statement concerning the properties of each kind of soil will be found in this report.

In the soil descriptions considerable emphasis is placed on soil color. The reason for this approach is that soil colors are usually a guide to the "wetness" of the soil. Red, brown, and most yellow colors indicate good drainage, but gray colors (especially those that are somewhat mottled and designated as "glei") indicate more of a waterlogged condition in the soil.

A Glossary of Special Terms is on page 85.

Page	Soil	Soil Groups					
		Excellent	Good	Fair	Rather poor	Very poor	Unsuitable
		A	B	C	D	E	F
9	Alloway Loam				x		
9	Alloway Sandy Loam				x		
9	Alloway Silty Clay Loam				x		
10	Berks Shale Loam		x				
10	Bermudian Loam			x			
11	Bermudian Silt Loam			x			
11	Birdsboro Fine Sandy Loam	x					
11	Birdsboro Silt Loam	x					
12	Chenango Fine Sand			x			
12	Chenango Fine Sandy Loam	x					
12	Chenango Loam	x					
13	Chenango Loamy Sand	x					
13	Chenango Sand			x			
14	Chenango Sandy Loam		x				
14	Chenango Silt Loam	x					
14	Chester Gravelly Loam		x				
15	Chester Loam	x					
15	Chester Loam, Gravelly Phase		x				
15	Chester Loam, Stony Phase					x	
15	Chester Stony Loam					x	
16	Clyde Loam					x	
16	Clyde Silt Loam					x	
17	Clyde Stony Loam					x	
17	Coastal Beach						x
18	Codorus Loam			x			
18	Collington Clay Loam		x				
18	Collington Fine Sandy Loam	x					
19	Collington Fine Sandy Loam, Deep Phase	x					
19	Collington Fine Sandy Loam, Imperfectly Drained Phase		x				
19	Collington Fine Sandy Loam, Low Greensand-Content Phase		x				
20	Collington Loam	x					
20	Collington Loam, Imperfectly Drained Phase		x				
20	Collington Loam, Low Greensand- Content Phase	x					
21	Collington Loamy Sand		x				
21	Collington Loamy Sand, Low Greensand- Content Phase		x				

Page	Soil	Soil Groups					
		Excellent	Good	Fair	Rather poor	Very poor	Unsuitable
		A	B	C	D	E	F
21	Collington Sand			x			
22	Collington Sand, Low Greensand-Content Phase	x					
22	Collington Sandy Loam	x					
22	Collington Sandy Loam, Deep Phase	x					
23	Collington Sandy Loam, Deep Phase, Low Greensand-Content Phase	x					
23	Collington Sandy Loam, Imperfectly Drained Phase		x				
23	Collington Sandy Loam, Low Greensand-Content Phase		x				
24	Colts Neck Fine Sandy Loam	x					
24	Colts Neck Gravelly Sand		x				
24	Colts Neck Loam	x					
25	Colts Neck Loamy Sand		x				
25	Colts Neck Sandy Loam	x					
26	Colts Neck Sandy Loam, Eroded Phase		x				
27	Colts Neck Sandy Loam, Light-Textured Phase		x				
27	Croton Silt Loam				x		
27	Croton Silt Loam, Poorly Drained Phase					x	
28	Culvers Loam			x			
28	Culvers Stony Loam					x	
29	Dover Fine Sandy Loam			x			
29	Dover Gravelly Loam		x				
30	Dover Loam		x				
30	Dover Loam, Light Phase	x					
30	Dover Loam, Sandy Phase			x			
31	Dover Stony Loam					x	
31	Dunellen Loam	x					
31	Dunellen Sandy Loam	x					
32	Dutchess Loam	x					
32	Dutchess Loam, Shaly Phase		x				
33	Dutchess Shale Loam		x				
34	Dutchess Shale Loam, Steep Phase				x		
34	Dutchess Silt Loam	x					
34	Dutchess Stony Loam					x	
35	Elkton Clay Loam				x		
35	Elkton Loam				x		
35	Elkton Sandy Loam				x		

Page	Soil	Soil Groups					
		Excellent A	Good B	Fair C	Rather poor D	Very poor E	Unsuitable F
36	Elkton Silt Loam				x		
36	Fox Gravelly Loam		x				
36	Fox Loam	x					
37	Fox Sandy Loam		x				
37	Freneau Loam				x		
38	Genesee Loam			x			
38	Genesee Silt Loam			x			
38	Gloucester Gravelly Loam		x				
39	Gloucester Gravelly Loam, Compact Subsoil Phase			x			
39	Gloucester Loam	x					
39	Gloucester Loam, Gravelly Phase		x				
40	Gloucester Loam, Silty Phase	x					
40	Gloucester Loam, Stony Phase					x	
40	Gloucester Sandy Loam		x				
41	Gloucester Sandy Loam, Gravelly Phase		x				
41	Gloucester Stony Loam					x	
41	Gloucester Stony Sandy Loam					x	
42	Hagerstown Silt Loam	x					
42	Holyoke Gravelly Loam		x				
42	Holyoke Loam		x				
43	Holyoke Stony Loam				x		
43	Hoosic Gravelly Loam			x			
44	Hoosic Loam		x				
44	Hoosic Sandy Loam		x				
45	Keansburg Fine Sandy Loam				x		
45	Keansburg Loam				x		
45	Keansburg Sand				x		
46	Keansburg Sandy Loam				x		
46	Keansburg Silt Loam				x		
46	Keyport Clay Loam			x			
47	Keyport Fine Sandy Loam		x				
47	Keyport Loam		x				
48	Keyport Sandy Loam		x				
48	Keyport Sandy Loam, Deep Phase		x				
48	Keyport Silt Loam		x				
49	Keyport Silty Clay Loam			x			
49	Lackawanna Loam			x			
49	Lackawanna Stony Loam					x	
50	Lakewood Fine Sand				x		
50	Lakewood Gravelly Sandy Loam				x		

Page	Soil	Soil Groups					
		Excellent	Good	Fair	Rather poor	Very poor	Unsuitable
		A	B	C	D	E	F
50	Lakewood Sand					x	
51	Lakewood Sand, Shallow Phase				x		
51	Lakewood Sandy Loam, Deep Phase					x	
52	Lansdale Gravelly Loam		x				
52	Lansdale Shale Loam		x				
52	Lansdale Silt Loam	x					
53	Lansdale Stony Loam					x	
53	Lehigh Shale Loam			x			
53	Lehigh Silt Loam			x			
54	Leon Fine Sand					x	
54	Leon Sand					x	
54	Made Land and Clay Pits						x
55	Meadow				x		
55	Merrimac Fine Sandy Loam		x				
55	Merrimac Gravelly Loam		x				
55	Merrimac Gravelly Loam, Rolling Phase			x			
56	Merrimac Gravelly Sandy Loam			x			
56	Merrimac Gravelly Sandy Loam, Rolling Phase				x		
57	Merrimac Loam		x				
57	Merrimac Loam, Gravelly Phase		x				
57	Merrimac Loam, Imperfectly Drained Phase			x			
57	Merrimac Loamy Sand			x			
58	Merrimac Sandy Loam		x				
58	Merrimac Sandy Loam, Gravelly Phase			x			
58	Merrimac Sandy Loam, Imperfectly Drained Phase			x			
58	Montalto Gravelly Loam		x				
59	Montalto Silt Loam	x					
59	Montalto Silt Loam, Gravelly Phase		x				
59	Montalto Stony Loam					x	
59	Muck (Improved)	x					
59	(Unimproved)					x	
60	Muck, Intermediate Phase					x	
60	Muck, Shallow Phase					x	
60	Norfolk Fine Sand			x			
60	Norfolk Sand, Poorly Drained Phase				x		
61	Norfolk Sandy Loam, Imperfectly Drained Phase			x			

Page	Soil	Soil Groups					
		Excellent	Good	Fair	Rather poor	Very poor	Unsuitable
		A	B	C	D	E	F
61	Norfolk Sandy Loam, Poorly Drained Phase				x		
61	Papakating Silt Loam				x		
62	Papakating Silty Clay Loam				x		
62	Penn Gravelly Loam		x				
62	Penn Shale Loam		x				
63	Penn Silt Loam		x				
63	Podunk Loam			x			
64	Portsmouth Loam					x	
64	Portsmouth Loamy Sand				x		
64	Portsmouth Sandy Loam				x		
65	Reclaimed Tidal Marsh				x		
65	Roanoke Silt Loam				x		
65	Roanoke Silty Clay Loam				x		
66	Rock Outcrop*					x	x
66	Rough Stony Land*					x	x
66	Sassafras Coarse Sand				x		
66	Sassafras Coarse Sandy Loam			x			
66	Sassafras Fine Sand		x				
67	Sassafras Fine Sand, Rolling Phase			x			
67	Sassafras Fine Sandy Loam		x				
67	Sassafras Gravelly Loam		x				
68	Sassafras Gravelly Sandy Loam		x				
68	Sassafras Gravelly Sandy Loam, Flat Phase		x				
68	Sassafras Loam	x					
69	Sassafras Loam, Shallow Phase	x					
69	Sassafras Loamy Coarse Sand			x			
69	Sassafras Loamy Fine Sand		x				
70	Sassafras Loamy Sand		x				
70	Sassafras Loamy Sand, Flat Phase			x			
70	Sassafras Sand				x		
71	Sassafras Sand, Flat Phase			x			
71	Sassafras Sand, Mixed Phase				x		
71	Sassafras Sandy Loam	x					
72	Sassafras Sandy Loam, Deep Phase	x					
72	Sassafras Sandy Loam, Depressional Phase			x			
72	Sassafras Sandy Loam, Flat Phase	x					
73	Sassafras Silt Loam	x					
73	Scranton Sandy Loam				x		
73	Shrewsbury Fine Sandy Loam			x			
74	Shrewsbury Loam				x		

*In general, F applies; in certain areas, E applies.

Page	Soil	Soil Groups					
		Excellent	Good	Fair	Rather poor	Very poor	Unsuitable
		A	B	C	D	E	F
74	Shrewsbury Sandy Loam				x		
75	Shrewsbury Silt Loam					x	
75	St. Johns Fine Sand (Improved)		x				
75	(Unimproved)					x	
75	St. Johns Sand (Improved)		x				
75	(Unimproved)					x	
76	Swamp (Improved)		x				
76	(Unimproved)					x	
76	Tidal Marsh					x	
76	Unclassified City Land -- not applicable						
76	Wallkill Silty Clay Loam				x		
77	Wallpack Fine Sandy Loam			x			
77	Wallpack Shale Loam			x			
77	Wallpack Silt Loam		x				
78	Wallpack Silt Loam, Heavy Subsoil Phase		x				
78	Wallpack Stony Loam					x	
78	Washington Loam	x					
79	Washington Loam, Gravelly Phase		x				
79	Wasteland						x
79	Watchung Silt Loam				x		
79	Watchung Silty Clay Loam				x		
80	Wehadkee Silt Loam				x		
80	Wehadkee Silty Clay Loam				x		
80	Wethersfield Gravelly Fine Sandy Loam		x				
81	Wethersfield Gravelly Loam		x				
81	Wethersfield Loam	x					
81	Wethersfield Loam, Light-Color Phase	x					
82	Wethersfield Silt Loam	x					
82	Whippany Loam, Sandy Subsoil Phase				x		
82	Whippany Silty Clay Loam				x		
83	Whitman Silty Clay Loam				x		
83	Woodstown Loam			x			
84	Woodstown Sandy Loam			x			

ALLOWAY LOAM
Group D

The surface soil is a brown, dark-brown, grayish-brown, or dark-gray loam from 6 to 12 inches thick. It is underlain by a bluish-gray loam or heavy loam mottled with yellow or yellowish brown. This grades to a stiff yellow clay with bluish mottles at a depth varying from 15 to 20 inches. In places, this clay grades within a depth of 3 feet to bluish-gray clay with yellowish mottles.

Included with mapped areas of Alloway loam are patches of the silty clay loam, sandy loam, and silt loam of the Alloway series. As areas approach the contiguous upland soils, the surface colors are more grayish, and the soil material looks very much like that of the Elkton soils.

This soil occupies flat or depressed areas and is imperfectly drained.

Alloway loam is used for pasture and such farm crops as corn, wheat, and hay.

ALLOWAY SANDY LOAM
Group D

The surface soil is dark-brown, grayish-brown, or dark-gray loamy sand or sandy loam about 8 inches thick. The upper part of the subsoil is mottled yellow or bluish-gray sandy clay. It grades to a stiff plastic clay or sandy clay mottled with yellow and bluish-gray at a depth of more than 20 inches. In places the soil is rather deep and the lower part is mottled yellow and bluish-gray sandy loam. In most places this grades to the underlying clay within a depth of 3 feet. In other places the soil is shallow, and sandy clay comes almost to the surface.

Alloway sandy loam occurs in flats or depressions. Generally it is poorly drained, and very little of it is used for agricultural purposes other than pasture.

ALLOWAY SILTY CLAY LOAM
Group D

To a depth ranging from 6 to 12 inches, the surface soil is a dark-brown, grayish-brown, or dark-gray silty clay loam mottled with rust brown. This grades to grayish-brown or brownish-gray silty clay mottled with bluish gray and rust brown. In turn, this grades to a yellow, plastic, sticky clay mottled with bluish gray and reddish yellow. In most places this material is continuous to a depth of more than 3 feet.

In some places the surface soil is rather deep, has a high content of organic matter, and might be described as mucky. In other places it

is shallow and very compact, and the underlying bluish-gray silty clay is present within 10 inches of the surface.

Alloway silty clay loam occurs in flat or depressed areas, and the drainage is generally poor. In early spring many of these areas are covered with water. During the summer most of them become dry, but the soil is so heavy and surface drainage is so slight that water frequently remains on the land for some time after rains.

Alloway silty clay loam is a difficult soil to manage. It adheres to the plow if it is broken when too wet and breaks into clods if it is plowed when too dry.

BERKS SHALE LOAM Group B

The surface soil is brown or chocolate-brown silt loam 6 to 12 inches thick over yellowish-brown or brownish-yellow silty clay, which is slightly reddish in places. There is an abundance of thin to fairly thick or blocky shale fragments on the surface and throughout the soil profile. Typically the shale is thin, and the areas of blocky fragments occur within the soil. These areas differ from the typical soil in that they contain patches of red or reddish shale material. In places shale rock is frequently reached within less than 3 feet of the surface.

This soil is usually cleared and devoted to general farm crops. Corn, oats, hay, and wheat are grown. Apples and peaches do well under proper management. A few farmers use this soil to produce potatoes and alfalfa.

BERMUDIAN LOAM Group C

The surface soil is chocolate-red or dark reddish-brown loam underlain at a depth of 10 to 12 inches by brownish-red, Indian-red, or chocolate-red silt loam to a depth of 3 or more feet. In most areas there is little change in color between the surface soil and subsoil, but in places yellowish-red and grayish mottles occur in the subsoil below a depth of 15 inches. In other places the subsoil is sandy.

This soil occurs chiefly along streams adjacent to glaciated Triassic sandstone and shales. The drainage ranges from good to imperfect.

This soil is used mainly for pasture. It supports a good growth of grasses even during dry seasons. Practically all of it is cleared of timber. Areas are subject to overflow during flood stages.

BERMUDIAN SILT LOAM
Group C

A reddish-brown or brownish Indian-red silt loam underlain by reddish-brown or Indian-red silt loam to silty clay loam. The lower few inches of the 3-foot section frequently consist of sandy loam or sand. Pockets or strata of sand and small sandy patches are sometimes found. In places the deep subsoil is a bluish silty clay. In places where the drainage is imperfect or poor, the subsoil is mottled red and yellow, gray and yellow, or bluish.

Bermudian silt loam as a whole is fairly well drained for a bottom soil, but it is subject to overflow during periods of excessive precipitation, especially where it borders the smaller streams. It supports a good growth of native grasses that do not suffer much even during periods of drought owing to the high water table. Small areas here and there are cultivated, and when the crops are not killed by overflows, excellent yields of corn, oats, and wheat are obtained. In most places, however, unless the stream channels are deepened, dikes built, or floods prevented in some other way, cultivation is more or less risky. But some areas are inundated so rarely that they can be farmed profitably.

BIRDSBORO FINE SANDY LOAM
Group A

A brown fine sandy loam underlain at about 12 inches by a yellowish-brown sandy loam. At about 20 inches it passes into a somewhat reddish sandy loam. In places cobbles and gravel are scattered over the surface. The color and texture of the surface soil varies somewhat. In places it is a sandy loam or heavy loamy sand in which reddish shades replace the brownish colors.

Birdsboro fine sandy loam is well drained. Practically all of it is farmed. General farming, dairying, and truck crops are the principal interests. Crop yields are good to excellent.

BIRDSBORO SILT LOAM
Group A

A chocolate-brown or reddish-brown silt loam underlain at 8 to 12 inches by a lighter Indian-red silty clay loam that contains more or less grit. In places the extreme lower subsoil has a deeper Indian-red color, and it varies from a friable gritty clay to a sandy loam. Gravel of quartz, red sandstone, traprock, and quartzite is abundant in the lower part. In places quantities of gravel are present on the surface and scattered throughout the soil to a depth of 3 feet. (See gravel symbol on soil maps.)

Birdsboro silt loam occurs on flat to slightly undulating terraces in Somerset and Middlesex Counties. It is a well-drained soil.

Nearly all of this soil is cleared for cultivation. Crop yields are equal to if not a little better than those obtained on the nearby Penn silt loam.

CHENANGO FINE SAND

Group C

This soil consists of 10 to 12 inches of brown or light-brown fine sand or slightly loamy fine sand underlain by a reddish-yellow or reddish-brown fine sand. Quartz, quartzite, gneiss, and sandstone gravel are found in places. In some places coarse sand or even fine gravel is encountered in the lower subsoil or substratum.

On a few islands in the Delaware River and in a few strips along the river there are small low areas that consist of gravel, cobblestones, coarse sand, and other materials. These areas, which really represent the soil usually classed as Riverwash, are overflowed at every slight rise of the river.

CHENANGO FINE SANDY LOAM

Group A

A light-brown to brown fine sandy loam to heavy fine sandy loam underlain at 8 to 12 inches by yellowish-brown fine sandy loam to loamy fine sand. In places the subsoil is reddish yellow. As mapped, some patches consist of loam and others of sand or loamy sand or fine sand.

Chenango fine sandy loam occurs on terraces of the Delaware River. Drainage is good, and this soil is nearly all cultivated. Dairying is an important industry on nearly all the farms.

Under proper management, this soil is excellent for general farm and truck crops.

CHENANGO LOAM

Group A

The surface soil is a friable brown loam that is 8 to 15 inches deep. It carries a relatively high content of fine and very fine sand. The subsoil is practically the same in texture, but it is slightly lighter in color than the surface soil. Like most water-deposited materials, the texture is more or less variable. For a depth of 3 feet, it is practically free from gravel and stones, making cultivation easy. The surface and subsoil are sufficiently heavy to retain moisture necessary for crop growth.

This material was deposited when the Delaware River flowed at levels from 20 to 60 feet higher than it does at present. On account of its fine texture, it is likely that a large part of the soil mass was deposited at times when there was very little current.

A level surface and freedom from stones make Chenango loam one of the most desirable soils for agriculture. It is used for general farm crops.

CHENANGO LOAMY SAND Group A

A brown sand or slightly loamy sand underlain at 8 to 10 inches by yellow to brownish-yellow loamy sand that extends to 3 or more feet. Fine gravel is frequently encountered in the lower subsoil.

As mapped, this soil is highly variable, including patches of Chenango very fine sand, fine sand, sand, very fine sandy loam, and loamy fine sand. In places small quantities of greensand marl are present in the subsoil. This is particularly noticeable where the soil consists of a brown loamy sand that is 12 to 14 inches deep and underlain by a yellowish-brown loamy sand that extends to a depth of 36 inches or more.

Chenango loamy sand occupies level, nearly flat terraces adjacent to or near streams. It is well drained. Practically all of it is under cultivation. It is easily tilled and produces good yields.

CHENANGO SAND Group C

The surface soil is a brown to yellowish-brown sand that is 5 to 8 inches deep, contains small quantities of silt, and is low in organic matter. The subsoil is a yellow to yellowish-brown sand of about the same texture as the surface soil except for the absence of the organic matter. Strata of heavier soils, such as loam and fine sandy loam, occur at a depth of several feet, but they have little or no effect on the overlying soil. The sand grains of both soil and subsoil are rounded, and very little gravel or coarse material is incorporated in the soil profile.

Several small areas of Chenango sand are found along the Delaware River. The surface takes the form of shallow dunes from 30 to 70 feet above the normal elevation of the river. The light texture and loose structure of this soil make the retention of moisture almost impossible during periods of drought.

Although originally a river deposit, the present dunelike contours have been formed largely by wind action. Early truck crops can be raised on this soil, but crop yields tend to be low.

CHENANGO SANDY LOAM
Group B

The surface soil is a loose, friable, brown or grayish-brown light sandy loam. It is about 8 inches deep and has a marked content of coarse and medium grades of sand. The subsoil is a somewhat loose yellow to yellowish-brown sandy loam of rather light texture. There is a decided content of silt and clay in the surface soil that decreases with depth until at 3 feet the lower subsoil is a loamy sand or very light sandy loam.

Chenango sandy loam is found as a terrace soil in the Delaware Valley. It occurs on level to gently sloping sections between the river and upland soils or on elevations varying from 20 to 70 feet above the river.

Chenango sandy loam is derived from stream sediments deposited by the Delaware River, but little of it is subject to inundation under present conditions.

Drainage is well established, and this soil warms up early in the spring. Chenango sandy loam is easily tilled and well adapted to the production of small fruits and early truck crops, which mature rapidly and to better advantage on this soil than they do on the heavier soils in this region.

CHENANGO SILT LOAM
Group A

The surface soil is a smooth, friable, light-brown silt loam to heavy silty loam that is 8 to 12 inches deep, and it contains a relatively large proportion of fine sand. To a depth of 20 inches the subsoil is a lighter brown than the surface soil, and it becomes lighter in texture below this point. Coarser material is found at a depth of several feet. As a rule, this soil is free from stones or stony materials that interfere with cultivation. It occurs as nearly level tracts at 20 to 40 feet above the Delaware River.

Chenango silt loam is one of the most valuable soils in the area.

CHESTER GRAVELLY LOAM
Group B

A light-brown or brown, gritty loam that is 8 to 12 inches deep. This is underlain by a brownish-yellow or yellow, friable, gritty clay loam or clay. When dry, the surface layer has a grayish shade. Angular fragments of gneiss are abundant over the surface and through the soil and subsoil. In places the soil is shallow, which means that the yellowish subsoil comes near enough to the surface to give plowed fields a spotted brownish and yellowish appearance.

Chester gravelly loam is an extensive soil on the gneiss mountains or uplands south of the glaciated area. It comprises 85 to 90 percent of the cleared land. The topography varies from steep to gently rolling to nearly level.

Nearly all of this soil is cleared and used for growing corn, oats, hay, and some wheat. Dairying is important on almost every farm. Apples and peaches do well on this soil.

Chester gravelly loam is a productive soil, and it responds well to good farming methods. The soil is well adapted to fruit production, and properly managed orchards do well. Also, potatoes can be grown on this soil.

**CHESTER LOAM
Group A**

A brown to light-brown, friable, gritty loam underlain at 8 to 12 inches by a yellow, friable, gritty clay subsoil. In places the subsoil has a reddish cast, but this is not typical. The grit is derived from gneiss fragments, which are present in all stages of decay.

Nearly all of this soil is cleared. The same crops that are grown on the more extensive Chester gravelly loam are grown on this soil. The yields, methods of handling, and the system of fertilization are very similar, too. Usually the value of crops grown on this soil is slightly higher than on similarly located areas of the Chester gravelly loam.

**CHESTER LOAM, GRAVELLY PHASE
Group B**

See CHESTER GRAVELLY LOAM.

**CHESTER LOAM, STONY PHASE
Group E**

See CHESTER STONY LOAM.

**CHESTER STONY LOAM
Group E**

A brown, gritty loam that is 3 to 4 inches deep. It grades into a yellow, gritty loam that extends to a depth of 8 to 12 inches where the subsoil, consisting of a yellow, friable, gritty clay loam or clay, is encountered. An inch or so of dark leaf mold is found on the surface. Also, large quantities of gneiss fragments of varying sizes occur on the

surface and throughout the 3-foot section. The areas that have been sufficiently cleared of stone and timber to permit cultivation are separated and mapped as Chester gravelly loam. In these areas the brown surface material has been mixed through the first 8 inches or more of soil. This causes the brownish cast to extend much deeper than it does in the wooded Chester stony loam areas. Small developments of Chester loam, Chester gravelly loam, and rough stony land, which cannot be shown on the map, are included with this soil.

Chester stony loam, in association with the other Chester soils, occupies a large proportion of the wooded slopes and stony uplands on the gneiss mountains. Much of the topography is steeper than where the Chester gravelly loam occurs, but there are some rather level areas on the tops of the ridges. Naturally, the soil is well drained.

Nearly all of this soil has trees growing on it. A few areas have been cleared, but the stones remain. Chester stony loam is used as pasture and forest land. The trees should remain on the steeper areas.

CLYDE LOAM

Group E

A dark-colored or black mucky loam to silty loam underlain at depths varying from about 7 to 30 inches, usually at about 10 inches, by a gray, black, or mottled grayish and yellowish or brownish heavy silty clay. In places the lower subsoil is a gray or greenish-gray loamy sand or sand. This soil, as mapped, contains many variations. In places the clay layer is not present, and the black surface soil is underlain by gray or mottled gray and yellow sand or loamy sand. In other places the clay is so stiff that it is difficult to bore into it, and often the sand layer is not reached within the 3-foot section. Some areas consist of a dark-brown to black loam that is underlain by mottled gray, yellow, and rusty-brown clay, which in places has a claypan consisting of a yellowish-brown and rusty-brown color that contains some dark concretionary material at depths of about 2 feet. Some of the areas consist of brown, dark-gray, or light-gray silt loam in the surface with a mottled yellow and gray silty clay subsoil.

This soil is mapped in depressions and on wet seepage slopes. It is a very poorly drained soil.

Where cleared it is used chiefly for pasturing dairy cows during dry periods.

CLYDE SILT LOAM

Group E

A black or dark-brown silt loam underlain at any depth from 8 to 24 inches by mottled yellowish and grayish or grayish-yellow silty clay

mottled with rusty brown or gray in places. Occasionally the black soil overlies a light-gray silty clay that is often mottled with yellow. In places the soil is very nearly a muck, and some small patches of true muck are included. Along the southeastern and western borders of the Great Meadows, the areas mapped as Clyde silt loam consist of 8 to 10 inches of brown silt loam or loam overlying deep black muck.

Clyde silt loam occurs in poorly drained marshy depressions at the heads of small streams and where stream bottoms and muck areas join in the glacial regions.

This is not an important soil agriculturally. In some of the better drained situations oak, elm, and basswood grow, but reeds and other plants that grow in or near water form the principal growth in the wetter places. Nearly all of this soil has been roughly cleared and partly reclaimed by ditching or enlarging and straightening the natural streams. It is used largely as permanent pasture.

CLYDE STONY LOAM
Group E

A black silt loam, 8 to 12 inches deep, overlying gray or mottled grayish, yellowish, and brownish clay, which often contains much limonite-yellow friable material. Part of this soil consists of a dark-brown or rusty-brown silt loam underlain by a mottled yellow and gray clay, and some included areas are grayish brown. Large stones are scattered through the greater part of this soil, but some areas have only small stones, and others are stone free.

This soil occurs in drainageway depressions, along low slopes near drainageways, and in flats in the areas of gneiss. It occupies only small patches, but the total acreage is rather large. The soil is poorly drained.

Only a small percentage of this soil is completely cleared; much of it is partly cleared. Black alder, rushes, calamus, ferns, and skunk cabbage are common in the more poorly drained places, and ash, oak, hickory, black gum, elm, birch, alder, and maple are plentiful elsewhere. The wooded tracts are commonly used for pasture.

COASTAL BEACH
Group F

This soil lies between the ocean and the tidal marsh areas as mapped. It consists almost entirely of rather fine particles of quartz sand that have been more or less rounded by the continuous washing of the sea.

CODORUS LOAM
Group C

A brown to light-brown, mellow, gritty loam underlain by a light-brown to yellowish-brown loam, which becomes more sandy in the lower part of the 3-foot section. This soil lacks uniformity. In many places the subsoil varies from clay to sand. Included with this soil are some patches of Codorus sand and Codorus sandy loam. Cobblestones and boulders are present in some places.

Codorus loam occurs along streams. It is subject to overflow, but it is fairly well drained, except, of course, during periods of inundation. It is not an extensive soil. Most of it occurs in narrow belts along small streams that have cut rather deep valleys. It is used mainly for pasture.

COLLINGTON CLAY LOAM
Group B

This soil is used to produce general farm crops. It is associated geographically with Collington loam. Often both soils are found on the same farm. Because of its heavier texture, it is less easily managed and its moisture supply is less favorable than that of the Collington loam. The color of the surface soil ranges from brown or greenish brown to dark green, and the subsoil ranges from yellowish green to green or bright green. The surface soil is about 5 to 6 inches thick, and it is underlain by clay, which when wet is plastic and sticky and when dry is only moderately friable. Subsoil material continues in most places to a depth of 36 inches without essential change other than an increasing intensity of the green color. The soil becomes hard and compact when dry, and it is difficult to maintain a good tilth. These unfavorable conditions are increased if the land is plowed when wet.

COLLINGTON FINE SANDY LOAM
Group A

A brown fine sandy loam underlain at about 8 inches by an upper subsoil layer of yellowish-brown fine sandy loam that is similar to the lower subsoil. It ranges from a few inches to 18 inches in thickness. In both the surface soil and the upper subsoil layer a faint green color reveals the presence of grains of greensand. The upper subsoil layer is underlain at a depth ranging from 18 to 24 inches by a fine sandy loam that contains a much larger quantity of greensand than is present in the surface soil.

This soil, in both physical and chemical characteristics, is essentially like Collington sandy loam with the exception of a higher content of fine sand and a lower content of medium or coarse sand. In texture it is intermediate between the sandy loam and the loam. It has a somewhat better waterholding capacity than the sandy loam, and it is more easily cultivated. It is a highly productive soil.

COLLINGTON FINE SANDY LOAM,
DEEP PHASE
Group A

This soil differs from the typical Collington fine sandy loam in that it has a much lighter surface soil of light-brown or brown fine sand or loamy fine sand that is underlain at 18 to 20 inches by a reddish-yellow loamy fine sand. This layer is only a few inches thick, and it is underlain by a reddish-yellow or greenish-yellow fine sandy loam or friable sandy clay. Greensand is present in large quantities in the lower subsoil.

Because of its sandy surface, this soil is used chiefly for the production of truck crops.

Practically all this soil is cleared and under cultivation. It has a slightly higher value than the Collington sand because it is somewhat more productive, especially during dry seasons.

COLLINGTON FINE SANDY LOAM,
IMPERFECTLY DRAINED PHASE
Group B

This soil occupies flat or depressed areas that do not favor the ready escape of drainage waters. Consequently, the soil is less well drained and darker than the typical Collington fine sandy loam, and the subsoil is more or less mottled.

This soil does not have the same crop adaptations as the typical Collington fine sandy loam. It is, however, well suited to grass and produces moderate yields of corn and wheat.

COLLINGTON FINE SANDY LOAM, LOW
GREENSAND-CONTENT PHASE
Group B

This soil, like similar phases of the sandy loam and loam, does not differ in essential characteristics from the typical Collington fine sandy loam except in the presence of a very low percentage of greensand. Since it is well known that Lakewood material is present in the Collington soils along the border as mapped, the low content of greensand in this small area of the Collington soil shows without doubt that the area contains a rather large percentage of Lakewood material. Because of this fact, the low greensand-content phase is a somewhat less productive soil than the typical Collington fine sandy loam. The surface soil is light in color and in places shades to gray.

COLLINGTON LOAM

Group A

The surface soil is a brown moderately heavy-textured loam. It is faintly red in color. In most places it has a green shade, and below a depth ranging from 10 to 14 inches it changes to a greenish-brown moderately friable clay loam, clay, or sandy clay. In many places near the 3-foot depth the material becomes coarser in texture than that in the upper part of the surface soil and subsoil, but in some places this layer may consist of plastic clay. In other places the deep clay or sandy material is more sandy than the surface soil. The percentage of glauconite increases with depth, and the parent material in many places is strongly green -- the intensity of color depending on the proportion of glauconite present.

This is one of the best soils in the area, and it is used mainly for general farm crops and potatoes.

COLLINGTON LOAM, IMPERFECTLY DRAINED PHASE

Group B

This soil is darker in color than the typical Collington loam, and the subsoil is usually mottled with gray, reddish yellow, and green. Also, the drainage is not well established. These characteristics are due to the fact that the phase is developed in level or depressed situations from which drainage waters escape very slowly.

The imperfectly drained phase has a lower agricultural value than the well-drained Collington loam. It can be made to produce fair to good yields of potatoes when it is thoroughly drained by means of ditches or tile, preferably the latter. Wheat and corn produce fair yields, and grass does well.

COLLINGTON LOAM, LOW GREENSAND- CONTENT PHASE

Group A

This soil differs from the typical Collington loam in that the subsoil contains enough greensand marl to give it a slight greenish cast in the lower part. The surface soil may also contain a conspicuous quantity of greensand.

COLLINGTON LOAMY SAND
Group B

The surface soil is a brown loamy sand to a depth of about 8 inches. It is underlain by a yellowish-brown, loose loamy sand that has a faint green shade. Below a depth ranging from 24 to 30 inches, greenish-brown or green loamy sand to sand is present.

This soil is widely distributed over the eastern and northern parts of the Collington belt. The significance of this occurrence is that it lies in that part of the Collington belt where the parent materials are sandy. In the eastern part the sand is derived from the sands of the Lakewood plain, and in the northern part the sand is derived from the sands that underlie the greensand beds.

This soil occurs in smooth or nearly level areas.

COLLINGTON LOAMY SAND, LOW
GREENSAND-CONTENT PHASE
Group B

The surface soil is a brown loamy sand from 8 to 12 inches thick. This grades into yellow loamy sand that contains a little greensand, which, in turn, gives way to a heavier loamy sand or sandy loam with a faint reddish cast that contains more greensand below a depth of 20 to 24 inches. Most of the surface soil contains some greensand.

Areas of this soil occupy an intermediate position between typical Collington loamy sand and Sassafras loamy sand, and soil boundaries are somewhat arbitrary in places. Locally there is a scattering of gravel over the surface.

This soil occupies undulating or gently rolling areas, and it is generally well drained. About 80 percent of this soil area is used for agricultural purposes. The rest supports a mixed growth of pine and scrub oak.

COLLINGTON SAND
Group C

A light-brown or brownish-gray sand or loamy sand from 6 to 10 inches deep that is underlain by a yellowish-brown or reddish-yellow loose sand extending to a depth of 3 or more feet. Glauconite or greensand is present in considerable quantities. Small areas of Collington fine sand and Collington coarse sand are present.

This soil occupies rather flat positions and terrace-like strips along streams. Drainage is good or excessive.

Much of this soil still remains in timber, which consists principally of pitch pine and a scattering of scrub oak. When heavy amounts of fertilizer are used, early truck crops can be grown. The soil is apt to be droughty during dry seasons.

COLLINGTON SAND, LOW GREENSAND-CONTENT PHASE
Group A

This soil differs from the typical Collington sand principally in that it has a lower content of greensand marl. It resembles Sassafras sand, but it lacks the open structure and lighter texture of the Sassafras subsoil. This soil constitutes a gradational soil between Collington sand and Sassafras sand, and generally it occurs in close association with the Sassafras sand.

The areas of this soil are well drained and occupy the same topographic positions as the typical Collington sand.

COLLINGTON SANDY LOAM
Group A

A brown or light-brown sandy loam underlain at a depth of about 8 inches by a greenish-brown or brown heavy sandy loam that grades into a greenish-brown friable sandy clay loam, which extends to a depth of about 30 inches. Below this depth the material is a light sandy loam that is somewhat more friable than the overlying material. The color is about the same as that of the subsoil. As in the loam, a small quantity of rounded quartzose gravel may be present in the surface soil but usually not in the subsoil. Because of the more sandy texture at the surface, this soil absorbs moisture more readily than Collington loam or Collington clay loam.

The sandy clay subsoil is capable of holding a good supply of moisture. Consequently moisture conditions as well as ease of working the soil are somewhat more favorable in the sandy loam than in the clay or clay loam.

Practically all the areas of this soil are cleared and are utilized both for general and intensive farming.

As a rule, corn does well on this soil. Locally considerable attention is given to the production of tree fruits, including peaches and apples.

COLLINGTON SANDY LOAM, DEEP PHASE
Group A

The difference between Collington sandy loam, deep phase, and the typical Collington sandy loam lies in the occurrence of a layer of sandy

material that extends from the surface to a depth of about 12 inches. This layer is about 50 percent thicker and usually lighter textured than the sandy surface layer of the typical Collington sandy loam. For this reason, areas of this soil were differentiated as a deep phase. The surface soil also is somewhat paler in color than the surface soil of the typical Collington sandy loam, and in most places it contains a slightly higher percentage of sand. The percentage of greensand in the subsoil and parent material, as well as the percentage of clay in the subsoil, varies from place to place. This is equally true of the typical Collington sandy loam. In no place, however, is the heaviness of the sandy clay subsoil sufficient to warrant differentiation of the soil into a different series, and in no place does the subsoil become a claypan. Drainage is good throughout.

COLLINGTON SANDY LOAM, DEEP PHASE,
LOW GREENSAND-CONTENT PHASE
Group A

This soil has all the characteristics of Collington sandy loam, deep phase, but it contains much less greensand marl in the subsoil. It represents an intermediate condition between the deep phase of Collington sandy loam and the deep phase of the Sassafras sandy loam.

COLLINGTON SANDY LOAM,
IMPERFECTLY DRAINED PHASE
Group B

This soil differs from the typical Collington sandy loam principally in that it has less perfect drainage owing to the fact that it occurs in level or flat and depressed areas from which the drainage waters do not readily escape. The surface soil is darker than the typical Collington sandy loam. The subsoil is commonly mottled with green and slightly to highly mottled with gray and reddish yellow.

Agriculturally the imperfectly drained phase is inferior to the typical Collington sandy loam.

COLLINGTON SANDY LOAM, LOW
GREENSAND-CONTENT PHASE
Group B

This soil is widely distributed over the belt occupied by the Collington soils.

It is identical in general physical characteristics with the typical Collington sandy loam except that it has a lower percentage of glauconite. This soil seems to be practically as productive as the typical Collington sandy loam. Very careful chemical analysis would possibly show that this

soil, where it has not been changed by the application of lime or fertilizers, is a little more acid and possibly contains a slightly lower percentage of potash. Since, however, its productivity to a great extent is due to its highly favorable physical characteristics, it must be considered a good soil.

COLTS NECK FINE SANDY LOAM Group A

This soil is essentially identical in all characteristics with Colts Neck sandy loam except in the surface soil, which contains a higher percentage of fine sand and a lower percentage of medium sand than the sandy loam. The heavier texture of the surface soil may have a slight influence on the yield and character of the crops grown. If the soil itself were the only factor in agricultural production, such slight differences as those between the sandy loam and fine sandy loam of the Colts Neck series would possibly deserve rather important consideration, but the great number of other factors, all of which are important, renders such slight differences comparatively unimportant.

COLTS NECK GRAVELLY SAND Group B

A grayish-brown loam underlain at a depth of about 1 foot by a pale-yellow or yellow moderately friable clay loam that ranges from 15 to 24 inches deep. This grades into a somewhat plastic clay that contains gray and yellow spots, which is indicative of incomplete oxidation. Quartz gravel may be present in some places on the surface.

Both the subsoil and substratum are comparatively heavy. In wet weather they are subject to excessive ground water, but this condition is soon disposed of because of the comparatively good surface drainage.

Colts Neck gravelly sand is considered an important general farming soil.

Grasses and corn are the principal crops grown on this soil, and some truck crops, mainly peppers and tomatoes, are produced. This is an important corn soil because of its comparatively heavy texture and good moisture supply. The soil is too heavy for successful potato growing.

COLTS NECK LOAM Group A

A red or brownish-red loam underlain at a depth of 7 to 8 inches by a red or reddish-brown friable sandy clay loam or sandy clay. In the lower part of the subsoil, usually below a depth of 30 inches, the texture

becomes somewhat lighter, the structure becomes somewhat more porous, and the color grades to a yellowish red.

In general, the Colts Neck soils are characterized by the presence of a certain amount of ironstone. In the smoother areas of Colts Neck loam, the content of the ironstone is small and the fragments resemble pieces of shale. In other localities the content of this material is large. Before this material is broken into fragments on being brought to the surface and subjected to weathering, it consists of plates.

The Colts Neck soils lying in the more hilly areas of the north-central part of the greensand belt contain a larger percentage of iron oxide fragments than those in the southern part.

Practically all the Colts Neck loam is under cultivation. It is considered one of the best soils in the area, and it is adapted to a wide variety of general farm crops. If this soil is plowed when it contains an optimum amount of moisture, good tilth is obtained. Potatoes are produced successfully on this soil. Other general farm crops, such as alfalfa, timothy, clover, corn, and wheat, return good yields. Peach trees do well, and they succeed better on this soil than on Collington loam because of good drainage and aeration.

COLTS NECK LOAMY SAND Group B

A dark-red or brownish-red loamy sand underlain at a depth of 5 to 6 inches by a bright-red loamy sand that contains a little more clay than the surface soil. The clay gives the material a somewhat loamy texture. The loamy material may extend to a depth of 3 feet without change, or the lower part may be rust iron in color and slightly heavier in texture. The brown color of the surface soil is caused by organic matter mixed with finely divided material that contains much iron oxide. As a general rule the material below a depth of 3 to 4 feet is lighter in texture than the subsoil, and it may also be lighter in color.

Because of the very sandy character of the surface soil, Colts Neck loamy sand may be cultivated without danger of puddling. For this reason, it is one of the better soils in the area for early truck crops.

COLTS NECK SANDY LOAM Group A

A brownish-red loamy sand or light sandy loam underlain at about 15 inches by a red moderately friable sandy clay. The percentage of iron oxide, which imparts the red color to both surface soil and subsoil, varies slightly from place to place, but this variation has not been

taken into consideration in mapping as it does not affect either the physical character or productivity of the soil. The percentage of ironstone fragments varies also, but in general the quantity is less and the fragments are smaller than in the lighter-textured Colts Neck soils.

In the somewhat more hilly areas where leaching has been more extensive, the surface soil is a little lighter in color than the typical Colts Neck sandy loam. This soil, like the others in the Colts Neck series, is locally called "red land." On account of the coarseness of the surface soil and the slightly coarser substratum, drainage is good. This is advantageous during seasons of wet weather, but it has its disadvantages during droughts. However, Colts Neck sandy loam is not considered a droughty soil.

The land is utilized for the production of a large number of crops, but it is more important for general agriculture, including potatoes, than for truck crops. Locally, however, it is used to produce a number of truck crops. Under favorable moisture conditions and careful management, it is a good soil for general farming.

COLTS NECK SANDY LOAM, ERODED PHASE Group B

A brownish-red loamy sand or light sandy loam underlain at about 15 inches by a red moderately friable sandy clay. The percentage of iron oxide, which imparts the red color to both surface soil and subsoil, varies slightly from place to place, but this variation has not been taken into consideration in mapping as it does not affect either the physical character or productivity of the soil.

In the somewhat more hilly areas where leaching has been more extensive, the surface soil is a little lighter in color than in the typical Colts Neck sandy loam, eroded phase. This soil, like the other types of the Colts Neck series, is locally called "red land." On account of the coarseness of the surface soil and the slightly coarser substratum, drainage is good. This is advantageous during seasons of wet weather, but it has its disadvantages during droughts. However, Colts Neck sandy loam, eroded phase, is not considered a droughty soil.

The land is utilized for the production of a large number of crops, but it is more important for general agriculture, including potatoes, than for truck crops. Locally, however, it is used to produce a number of truck crops. Under favorable moisture conditions and careful management, it is a good soil for general farming.

In a few places Colts Neck sandy loam, eroded phase, has been subjected to noticeable erosion. This is not serious enough to decrease the productivity of the soil to a great extent, but the land requires more careful handling than soils such as Collington loam and others, which occur in smoother parts of the area.

COLTS NECK SANDY LOAM, LIGHT-
TEXTURED PHASE
Group B

A reddish-brown loamy sand underlain at 8 to 10 inches by a brownish-red loamy sand to deep-red loamy sand that extends to a depth of 3 feet or more. Usually in the lower subsoil, at depths of 30 to 36 inches, there is enough greensand present to give a greenish cast to the soil material. There is included with this phase, as mapped, a very small acreage of the Colts Neck fine sandy loam.

The Colts Neck sandy loam, light-textured phase, is a soil of good agricultural possibilities, especially in the production of truck crops and fruit. It is a good soil for asparagus and peaches, and it is extensively used for these crops. A considerable part of this soil is in forest.

CROTON SILT LOAM
Group D

A grayish-brown to gray silt loam underlain at 5 to 8 inches by a light-gray silty clay loam that passes abruptly into gray clay. At a depth of 14 to 24 inches, this soil becomes a very compact chocolate-brown or reddish-brown silty clay. This hardpan-like layer usually contains considerable brownish or brownish-yellow material of a concretionary nature. In many places the upper subsoil is mottled gray and yellow, and the yellow mottlings become more marked as depth increases.

Drainage is poor to imperfect owing to the flat topography and to the hard, impervious subsoil layer, which prevents the proper circulation of moisture.

Wheat does not do well. Some farmers report that the crop drowns during wet periods in the winter. Corn and other deep-rooted crops do not generally produce profitable yields except in very favorable seasons. For example, during very wet years the roots stand in a water-logged soil, and during dry periods the hardpan layer prevents sufficient moisture from rising to the root zone. Hay crops do well as a rule.

Planting is often delayed to permit the soil to become dry.

Croton silt loam needs artificial drainage.

CROTON SILT LOAM, POORLY DRAINED PHASE
Group E

A brownish-gray or ashy-gray silt loam underlain at 6 to 8 inches by a light-gray or mottled gray and yellow silty clay loam. This passes quickly into mottled, limonite-yellow, and gray silty clay, which is

underlain at 12 to 28 inches by a compact silty clay of a limonite-yellow or mottled Indian-red and limonite-yellow color. Rusty-brown and dark-colored concretionary material is usually present in this hardpan-like lower subsoil. This layer is so hard and impervious that even during periods of excessive rainfall it seems hard and dry. Slabs of bluish and reddish argillite are present in many places on the surface and throughout the soil section.

This soil is found in association with the typical Croton silt loam. It occupies flats or depressions at the head of or adjacent to streams and other places slightly lower than the typical Croton silt loam and other soils. It is not an extensive soil, and it occurs only in small tracts.

Part of this soil is cleared. More birch, ironwood, maple, and willow trees are found on this soil than on the typical Croton silt loam. Sedges and rushes often crowd out other pasture grasses. Pasturing is the chief use of this soil.

This soil is harder to drain than the typical Croton silt loam, but with proper care forage crops and pastures can be grown profitably.

CULVERS LOAM Group C

A heavy soil with a brown surface underlain by a yellowish-brown subsoil that sometimes shows traces of red. Stone fragments are numerous throughout the soil profile, but they do not interfere with cultivation.

This soil occupies gently rolling to rolling uplands.

From the rock fragments found in this soil, it appears that the rocks forming the Kittatinny Mountain contributed extensively to the soil material. Drainage is frequently poorly established owing to the formation of a compact stratum in the subsoil that does not allow water to escape.

CULVERS STONY LOAM Group E

The surface soil consists of 4 to 9 inches of brown to drab loam or silty loam that is usually friable but inclined to be sticky when wet. The subsoil varies from a yellow to a yellow and gray mottled loam to clay. Rocks ranging in size from a few inches to several feet in diameter are found in large numbers on the surface and throughout the soil section, making cultivation impracticable.

On account of the high stone content, this soil is used only for forestry or pasture.

DOVER FINE SANDY LOAM
Group C

A brown to grayish-brown friable fine sandy loam underlain at 6 to 8 inches by a yellow to yellowish-brown fine sand to fine sandy loam that becomes decidedly heavier at a depth of 30 inches. The loam sub-soil consists of residual material. The surface soil is marked by an absence of coarser grades of sand.

The topography is greatly rolling. This feature combined with the porous texture of the soil assures good drainage.

Practically all of this soil is cleared and under cultivation. General farming and dairying are the prevailing forms of agriculture. Corn, wheat, oats, and grass for hay and pasture are the principal crops.

The open texture of this soil does not favor retention of moisture. Consequently, this soil is apt to be somewhat droughty, especially where the organic matter is allowed to become depleted.

DOVER GRAVELLY LOAM
Group B

A brown or light-brown loam that is very silty in places. It is underlain at 8 to 15 inches by a yellowish-brown friable clay loam to gritty friable clay. In depressions and on some flats and lower slopes that receive wash from adjacent slopes, the soil is more silty, deeper, and often slightly darker. Boulders and small angular and rounded fragments of sandstone, quartzite, flint, quartz, limestone, and, in places, gneiss and shale are plentiful on the surface and throughout the 3-foot section. In places the material is very gritty and contains a relatively large proportion of sand.

Dover gravelly loam is a well-drained productive soil that is largely cleared and under cultivation. Trees usually found on the un-cleared areas are red cedar, oak, hickory, ash, and maple. This soil is used for growing corn, oats, wheat, timothy, and clover. Cattle are often pastured on the low or stony soils. As a whole this soil is managed the same as Dover loam, and the returns are nearly as large. Dover gravelly loam is harder to cultivate than the Dover loam because of its irregular and gravelly surface, and in places the slopes are so steep that improved machinery cannot be used.

This soil is well suited to the present system of agriculture. The steeper slopes are suitable for orchards.

DOVER LOAM
Group B

A brown to light-brown gritty loam or silt loam underlain at 8 to 15 inches by a yellowish-brown gritty clay or gritty clay loam that passes quickly into a yellow or reddish-yellow friable sandy clay. In places the lower subsoil is somewhat more sandy than the upper subsoil. In some areas gravel and occasional boulders of limestone, gneiss, quartzite, and chert are present.

This soil is derived from glacial till that contains varying amounts of limestone.

It has a good agricultural value. Dover loam is nearly all cleared and cultivated, but there are a few areas of second-growth cedar and oak.

DOVER LOAM, LIGHT PHASE
Group A

A dark-brown friable loam underlain at about 8 inches by a yellowish-brown loam that becomes lighter as depth increases. Fragments of limestone and gneiss are found throughout the soil section, but they do not ordinarily hinder cultivation.

This soil is derived principally from till of limestone material that has been redeposited over practically the same formation.

On account of its location and high agricultural value, Dover loam, light phase, is nearly all under cultivation.

The value of Dover loam, light phase, is as high as any of the upland soils in the Kittatinny Valley.

DOVER LOAM, SANDY PHASE
Group C

A brown or light-brown sandy loam or fine sandy loam underlain at 10 to 24 inches by a yellowish-brown sandy loam or sandy clay loam. In many places considerable fine gravel or coarse grit occurs, and it consists mainly of limestone and gneiss through the 3-foot section. Some large gravel and boulders are present in places.

Crop yields differ slightly from those produced on the typical Dover loam. Farmers do not consider this soil to be equal to Dover loam since somewhat heavier applications of fertilizer are necessary to produce equal yields.

DOVER STONY LOAM
Group E

A grayish-brown to brown loam to silt loam about 7 inches deep and thickly strewn with boulders of varying sizes. The subsoil varies from a yellowish-brown to yellow silty loam to silt loam. The texture changes with depth because of increasing quantities of finer grades of sand. In some cases there is a large content of silt and clay, which makes the subsoil distinctly heavier than the surface soil.

In many parts of this soil, outcrops of gray to dark-blue limestone are numerous. This gives the soil a rough and rugged appearance. Intervening areas are often cultivated.

The surface varies from level to gently rolling areas with occasional hillocks of very steep broken land. Drainage is good.

This soil is derived from residual material and glacial till, the former coming chiefly from Kittatinny (blue) limestone. Some areas are derived from Franklin or white limestone. In some areas there is a thin layer of glacial till underlain by reddish to reddish-brown residual material.

This soil is best adapted to pasture. The large amount of rock outcrop makes cultivation impracticable.

DUNELLEN LOAM
Group A

A brown loam underlain at 8 to 10 inches by a dark reddish-brown loam that grades at depths ranging from about 15 to 22 inches into Indian-red or dark reddish-brown friable clay. This usually passes into sandy loam, coarse sandy loam, or other material more friable than the upper subsoil at a depth of about 30 inches. In places the subsoil has a more yellowish-brown color with only a slight reddish cast. The color becomes more reddish as depth increases. A considerable amount of small rounded gravel, consisting mainly of red sandstone and some gneiss and traprock, is found in places on the surface and through the 3-foot section.

This soil has nearly all been cleared. Like the sandy loam soil of the same series, it is being held for the most part as building sites. Much of it has been subdivided into town lots.

Dunellen loam is a productive soil.

DUNELLEN SANDY LOAM
Group A

A dark reddish-brown sandy loam underlain at 8 to 12 inches by a sandy loam of a lighter shade of reddish-brown that grades at 18 to 25

inches into Indian-red friable sandy clay, which normally is coarser and more friable below 30 to 36 inches. The lower part consists of sand, loamy sand, coarse sand, loamy coarse sand, coarse sandy loam, or sandy loam. The distinctive purplish-red color is due to material derived from Indian-red Triassic shale and sandstone. The material contains many dark-green and black particles.

As mapped, this soil includes patches of sand, loamy sand, coarse sand, and fine sandy loam. In places the material giving rise to this soil is so thin that the underlying red shale is reached at about 3 feet.

The surface of the larger areas is flat to gently undulating, but much of it near streams is sloping. Drainage is good.

Dunellen sandy loam is a productive soil.

DUTCHESS LOAM

Group A

A friable light-brown to brown heavy loam to silty loam or silt loam that varies in depth from 8 to 10 inches. The subsoil is a light-brown to yellowish-brown silty loam, which forms a hardpan at 18 to 28 inches. The material below the hardpan contains considerable sand and is somewhat lighter in texture than the overlying soil.

Slate and shale fragments, usually forming about 10 percent of the soil mass, are found in varying quantities throughout the soil section. A few large boulders occur in the soil, and a number of large rocks are scattered over the surface. They are usually dark-colored sandstone from the coarser layers of the Martinsburg formation or light-colored quartzites and conglomerate from the Shawangunk conglomerate found on the Kittatinny Mountain.

This soil occupies gently sloping areas and hilltops in the Kittatinny Valley in what is known as the slate and shale district. Drainage as a whole is well established, but the hardpan layer tends to restrict the downward movement of soil moisture.

This soil is friable and easily cultivated. General farming is the prevailing type of agriculture. Wheat, corn, and oats are the principal grain crops. Dairying is extensive.

DUTCHESS LOAM, SHALY PHASE

Group B

A light-brown to grayish-brown silty loam from 6 to 12 inches deep that carries considerable thin platy slate and shale. The subsoil is a grayish-yellow silt loam to loam with a high content of gravel and shaly material, which makes up 30 to 60 percent of the soil mass. The structure varies with the shale content, but this soil is friable and always easily worked.

Drainage is ordinarily adequate; however, there are some poorly drained springy spots that are too small to show on the map.

In productivity this soil is intermediate between the shale loam and the loam.

Dutchess loam, shaly phase, is suitable for corn, small grains, and pastures.

DUTCHESS SHALE LOAM Group B

A smooth friable light-brown to grayish-brown silt loam from 4 to 9 inches deep that becomes a distinct gray when dry and contains from 40 to 75 percent slaty-shale material. The subsoil is practically the same in texture as the surface soil. It ranges in color from grayish-brown to grayish-yellow, the lighter color being found in areas of deficient drainage. The organic matter content of this soil is low. In areas where the rock material in the surface soil has been sufficiently broken, a gravelly silt loam soil is developed.

Partially decomposed rock fragments are often found throughout the soil section. The proportion of shaly material depends on the closeness of the underlying shales and slates known as the Martinsburg formation. Where the soil mantle is thinnest, rock fragments often form the greater part of the soil mass. The topography of such areas is usually rough and uneven. Boulders of material other than the parent rock are occasionally found. Locally the ice sheet left a thin veneer of debris, but over most of this soil its contribution was scarcely more than scattered boulders and small stones -- many of them coming from nearby ledges of sandstone and others from more distant formations. Ordinarily these boulders and stones are not so numerous as to affect the agricultural possibilities of the soil. In some localities, notably along the base of the Kittatinny Mountain, this is not the case.

This soil occupies gently rolling to rolling areas. Portions of the more resistant rocks are found on the slopes in terrace-like formations. Over such areas the soil is generally deeper and more productive.

Dutchess shale loam is the most extensive type of the series and occupies a large part of the Kittatinny Valley. The areas occur as ridges traversing the valley.

Dutchess shale loam is likely to be droughty during the growing season. This is due to the rapid runoff of surface waters caused by the rolling surface and by the shallow subsoil, which cannot store sufficient moisture to carry crops through seasons of protracted drought.

Crops grown on Dutchess shale loam are corn and hay. Apple trees produce satisfactory yields.

DUTCHESS SHALE LOAM, STEEP PHASE
Group D

This soil occurs on steep slopes. The soil is shallow and contains frequent outcrops of shale. It is also more droughty than the typical Dutchess shale loam.

Part of this rather inextensive phase has been cleared. Crops grown on this soil are the same as those grown on the typical Dutchess shale loam, but a larger percentage of the fields are kept in grass. The numerous shale fragments help prevent excessive erosion. Yields are somewhat lower than they are on the typical Dutchess shale loam.

DUTCHESS SILT LOAM
Group A

A brown or light-brown silt loam underlain at 10 to 15 inches by a yellowish-brown silty clay loam or yellow silt loam, which passes into a yellow friable silty clay loam or silty clay. In wooded areas the yellow color is often reached within 3 or 4 inches of the surface. Fragments of shale are common on the surface and through the soil and subsoil, but they are not nearly so abundant as those found in the Dutchess shale loams, and the shale bedrock averages considerably deeper even though it is reached at 18 to 20 inches in some places. There are some cobbles of quartzite, gneiss, flint, and limestone. Where these occur in sufficient numbers, gravel symbols are used on the map.

Drainage is adequate, and most of this soil is under cultivation. It is the most highly valued of the Dutchess soils. The timber growth in the few wooded areas consists largely of oak.

Wheat, corn, oats, and timothy and clover hay are the principal crops.

DUTCHESS STONY LOAM
Group E

A brown or drab silty loam underlain at 6 inches by a yellowish-brown to yellow silty loam to silt loam that occasionally shows bluish mottlings. Both the soil and subsoil carry variable quantities of shale fragments and rocks that range from 6 inches to several feet in diameter.

The rock content makes cultivation impracticable. The topography is level to rolling, and there are various drainage patterns.

This soil is derived mainly from the weathering of the till from the Martinsburg shale mixed with boulders from adjoining areas of Shawangunk conglomerate. This formation gives rise to the large, hard gray rocks that form such a pronounced feature of this soil.

The only use made of this soil is for forestry and pasture.

ELKTON CLAY LOAM
Group D

A gray loam underlain at about 10 inches by a mottled yellow and bluish-gray loam or silt loam, which at about 20 inches becomes grayer in color and lighter in texture. In places the surface soil is light brown; in other places it is dark gray. The typical color is gray, especially when the soil is dry. This soil is variable also in the color and texture of the subsoil.

Elkton loam occupies flat depressions in which drainage is poorly established.

Most of this soil has trees growing on it, but a small part of the area is under cultivation.

The value of this land is low. Before it can be cropped profitably, it must be improved by drainage.

ELKTON LOAM
Group D

A gray loam underlain at about 10 inches by a mottled yellow and bluish-gray loam or silt loam, which at about 20 inches becomes grayer in color and lighter in texture. In places the surface soil is light brown; in other places it is dark gray. The typical color is gray, especially when the soil is dry. This soil is variable also in the color and texture of the subsoil.

Elkton loam occupies flat depressions in which drainage is poorly established.

Most of this soil has trees growing on it, but a small part of the area is under cultivation.

The value of this land is low. Before it can be cropped profitably, it must be improved by drainage.

ELKTON SANDY LOAM
Group D

A gray to dark-gray sandy loam or light loam underlain at 8 to 10 inches by a mottled bluish-gray and yellow sandy loam, which becomes grayer with depth. The color of the subsoil is especially variable, depending chiefly on the drainage conditions. There is some reddish-yellow mottling in places.

It occupies level or depressed areas that have poor drainage. During the winter months water frequently stands on the surface for long periods.

Elkton sandy loam is not important agriculturally. Most of it is in forest trees. Oak, maple, and sweet gum are the predominant species. When this soil is drained, it produces fair yields of corn, grass, and wheat.

ELKTON SILT LOAM

Group D

A gray to ashy-gray silt loam underlain at about 10 inches by a mottled bluish-gray and yellow silt loam, which becomes more sandy and mottled at about 30 inches. This soil is variable, especially in the color and texture of the subsoil.

Elkton silt loam occupies flat depressed areas of poor drainage. A considerable part of this soil is in forest trees. White oak, sweet gum, maple, birch, alder, and some cedar are the predominant species. This soil gives about the same yields as Elkton loam, but because of its heavy texture it is harder to manage. Productiveness of Elkton silt loam can be improved by drainage.

FOX GRAVELLY LOAM

Group B

A brown to dark-brown gravelly loam about 10 inches deep. It becomes lighter in texture and color until at 24 to 30 inches it grades into a gravelly sandy loam or gravelly sand. The lower subsoil becomes decidedly lighter in texture, and at several feet it is composed mainly of gravelly material that consists of waterworn limestone fragments.

It occupies level areas of stratified glacial drift in limestone valleys. Several depressions and broken sections make some areas of this soil much less valuable agriculturally than the typical Fox gravelly loam. Drainage is adequate. Practically all of this soil is under cultivation.

On account of its location and its potential productivity, this soil is probably more valuable than any of the other soils in the area.

FOX LOAM

Group A

A brown mellow loam underlain at 10 to 12 inches by a yellowish-brown friable loam to gritty clay loam or clay. In places there is considerable sand in the lower subsoil, and the material at the base of the 3-foot section in a layer 6 to 8 inches thick is often slightly redder than the

overlying material. Gravel and cobblestones of limestone, flint, gneiss, and quartzite are present in places.

Some small patches of Fox gravelly loam are included with this soil. They are indicated by gravel symbols on the map.

This soil is found on flat or slightly rolling terraces, and it is well drained.

Nearly all Fox loam has been cleared, and it is used mainly for growing general farm crops.

Fox loam is well adapted to farming.

FOX SANDY LOAM Group B

A heavy brown sandy loam underlain at 12 to 15 inches by a yellowish-brown or yellow sandy loam, or in places a sandy clay that becomes lighter as depth increases, or occasionally a loamy sand. Gneiss, quartzite, and limestone gravel occur in places, and in areas where they are abundant, gravel symbols are used on the map. As shown in exposures, the material is stratified and includes a large proportion of fine to large gravel and cobblestones of limestone.

This soil is nearly all cleared and devoted to the same agricultural uses as the Fox loam and Fox gravelly loam. Yields of corn and grass are slightly lower than on the heavier soils, but Fox sandy loam is, nevertheless, a good soil.

FRENEAU LOAM Group D

Freneau loam is formed on alluvial deposits. The surface soil consists of a dark reddish-brown loam to a depth of about 10 inches. It is underlain by material that ranges in color from mottled reddish brown, rust brown, and greenish brown to limonite yellow. In texture it ranges from clay to sandy clay. No attempt was made to differentiate this soil according to drainage, texture of the surface soils, or layers of different textures. All the alluvial deposits with fair drainage and consisting mainly of mineral material were mapped without further differentiation as Freneau loam.

This soil is subject to flooding. Because of the shallow channels in which the small streams of the region flow, flooding takes place very readily and frequently. Protection from flooding must be provided for this soil before it can be used for crop production. Very little of it is under cultivation, but a great part of it is used for hay and pasture.

GENESEE LOAM

Group C

A heavy brown to dark-brown fine sandy loam to loam underlain at 8 to 12 inches by a similar material that shows mottlings of gray and yellow in areas of deficient drainage and aeration.

This soil material is of alluvial origin. It consists of depositions by the smaller streams of the area during periods of high water. The variation in texture throughout this soil is due to the stratification resulting from continued depositions at recurring intervals of high water.

This bottom land soil is subject to inundation during periods of extremely high water. On account of inundation it is not usually plowed. When this soil is cultivated, it proves productive and easily managed.

The poorly drained sections produce good pastures during dry seasons.

Genesee loam is found along the better drained stream bottoms scattered throughout the area. This soil is of limited extent and not of great importance agriculturally, but it is considered one of the best pasture soils in the area.

GENESEE SILT LOAM

Group C

Typically this soil is a brown to dark-brown silt loam underlain at 15 to 20 inches by a yellowish-brown silty clay loam that becomes a yellow or yellowish-brown friable silty clay as depth increases. But one boring may show the typical material, whereas a few feet away the soil may be much sandier. Nearer the streams the sand content is usually larger.

There are included with this soil some patches of poorly drained soil that are too small to separate.

Many of the bottom areas have been cleared of trees and undergrowth. The principal growth in the uncleared areas consists of willow, elm, sycamore, tulip poplar, hickory, maple, and some sweet gum along with an undergrowth of black alder and hazel. The cleared areas are devoted chiefly to pastures.

GLOUCESTER GRAVELLY LOAM

Group B

A light-brown or brown gritty loam underlain at 6 to 10 inches by a brownish-yellow or yellow gritty loam or clay loam. In places a sandy layer occurs in the deep subsoil, but such areas represent pockets of sand and gravel rather than true stratification. Gneiss, quartzite, sandstone, and trap gravel are abundant -- both on the surface and throughout the subsoil.

This soil occupies the more gentle slopes at the lower levels of ridges. Drainage is good.

This soil produces good yields of corn and other general farm crops. It is well suited to fruit. Crop yields are largely dependent on the proportion of gravel present. Cultivation is rather difficult in places, and yields are impaired by the presence of excessive quantities of gravel.

GLOUCESTER GRAVELLY LOAM,
COMPACT SUBSOIL PHASE
Group C

The compact subsoil phase of Gloucester gravelly loam differs from the typical Gloucester gravelly loam in that the subsoil below a depth of about 20 inches consists of compact gravelly loam and sand feebly cemented by ferruginous material into a heterogeneous substance closely resembling conglomerate. This compact layer acts as a hardpan, and it is more or less impervious to water. Its color is yellow or yellowish brown with streaks, splotches, and specks of rust brown. In places the compact layer is not well developed. In many places gravelly sand occurs below the compact or cemented layer, which is about 1 foot thick.

Its topographic position is similar to that of the typical Gloucester gravelly loam, but on the whole it occurs at lower levels and in somewhat less rugged country. Drainage is somewhat imperfect owing to the presence of the hardpan layer that in places appears to retard the seepage of surface water.

Moderate yields of general farm crops are produced, and the soil is well suited to the production of apples.

GLOUCESTER LOAM
Group A

A light brown or brown gritty loam underlain at 8 to 10 inches by a heavy brownish-yellow or yellow loam. In many places the subsoil is heavy. It may contain some gravel. Gloucester loam is well drained and occupies somewhat more level positions than Gloucester gravelly loam.

The material is mellow and easily worked. It produces good crops of corn and other general farm crops, and it is well suited to the production of fruits -- especially apples.

GLOUCESTER LOAM, GRAVELLY PHASE
Group B

See GLOUCESTER GRAVELLY LOAM.

GLOUCESTER LOAM, SILTY PHASE
Group A

A light-brown or brown gritty loam underlain at 8 to 10 inches by a heavy brownish-yellow or yellow loam. In many places the subsoil is heavy. It may contain some gravel. Gloucester loam is well drained and occupies somewhat more level positions than Gloucester gravelly loam.

The material is mellow and easily worked. It produces good crops of corn and other general farm crops, and it is well suited to the production of fruits -- especially apples.

GLOUCESTER LOAM, STONY PHASE
Group E

See GLOUCESTER STONY LOAM.

GLOUCESTER SANDY LOAM
Group B

The surface soil of the Gloucester sandy loam consists of an 8- to 10-inch layer of light-brown to yellowish-brown sandy loam to light loam that is loose and friable. Frequently enough finely divided mica flakes are found throughout the soil mass to impart a slightly greasy feel to the soil. This feature is more marked, however, in some of the other Gloucester soils. The subsoil is a yellowish-brown to yellow sandy loam, and the sand content becomes greater and the grains coarser with depth. A slight tendency toward hardpan is noted, but the compactness of the soil mass does not prevent the downward movement of soil moisture.

This soil is derived from glacial till, which is composed largely of gneissic and granitic material, but the lower subsoil may appear to be of residual origin. In road cuts, this soil is banded and resembles the unweathered rock. The stone content is lower than it is in other Gloucester soils. Rocks were at one time numerous over the surface, but they have been removed and used to build fences. The soil mass contains a large quantity of small rock fragments.

The native vegetation consisted principally of deciduous trees, particularly chestnut and some oak. At the present time, practically all of this soil is cleared.

Grass, corn, and oats are the principal crops. These crops produce satisfactory yields, but the soil is more inclined to be droughty than the loams of the same series.

GLOUCESTER SANDY LOAM,
GRAVELLY PHASE
Group B

A brown heavy sandy loam with a large quantity of gravel underlain at 8 inches by a similar material that is yellowish brown to a depth of 24 inches. The texture becomes heavier with depth. In some areas, a hardpan stratum is encountered in the lower part of the soil section.

This soil is derived from glaciated materials that were deposited over local rocks. The topography is gently rolling, and Gloucester sandy loam, gravelly phase, occupies much lower areas than any of the surrounding soils of the series. This soil is well adapted to truck crops, and it can also be used for apple and peach orchards.

GLOUCESTER STONY LOAM
Group E

A yellowish-brown gritty loam underlain at 4 to 8 inches by a brownish-yellow gritty loam. Gravel and large boulders of gneiss occur on the surface and throughout the soil. Some gravel and boulders of sandstone, quartzite, and trap are also present. In places a compact yellowish-brown mottled with rust brown stratum of partly cemented concretionary material consisting of mixed gravel, sand, and cobbles occurs at a depth of about 20 inches. This layer closely resembles a hardpan.

It occupies the summits and more gentle slopes of the gneiss ridges, and in most places it is covered with maple, hickory, oak, ash, tulip poplar, and other hardwoods.

Little of the Gloucester stony loam is cultivated owing to the abundance of boulders and rocks present and to its unfavorable topographic position. In its present condition it can best be used for forest and pastures, but some areas, especially on the more gentle slopes, can be reclaimed for agricultural purposes by clearing the timber and removing the larger stones.

GLOUCESTER STONY SANDY LOAM
Group E

A light-brown to yellowish-brown heavy sandy loam underlain at 7 to 10 inches by a yellowish-brown sandy loam subsoil that becomes more sandy and more yellow in color as depth increases.

In some parts of the area there is a close relationship between the Gloucester stony loam and the Gloucester stony sandy loam in that they are made up of the same general class of material except for the difference in texture. As a rule, the distinction between the two soils is

very evident. But in some cases there is a gradual transition from the heavier sandy loam to the lighter loam. In exceptional cases fine mica is found mixed with the soil mass. This, however, is not of enough importance to give the soil any very marked characteristic or to affect its texture to any great extent.

The stone content is the greatest obstacle to the extensive use of this soil. In importance, this soil ranks the same as the Gloucester stony loam.

HAGERSTOWN SILT LOAM

Group A

A brown mellow silt loam underlain at 8 to 12 inches by a brownish-red to yellowish-red moderately friable clay. In places the subsoil grades through yellow silt loam and reddish-yellow clay loam into reddish friable clay.

This soil is all cleared and under cultivation, and it is considered one of the best soils in the area for general farm crops.

HOLYOKE GRAVELLY LOAM

Group B

A light-brown gritty loam grading at a depth between 3 to 5 inches into yellowish, or slightly reddish-brown, or orange gritty loam. This is underlain at a depth of about 8 to 10 inches by a brownish-yellow or reddish-yellow gritty loam that grades below a depth of 20 inches into reddish-brown gritty loam. This soil is derived from traprock that has been subjected to glacial action. Fragments of traprock with some gneiss, red sandstone, and quartzite occur in abundance in both surface soil and subsoil. In places small included areas are gravelly silt loam and gravelly sandy loam. These areas occupy the lower, more gentle slopes of glaciated trap ridges. Drainage is good.

This soil is not extensively cultivated. In some locations, it is used for fruit and truck crops.

HOLYOKE LOAM

Group B

A yellowish-brown or brown loam or silty loam underlain at 4 to 5 inches by a yellowish or slightly reddish-yellow silty clay loam that passes into a reddish-brown or reddish-yellow loam. In most places some gneiss, trap, and sandstone are found below a depth of 20 inches.

In places, especially on level areas, the subsoil is sandy. Some areas of Holyoke silt loam are included with this soil as mapped.

Holyoke loam is practically all cleared, but only a little of it is cultivated. Under cultivation, this soil produces good yields of general farm and truck crops. It is also especially suited to fruit.

HOLYOKE STONY LOAM Group E

A yellowish-brown loam or silty loam underlain at 5 to 6 inches by a yellow or pale-yellow gritty loam. At a depth of about 12 inches, it grades abruptly into yellow gritty loam, which becomes reddish yellow and more reddish as depth increases. In places the lower part of the subsoil is reddish. Small fragments of traprock together with some gneiss, quartzite, and red sandstone occur in abundance both on the surface and throughout the soil. Larger boulders and fragments of trap are also present along with outcrops of the underlying trap bedrock.

This soil is too stony for economic cultivation. If cleared and freed of the larger stones by blasting or otherwise, the more level areas would no doubt prove productive, especially where the bedrock lies several feet below the surface.

HOOSIC GRAVELLY LOAM Group C

A light-brown to brown gravelly loam underlain at 6 to 8 inches by a yellowish-brown gravelly loam that becomes more sandy as depth increases. At 20 inches it grades into a gravelly sandy loam, or gravelly sand, or gravel. A slight reddish tint is sometimes noticed at a depth of 12 inches. The gravel consists of waterworn and rounded material derived from a variety of rocks. It occurs on the slopes and steeper portions where erosion has been active in carrying away the fine earth and leaving the coarser rock fragments. In such places the soil is a gravelly sandy loam, but on account of its slight extent it was impracticable to make a separation on the map.

This soil is derived from reworked glacial deposits represented by kames, kame terraces, parts of moraines, and the steeper portions of the valley trains and glacial deltas. The lower subsoils are frequently composed of coarse gravel, pebbles, and stones.

Hoosic gravelly loam is considered a droughty soil since the subsoil is extremely porous. On the steeper and more sandy areas, the productivity is very low. Such tracts are considered practically worthless. The more level areas are used for general farm crops, such as corn, hay, and pasture. These areas are the most easily cultivated, and they give good results where the moisture supply is adequate. It is especially suited to the growing of potatoes and staple truck crops. In a few instances, small fruits and peaches are grown successfully.

The topography varies from nearly level to rolling and broken. In the level tracts there are frequent kettle-hole depressions that impair the value of the land for agriculture.

HOOSIC LOAM Group B

A light-brown to brown loam of variable texture underlain at 7 to 10 inches by a sandy loam. The content of sand and gravel increases with depth until at 30 inches a yellowish-brown to reddish-yellow light sandy gravelly loam or sandy gravel is encountered. The sandy gravelly material may be very dark in the lower subsoil. This color indicates the presence of slate or shale rocks.

This soil is found in small tracts on level areas widely distributed and generally associated with other soils of the same series. It occurs on the more level portions of moraines, kames, kame terraces, glacial deltas, and other valley deposits. Where it occurs on moraines it is more or less stony; otherwise it is generally free from cobbles or boulders. Gravel is scattered over the surface in varied amounts.

Hoosic loam is of minor extent, but it is recognized as a good soil. All of it has been cleared and used for growing general farm crops. It is not used for special crops, and it does not have any special crop adaptation. It is planted to staple crops, such as corn, grain, and grass. Areas favorably located may be used for peaches. Hoosic loam is of greater value than the sandy loam or gravelly loam. Since it has a higher moisture-retaining capacity, it is more able to carry crops through dry seasons than other soils in the series.

HOOSIC SANDY LOAM Group B

A friable light-brown to brown sandy loam that contains varying amounts of coarse sand and gravel. At 8 to 10 inches, it is underlain by a light-brown to yellowish-brown sandy loam that at 15 inches grades into a yellow to yellowish-brown stratified sand or gravel. The gravel content increases with depth. Below 3 feet a coarse gravel is encountered. This layer rests on water-deposited beds of stone. Hoosic sandy loam is practically free from large stones on the surface or near enough to the surface to interfere with cultivation. It is one of the most easily cultivated soils in the area.

The level topography and absence of large rocks favor extensive use of this land. It is practically all under cultivation. The porous subsoil and sandy loam soil make it somewhat droughty and inclined to leach unless it is kept well supplied with organic matter.

KEANSBURG FINE SANDY LOAM
Group D

A dark-gray or black fine sandy loam or fine sand underlain at about 10 inches by a gray fine sandy loam mottled in most places with spots of yellow sand. The lower part of the subsoil is orange-yellow or greenish-yellow fine sand or loamy fine sand. In places, at a depth ranging from 15 to 24 inches, a compact and somewhat impervious hardpan layer is present. Ordinarily at lower depths, this layer grades into yellow or golden-yellow sand or loamy sand. The lower part of the subsoil is saturated with water.

Both the sandy loam and fine sandy loam soils of the Keansburg series are poorly drained, and they are similar in texture throughout.

On account of poor drainage and the large amount of available well-drained land in the area, little attention has been given to this soil. When it is artificially drained, this soil can be used for corn and many truck crops. In its undeveloped condition, the value of the land is very low.

KEANSBURG LOAM
Group D

A black loam underlain at about 10 inches by a mottled yellowish-gray loamy sand subsoil that is underlain by a yellow loamy sand or sand. Under natural conditions, drainage has been deficient and organic matter has accumulated. In some parts of the areas the surface is covered with a peaty layer.

Practically all the land is cleared and used for farming. Artificial drainage is necessary to bring the soil under cultivation.

KEANSBURG SAND
Group D

A black or dark-gray loamy sand to a depth of about 15 inches. The dark color, like that of other Keansburg soils, is due to the presence of a high percentage of organic matter. The subsoil is porous white or gray sand that contains green material in places. In some localities, at a depth ranging between 24 to 30 inches, a hardpan is present. The thickness of this layer varies, but in most places it is between 3 to 4 inches. Below this lies yellow and golden-yellow sand.

Because of the high moisture content, crops mature later than on the sand and loamy sand soils of the Sassafras series with which Keansburg sand is associated.

KEANSBURG SANDY LOAM
Group D

A black or very dark brown sandy loam that is 8 to 10 inches thick. The subsoil, although varying considerably in both color and texture, is predominantly dark-gray loamy sand or sandy clay that grades into mottled drab and yellow sandy clay at a depth of 1 to 2 feet. In some places the lower part of the subsoil is lighter in texture than the upper part, and it shows the presence of much green, yellow, and blue material.

This soil occupies low, poorly drained areas. Some of it is covered with birch, alder, and other plants that must have an ample supply of moisture. When this soil is artificially drained, it can be used to produce corn, tomatoes, grass, late truck crops, and potatoes.

KEANSBURG SILT LOAM
Group D

A black silt loam underlain at about 8 inches by a plastic sticky clay with yellow, reddish-yellow, and greenish-yellow mottles. At about 20 inches this grades into a mottled brownish-red, bluish-green, and green plastic clay. Below this depth the subsoil becomes lighter, and it contains some coarse sand and fine gravel and much greensand marl.

As mapped, this soil includes some small areas of Keansburg silty clay loam that has a surface soil somewhat heavier than that of Keansburg silt loam.

Keansburg silty clay loam occurs in scattered sections of the central part of the area. It occupies low, flat areas or depressions that have poor drainage.

Some Keansburg silt loam is farmed, but it must be carefully managed to obtain satisfactory results. Corn does well on properly drained areas, but it matures late.

KEYPORT CLAY LOAM
Group C

A grayish-brown heavy loam or silty clay loam underlain at about 6 inches by a pale-yellow moderately friable silty clay that is underlain at a depth of 20 inches by a mottled yellowish-drab plastic clay. The surface soil is rather thin, and deep plowing brings some of the clay to the surface. This gives the surface soil in cultivated fields a heavier texture than the surface soil of unplowed areas. In many places small iron concretions are scattered throughout the surface soil and subsoil.

Practically all the land is cleared and used for general farm crops, tomatoes, and peppers. Because of the heavy character of the surface

soil and the possibility that a large part of the rainfall will run off rather than penetrate the soil, crops are likely to suffer from drought in midsummer unless care is taken to keep the land in good tilth. During periods of dry weather the soil cracks, but the cracks close when it rains. Because they are saturated with moisture during the winter, Keyport soils are considered somewhat late and cannot be used for the growth of early truck crops. The land may be used, however, with fair success for corn, late tomatoes, peppers, and other truck crops intended for the late market. Very little attention is given to the production of fruit. Apple trees, however, will do fairly well in the better drained places.

KEYPORT FINE SANDY LOAM
Group B

A gray fine sandy loam underlain at 10 inches by a yellow or pale-yellow moderately friable fine sandy clay loam. This material grades into yellow moderately friable fine sandy clay. At a depth of 20 inches gray spots occur in the material, and at a slightly greater depth a plastic drab clay with faint yellow mottlings is reached. Minute flakes of mica and some small quartz gravel are present in this material. As mapped, small areas of Keyport loamy fine sand are included with this soil.

The relief of the land is such as to afford ample surface drainage, but in some places the impervious substratum retards the percolation of ground water, especially in areas where the surface is comparatively flat. In such places the surface soil remains saturated for a long time, and this feature reduces the value of the soil for the production of truck crops. General farm crops and some truck crops are grown in most of the areas. In places where surface drainage is good, potatoes do fairly well because of the sandiness of the soil.

KEYPORT LOAM
Group B

A grayish-brown loam underlain at about 12 inches by a pale-yellow or yellow moderately friable clay loam. At a depth ranging from 15 to 24 inches, this soil grades into a somewhat plastic clay that contains gray and yellow spots, which indicate incomplete oxidation. Quartz gravel may be present in some places on the surface.

Keyport loam is an important general farming soil. Grasses and corn are the principal crops, and some truck crops, mainly peppers and tomatoes, are grown for market. This is one of the good corn soils of the area because of its comparatively heavy texture and good moisture supply. The soil is too heavy for successful potato growing.

KEYPORT SANDY LOAM
Group B

A gray loamy fine sand or light sandy loam underlain at about 8 inches by a yellow sandy loam that is underlain at about 18 inches by a greenish-yellow fine sandy clay. At a depth greater than 26 inches, a mottled yellow and grayish-yellow plastic clay is reached, and in the lower part of this layer the color is uniformly drab.

Surface drainage is good. Keyport sandy loam is an easily cultivated soil and fairly productive. It is a good soil for the production of early crops.

KEYPORT SANDY LOAM, DEEP PHASE
Group B

A light-brown loamy sand or light sandy loam underlain at 5 to 15 inches by a yellow heavy sandy loam or light sandy clay that becomes pale yellow in color and more like sandy clay in texture as depth increases. In most places, this sandy clay rests on yellow or pale-yellow stiff clay at a depth varying from 20 to 30 inches.

This soil occupies undulating, rolling, or hilly areas. Most of it is well drained, and the greater part of it is used for farming. It is very similar to Sassafras sandy loam, deep phase, but it is not considered so productive. It is a better truck-farming soil than typical Keyport sandy loam, but it is not so productive for corn, small grains, and hay.

KEYPORT SILT LOAM
Group B

A yellowish-brown or grayish-brown silt loam or heavy silt loam that is 6 to 10 inches thick. This grades to a pale-yellow silty clay loam that is underlain by a stiff heavy yellow clay mottled with gray and bluish gray. The mottling usually occurs at a depth of 18 to 25 inches. This heavy clay extends many feet below the surface.

It is considered a good soil for general farm crops. Corn, wheat, and hay are the main crops, but some of this soil is used for pasture and home orchards.

This is one of the better soils in the area for general farm crops.

KEYPORT SILTY CLAY LOAM
Group C

A grayish or yellowish-brown silty clay loam underlain at 5 to 8 inches by a yellow silty clay that becomes mottled yellow and gray below a depth of 15 inches. This grades to a stiff heavy pale-yellow and gray or bluish-gray clay within a depth of 3 feet.

Keyport silty clay loam might be described as a washed or eroded phase of Keyport loam, of Keyport silt loam, or of Keyport sandy loam. Where the surface soil is partly removed, the intricate mixture of the surface material and underlying clay, by instruments of tillage, has developed a clay loam texture; where the surface layer has been entirely removed, the underlying clay crops out on the surface and Keyport silty clay loam has developed; and where erosion has been light and plowing shallow, Keyport loam, Keyport silt loam, or Keyport sandy loam has developed.

Most of this land is cleared, and the greater part of it is utilized for pasture. Some of this soil is used for general farm crops, such as corn, wheat, and hay.

LACKAWANNA LOAM
Group C

A brown to reddish-brown heavy loam that ranges from 6 to 9 inches deep and contains a large amount of silt. When dry the soil is gray with a distinct tinge of red. The subsoil is reddish-brown to Indian-red loam. Fragments of red shale of various sizes are found throughout the soil profile. These fragments are universally subangular, which indicates relatively little glacial action. On account of its irregular topography, greater difficulty is experienced in the cultivation of this soil than in the cultivation of others on the more level areas.

Lackawanna loam is better suited to general farming than to special crops.

During dry seasons, pastures on this soil suffer from lack of moisture, and frequently the sod is ruined.

LACKAWANNA STONY LOAM
Group E

A slightly friable brown to reddish-brown loam that grades into a yellowish brown or Indian red at 5 to 8 inches deep. This variation in color is governed by the depth of glacial till and the proportion of materials derived from rocks other than those underlying this soil.

Lackawanna stony loam occupies the northwest slopes of the Kittatinny Mountain. The topography is gently to steeply sloping, and the drainage is well established.

This soil is derived from the weathering of glacial till composed largely of materials from the underlying red shale and sandstone. The shale material has been mixed with a considerable quantity of conglomerate and sandstone from Wallpack Ridge and the Kittatinny Mountain.

Lackawanna stony loam offers a good opportunity for systematic forestry.

LAKWOOD FINE SAND

Group D

A fine white sand underlain at 8 to 12 inches by an orange-colored loose fine sand that passes into a yellow or pale-yellow fine sand. In some places, particularly in low-lying areas, a rather compact layer of brownish sand forms an incipient hardpan at various depths.

The topography is level to gently undulating. Drainage is good to excessive except in the lower situations where the subsoil may remain saturated for a considerable time after periods of rainy weather.

LAKWOOD GRAVELLY SANDY LOAM

Group D

A gray loamy fine sand or very fine sandy loam underlain at 6 inches by a golden-yellow or dark yellowish-brown sandy loam or fine sandy clay loam. In most places quartz is present on the surface and throughout the soil. The quantity of gravel is variable, but it is sufficiently large to interfere with cultivation. In some places it forms a large part of the soil mass.

The gravel content interferes with the production of crops that require very careful cultivation, especially asparagus. Also, it hinders tillage of truck crops. The less gravelly areas produce moderately good truck crops. When these areas are fertilized according to recommendations, they are capable of producing sweet corn, tomatoes, peppers, and a number of other crops. Such areas are somewhat better adapted for general farm crops than Lakewood sand.

LAKWOOD SAND

Group E

A white loose clean sand underlain at 6 to 20 inches by an orange-colored sand of comparatively open structure that extends to a depth of 36 inches or more. Locally the orange-yellow color of the subsoil passes into yellow as depth increases. In general, the subsoil is uniform in texture; in places it contains some gravel and coarse sand.

Very little of this soil is cultivated. The greater part of it is covered with forest trees that are small and in places scattered. The

trees are mostly pitch pine and scrub oak with an undergrowth of shrubs. In many places the growth consists of bushes and a few small trees.

The agricultural value of this soil is very poor.

LAKWOOD SAND, SHALLOW PHASE
Group D

A loose white sand underlain at about 4 to 6 inches by an orange or yellow sand. In places the surface soil is grayish. Included within this phase are small areas of typical Lakewood sand and an occasional patch of white sand that is 3 feet deep and does not have the yellow or orange-yellow subsoil.

Topography is level to gently undulating, and the drainage is good to excessive. The soil is considered better farm land than the Lakewood sand, but it is not so productive as the Sassafras sand. Vegetables, peaches, and berries are the crops that may be expected to succeed best. This soil, like the typical Lakewood sand, is exceptionally low in organic matter, especially in the first 6 inches. It is also highly quartzose and low in plant nutrients.

LAKWOOD SANDY LOAM, DEEP PHASE
Group E

This soil consists of about 4 to 8 inches of white sand that frequently has a little grayish color in the surface inch. This is underlain by yellow or orange-yellow loamy sand that passes into reddish-yellow, orange-yellow, or yellow sandy loam to sandy clay at a depth ranging from 1 to 2 feet. In turn, this passes abruptly into yellow friable sandy clay at depths of about 30 inches.

This soil occupies high well-drained areas with rolling topography. Many of the higher knolls are capped with the gravelly variation. Drainage is excessive.

Practically none of the soil is cleared. The forest consists of scrub oak and pine with an undergrowth of bracken and huckleberry. On the plains the growth consists chiefly of stunted and prostrate pitch pine and scrub oak that rarely exceed 4 feet in height. Some laurel, bearberry, and the small plants of the heath family are also abundant. In other places the surface is bare of vegetation. The trees of the plains are very inferior to those found elsewhere.

LANSDALE GRAVELLY LOAM

Group B

A brown or light-brown silt loam underlain at 6 to 10 inches by a light-brown or yellowish-brown silt loam that passes quickly into brownish-yellow or yellow silty clay or silty clay loam. In some places the subsoil has a reddish cast. There is an abundance of angular platy fragments of grayish and reddish argillite or sandstone, quartzite, and shale on the surface and through the soil and subsoil.

This soil is used for general farm crops and pasture.

LANSDALE SHALE LOAM

Group B

A brown to light-brown silt loam underlain at 6 to 8 inches by a yellowish-brown silt loam. This passes into brownish-yellow silty clay loam or silty clay at about 12 to 15 inches. In places traces of reddish material occur in the subsoil. Angular fragments of gravel cover the surface of this soil and also occur throughout the soil section. These fragments consist chiefly of dense dark-gray argillite or sandstone, but in some areas platy shale fragments, varying in diameter from 2 to 8 inches or more, are present.

Some areas of Lansdale shale loam are included with the gravelly loam as mapped. The material in these two soils is practically the same.

A considerable part of this soil is cleared and used for general farm crops. Wheat, oats, and some corn and grass are the principal crops. Yields are lower than those obtained on the Lansdale silt loam. Dairying is important on this soil, and some fruit is grown.

LANSDALE SILT LOAM

Group A

A brown silt loam underlain at 8 to 14 inches by a yellow-brown friable silty clay loam that passes into a yellow or yellowish-brown friable silty clay. In many places there are some sandstone and shale fragments in it. Some small patches of Lansdale loam are included in this soil as mapped.

Drainage is well established except on the flatter areas where the subsoil is sometimes imperfectly drained.

This soil is nearly all under cultivation. There are only small tracts of timber left on this soil, and these are often on the flatter areas.

Dairying is an important industry. Alfalfa does well on this soil.

LANSDALE STONY LOAM
Group E

As mapped, Lansdale loam with stone symbols represents Lansdale stony loam. This soil is much like Lansdale silt loam. As most of this soil is wooded, the surface half inch usually consists of leaf mold. Under this there is a dark-brown silt loam underlain at 3 or 4 inches by a yellow silt loam or gritty loam that passes into a yellow clay loam to clay. Numerous stone fragments, usually of blue or red argillite and varying in size from that of an egg to pieces several feet in diameter, are found in this soil. In some places outcrops of bedrock occur. The surface is sloping to steep, and drainage is fairly good except in local spots where seepage water from higher slopes accumulates. Very little of this soil is cleared. The forest growth consists largely of red oak, white oak, chestnut oak, ash, some maple, beech, and elm. The few cleared areas are used almost exclusively for pasture. The steeper slopes occupied by this soil should be kept in forest trees.

LEHIGH SHALE LOAM
Group C

A light-brown to grayish-brown silt loam underlain at 6 to 8 inches by a mottled light-grayish, yellowish, and bluish silty clay loam to silty clay that is compact in the lower subsoil. Bedrock is normally encountered between 15 and 30 inches. Large quantities of grayish and bluish shale fragments occur throughout the soil.

General farm crops, such as wheat, corn, oats, and grass, are grown. Yields are slightly less than those obtained on the Penn shale loam. Lehigh shale loam is shallow, and during dry seasons crops suffer from lack of moisture. Dairying is an important industry on this soil.

LEHIGH SILT LOAM
Group C

A gray or brownish-gray silt loam underlain at 5 to 10 inches by a mottled gray and yellow or pale-yellow silty clay loam to silty clay. This passes into bluish-gray silt loam or silty clay loam at about 20 inches. In places it is somewhat compact. The degree of mottling in both the upper and lower subsoil varies considerably with the locality.

Lehigh silt loam occupies nearly flat to gently sloping areas that have good drainage except in some flat places where seepage water accumulates from higher slopes.

Much of this soil is under cultivation. Corn, wheat, oats, and grass are the crops generally grown. Yields are less than those on Penn, Lansdale, and Montalto soils.

LEON FINE SAND
Group E

A light-gray to white fine sand underlain at 10 to 16 inches by a coffee-brown layer of fine sand that is slightly compact. This passes into orange-yellow fine sand at 18 to 20 inches and extends to a depth of 3 feet or more.

Some variations from the above description are noted. In places an inch or so of dark-gray to black fine sand forms the immediate surface. In other situations, the soil is a white fine sand grading into white gravelly sand. This grades into compact coffee-brown sand at 30 inches. The thickness and compactness of this coffee-brown layer seems to depend on the drainage. The more nearly level poorly drained areas have the thickest and most compact layer. Included with this soil are some areas of Leon sand.

As far as crops are concerned, this is an unimportant soil in its natural state, and practically all of it is in forest. The growth consists of scrub oak, scrub pine, swamp maple, and birch with an undergrowth of greenbrier, laurel, huckleberry, and bracken. In places where sufficient water for flooding is available, this soil could be diked and drained and used for cranberry bogs.

LEON SAND
Group E

A light-gray loose sand underlain at 3 to 5 inches by a white loose sand that is underlain by a compact hardpan layer of dark-brown or coffee-brown sand at 10 to 16 inches. This layer is 8 to 10 inches thick. Below this layer the material is an orange or yellow sand or loamy sand that extends to 36 inches or more. In places the hardpan is found at depths below 16 inches. Some areas of St. Johns sand are included with the Leon sand.

The surface of this soil is characteristically flat, but in places it is slightly hummocky. This soil lies at a somewhat lower level than the Lakewood sand, and it lies in somewhat higher and better drained positions than the St. Johns sand. Drainage is, however, poor.

Little of this soil is cleared. The virgin forest is chiefly scrub pine and oak with considerable huckleberry and bracken.

MADE LAND AND CLAY PITS
Group F

Not applicable.

**MEADOW
Group D**

Meadow represents a condition rather than a soil. The material shows many different surface and subsurface colors and many textural variations both laterally and vertically. It occurs at the head of streams and drainageway bottoms. It is generally imperfectly drained, but it represents better agricultural material than swampland. It is now largely used as pasture and grazing land, and in places it produces some corn and hay. With the development of better drainage, some parts could be used for a wider variety of crops.

**MERRIMAC FINE SANDY LOAM
Group B**

A brown fine sandy loam that is rather heavy in places. This is underlain at about 8 to 12 inches by a light-brown or yellowish-brown fine sandy loam that grades into coarse material in the lower subsoil. There is a reddish cast in the subsoil of some areas.

Merrimac fine sandy loam is found in the old lake regions and along the streams that deposited outwash.

Most of the Merrimac fine sandy loam has been cleared of hardwood forest and is under cultivation. Both general farm crops and market-garden crops are grown. Tomatoes, cabbage, peppers, onions, potatoes, grapes, and small fruits are produced.

**MERRIMAC GRAVELLY LOAM
Group B**

A brown mellow loam or gritty loam that grades into a brownish-yellow or orange-yellow friable loam or gritty loam at 10 to 12 inches. Below a depth of 20 inches, gravel and sand are present in varying proportions. This stratified condition extends into the deeper subsoil. The surface soil commonly contains a small amount of gravel.

This is a productive soil. The mellow surface soil is easily worked into seedbeds, and the gravel in the subsoil ensures ample drainage. Good yields of corn and general farm crops are obtained. This soil is also used to produce excellent yields of potatoes and truck crops.

**MERRIMAC GRAVELLY LOAM, ROLLING PHASE
Group C**

A brown gravelly loam underlain at 6 to 8 inches by a brownish-yellow gravelly loam that becomes more yellow as depth increases. The

lower part of the subsoil usually contains more gravel mixed with some sand, which indicates stratification.

As mapped, some areas of Merrimac gravelly sandy loam, rolling phase, are included with this soil. It differs from the typical Merrimac gravelly loam, rolling phase, in that it contains both in the surface soil and subsoil a considerable amount of sand and gravel.

This soil occupies hillocks and rather steep slopes as well as rolling topographic positions. Drainage is good, and in many places it is excessive.

Owing to its topographic position, excessive drainage, and high gravel content, it is droughty and difficult to till. Merrimac gravelly loam, rolling phase, is suited to practically the same crops as Merrimac gravelly loam, but its agricultural value is inferior to that of the latter soil. Many areas are used as gravel pits.

MERRIMAC GRAVELLY SANDY LOAM Group C

A brown sandy loam underlain at about 10 to 12 inches by a yellowish-brown or yellow sandy loam that becomes more yellowish brown and contains more sand and gravel in the lower part of the subsoil below a depth of 28 to 30 inches. An abundant amount of rounded waterworn gravel is present throughout the entire soil.

Some of this soil is cleared and planted to general farm crops, some truck crops, and fruit. Its high content of gravel somewhat restricts its use for crops. Crops on extremely gravelly areas are affected by excessive drought.

MERRIMAC GRAVELLY SANDY LOAM, ROLLING PHASE Group D

The rolling phase of Merrimac gravelly sandy loam differs from the Merrimac gravelly sandy loam in that it has a higher content of gravel and occurs on rather steep slopes and rolling hilly areas that are subject to erosion and excessive drainage.

Very little attempt is made to farm this soil as its extreme droughtiness and steep relief render cultivation difficult and unprofitable.

MERRIMAC LOAM
Group B

A brown mellow loam or gritty loam underlain at 10 to 12 inches by a brownish-yellow or orange-yellow friable loam or gritty loam. Below a depth of 20 inches, gravel and sand are present in varying proportions. The surface soil commonly contains a small amount of gravel that consists of rounded waterworn gneiss fragments together with some sandstone, quartzite, and trap.

This is a productive soil. The mellow surface soil is easily worked into an excellent seedbed, and the gravel in the subsoil ensures ample drainage. Good yields of corn, general farm crops, potatoes, and truck crops are produced.

MERRIMAC LOAM, GRAVELLY PHASE
Group B

See MERRIMAC GRAVELLY LOAM.

MERRIMAC LOAM, IMPERFECTLY
DRAINED PHASE
Group C

A brown or yellowish-brown mellow loam underlain at 10 to 12 inches by a reddish-yellow or yellow friable fine sandy loam or sandy loam that becomes more sandy and mottled yellow and bluish gray with slight mottles of reddish yellow at a depth of 18 to 20 inches. In most places the subsoil is compact below a depth of about 20 inches.

MERRIMAC LOAMY SAND
Group C

A yellowish-brown loamy sand underlain at 2 to 3 inches by a yellow or slightly reddish-yellow loamy sand that contains more gravel and coarse sand in the subsoil.

This soil occupies level or very gentle rolling positions, and it is well drained.

This soil is practically all cleared and under cultivation. Crops grown are practically the same as on Merrimac sandy loam, and the two soils are managed in much the same manner. Crop yields are slightly lower on Merrimac loamy sand than on Merrimac sandy loam, but this disadvantage is offset somewhat by the early maturing qualities of crops grown on the loamy sand.

MERRIMAC SANDY LOAM

Group B

A brown sandy loam underlain at about 10 inches by a yellowish-brown or yellow friable sandy loam that grades abruptly into brownish-yellow sandy loam at a depth of 20 to 22 inches. The subsoil below this depth commonly contains some gravel and coarse sand, and in places it has a faint reddish color.

This soil occupies level or very gently rolling positions that are well drained. Although this is not an extensive soil, it is locally important in the production of market-garden crops.

MERRIMAC SANDY LOAM, GRAVELLY PHASE

Group C

See MERRIMAC GRAVELLY SANDY LOAM.

MERRIMAC SANDY LOAM, IMPERFECTLY

DRAINED PHASE

Group C

A brown or yellowish-brown sandy loam underlain at 9 to 12 inches by a reddish-yellow or yellow sandy loam that becomes more sandy and mottled with yellow, reddish-yellow, and bluish-gray in the deep subsoil. Considerable fine sand occurs throughout the soil. The mottling is the result of poor aeration and the lack of good subsoil drainage.

Mostly it is used to produce truck crops. The cultural practices and soil treatment are practically the same as that for the imperfectly drained phase of Merrimac loam with which this soil is closely associated.

MONTALTO GRAVELLY LOAM

Group B

A brown silt loam underlain at 6 to 8 inches by a rusty-brown, brownish-yellow, or reddish-yellow to yellowish-red moderately friable silty clay. The material is very gravelly from the surface down. The gravel consists of fine-grained basalt. In places gravel constitutes fully 50 percent of the soil mass. In some places there are still a few very large fragments of the parent rock in the fields. This soil has been derived from the underlying traprock except in those areas mapped at the foot of the steep slopes where much of the material is of colluvial origin.

As a whole the drainage is good, but there are a few spots where the drainage is imperfect. Where it is properly managed, this is a good soil for general farm crops and fruit.

**MONTALTO SILT LOAM
Group A**

A light-brown or brown to light reddish-brown silt loam that grades at depths ranging from 6 to 12 inches into reddish-yellow or reddish-brown silty clay loam that passes into friable yellowish-red clay. In a few places the soil contains more or less gritty particles of partly disintegrated rock. There are some small fragments of traprock in many places, particularly near areas of the Montalto gravelly loam and stony loam soils.

This soil occurs on gently sloping or gently rolling to nearly flat areas. The drainage is good except near areas of the Watchung soils where the underdrainage is poor in certain places. Montalto silt loam is an excellent soil. It has been cleared and is used chiefly for growing general farm crops.

**MONTALTO SILT LOAM, GRAVELLY PHASE
Group B**

See MONTALTO GRAVELLY LOAM.

**MONTALTO STONY LOAM
Group E**

Montalto stony loam resembles Montalto gravelly loam except that it contains many larger rock fragments. Where these rocks have been removed, the areas are mapped as gravelly loam. In many places there are outcroppings of bedrock.

It generally lies on the steeper slopes, and it is well drained. Most of it is in chestnut oak, witch-hazel, basswood, and maple. About the only use made of this soil is for pastures.

MUCK

Group -- Improved, A; Unimproved, E

Muck consists of black well-decomposed vegetable matter that contains some inorganic or mineral material. The organic deposit is 24 inches or more in depth, and it is underlain by gray or pale yellowish-gray silty clay, sandy clay, or clay.

Numerous large ditches with smaller laterals are required to drain these swamp areas.

MUCK, INTERMEDIATE PHASE

Group E

The organic deposit is not more than 24 inches thick. It is underlain by grayish clay, sandy clay, or sand, mottled with yellow, bluish gray, and greenish gray. This intermediate soil occurs in close association with the typical muck soil and with the shallow phase of muck.

MUCK, SHALLOW PHASE

Group E

A black organic material underlain at not more than 10 inches by a heavy bluish-gray clay mottled with yellow that generally becomes more sandy as depth increases. In places the material below a depth of 30 inches consists of greenish-gray or grayish sandy loam or sand.

Practically all the shallow muck is wooded. Some small areas have been cleared and used for pasture, especially in dry seasons. When cleared, the soil supports a heavy growth of coarse grasses that grow in tussocks.

When this soil is reclaimed by drainage, it has excellent agricultural possibilities.

NORFOLK FINE SAND

Group C

A grayish-brown or brownish-gray loose fine sand underlain at 3 to 4 inches by a yellow or pale-yellow fine sand. In places, especially in the lower subsoil, there is a slightly reddish or orange color that approaches the color of Sassafras subsoil, but such areas are not typical. In low flat areas, the lower subsoil shows some gray mottling, and it is very moist.

This soil is too light for best results with general farm crops, but under careful management good results are obtained with vegetables. Corn is grown to some extent, but it is not so satisfactory on this soil as it is on the heavier soils.

NORFOLK SAND, POORLY DRAINED PHASE

Group D

A grayish sand or loamy sand underlain at 4 to 5 inches by a yellow sand, which is usually pale yellow and often mottled with grayish or orange yellow in the lower subsoil. The water table is seldom encountered above 26 inches, but it is nearly always reached within the 3-foot section.

Crops grown on this soil are very similar to those grown on Norfolk sandy loam, poorly drained phase.

NORFOLK SANDY LOAM,
IMPERFECTLY DRAINED PHASE
Group C

A gray to brownish-gray sandy loam underlain at about 6 inches by a yellow friable sandy clay that is slightly reddish at about 30 inches as it passes down into yellow sandy clay. Yellow and gray mottlings are present locally in the lower part of the 3-foot section, and the lower subsoil is usually moist.

As the name implies, drainage is not well established, especially in the subsoil. Tile drainage and liberal applications of lime will increase the productiveness of this soil.

NORFOLK SANDY LOAM,
POORLY DRAINED PHASE
Group D

A brownish-gray loamy sand to sandy loam underlain at 3 to 5 inches by a pale-yellow sandy loam that passes at 10 to 20 inches into a pale-yellow heavy sandy loam or sandy clay. Mottling is usually present in the lower part of the 3-foot section.

This soil is variable in color and texture. In the less depressed areas, the subsoil below 15 inches contains considerable red material, but such areas are not extensive.

Norfolk sandy loam, poorly drained phase, occupies low, flat, depressed areas adjacent to and at the heads of streams and swamps. It often occupies the normal position of the Portsmouth soils, but it naturally lies at a higher elevation than the latter. There are rather large bodies adjacent to the Tidal marsh in the southern and southwestern parts of the area, and it is these sections that are chiefly farmed. The soil is used for corn and vegetables.

PAPAKATING SILT LOAM
Group D

A black, dark-gray, or dark-brown silt loam underlain at 10 to 15 inches by a bluish-gray silty clay that is mottled with brown or rusty brown. This usually passes into a bluish-gray fine sandy loam or fine sand. In places the sand resembles marl and contains some small shells. Occasionally the subsoil is a black loam or silt loam. Papakating silt loam occupies wet poorly drained bottoms along many of the streams in the glacial regions.

Papakating silt loam is used mainly for pasture. The cleared and partly reclaimed areas make dependable permanent pastures, but the wetter areas can only be pastured during droughts.

When drainage is improved, this soil should prove to be valuable for forage areas.

PAPAKATING SILTY CLAY LOAM

Group D

A dark-gray, brown, or brownish-black silty clay loam that passes into a mottled gray and yellow, blue, or black plastic heavy clay. In places the lower subsoil is a very tough dark-brown clay mottled with gray.

This soil is found in the same relative positions as the Papakating silt loam. The two soils are poorly drained, and tree growth is about the same on both.

PENN GRAVELLY LOAM

Group B

An Indian-red or brownish Indian-red silt loam to loam underlain at 10 to 20 inches by an Indian-red silty clay that carries a large quantity of angular fragments and small cobblestones throughout the soil mass. The bedrock, consisting of conglomerate beds with quartzite, quartz, and some limestone pebbles in a red matrix, is encountered within the 3-foot section in places.

Cleared areas are used for growing corn, oats, wheat, and hay. Dairying is an important industry.

Large quantities of stone make this soil rather difficult to plow and till.

Penn gravelly loam is a good soil.

PENN SHALE LOAM

Group B

An Indian-red silt loam underlain at 8 to 14 inches by a brighter Indian-red brittle clay. There is an abundance of shale fragments from the surface down, and in most places the parent shale occurs within the 3-foot section. This is a common if not universal occurrence on the steeper slopes and especially those approaching streams. Often the lower subsoil is friable because of its large quantity of partly decomposed shale material.

It occupies gently rolling ridges, hillsides, and stream slopes, and it is often encountered in more level situations where the parent shale is close to the surface. Drainage is usually excessive, especially on the slopes, and the soil may be eroded. Crops often suffer from lack of moisture, especially during dry seasons.

Penn shale loam is cleared except for the rather steep slopes or places where the shale is close to the surface. White oak and hickory predominate in the forested areas. Cedar grows on some slopes where the soil is thin, whereas on other slopes beech is an important tree. This soil is used mainly for growing corn, oats, wheat, and hay. Dairying is an important industry.

PENN SILT LOAM
Group B

A chocolate or brownish Indian-red silt loam underlain at 8 to 18 inches by an Indian-red brittle clay. Some whitish and reddish quartzite occurs in places along the northern border of this soil, and red shale fragments are often present on the surface. The lower subsoil nearly always contains some shale particles. The parent red shale is usually encountered at depths ranging from 20 to 36 inches. Occasionally some fragments of blue or red argillite occur within the 3-foot section.

This soil is well drained. Only the areas where the surface soil is shallow suffer from drought.

Penn silt loam is well adapted to growing general farm crops and to dairying.

PODUNK LOAM
Group C

A brown mellow loam underlain at 8 to 12 inches by a yellow or brownish-yellow loam that becomes sandy in the deep subsoil. In the areas where drainage is more imperfect the subsoil is heavy and mottled bluish gray, yellow, and light gray. Some areas of Podunk sandy loam and of Podunk fine sandy loam have been included with this soil as mapped.

Podunk loam is used principally as pasture land, but some of it is used to produce corn and some late truck crops. Floods are a drawback in cultivating this soil, but if overflow can be avoided, crop yields should be good.

PORTSMOUTH LOAM

Group E

A black mucky loam underlain at about 10 to 12 inches by a whitish sandy loam to sandy clay with some pale-yellow mottling in the deep subsoil. In some parts of this soil as mapped, there is a black mucky loam with considerable sand at a depth of 10 to 12 inches, whereas the subsoil is a white saturated sand that in exposed sections, such as in ditch banks and caves, flows like quicksand. In places the hardpan layer occurs much nearer the surface and grades down into yellowish or orange-colored sandy material.

This soil is of little agricultural importance. It occupies low depressed areas frequently near the heads of streams where drainage is imperfect.

PORTSMOUTH LOAMY SAND

Group D

A black or dark-gray loamy sand underlain at 5 to 10 inches by a whitish or grayish loamy sand that in most places prevails for 15 or 20 inches. In many places the loamy sand is mottled gray and yellow, or gray, yellow, and pale blue to a depth exceeding 3 feet. In places the whitish layer extends below a depth of 3 feet. Locally the black surface soil is underlain by sand that has the characteristic colors of Elkton soils. Included with mapped areas of this soil are patches of the sand, sandy loam, and loam members of the Portsmouth series.

Most of this soil is covered with brush through which is a scattering of sweet gum, maple, bay, willow, cedar, and pine. The underbrush is usually a tangle of vines, swamp huckleberry, laurel, fern, and coarse grasses. On the outskirts of cultivated fields, broom sedge, species of crabgrass, blackberry bushes, and grapevines are conspicuous.

Where the land has been cleared, it is used as pasture, and in the better drained parts contiguous to upland soils, it is used for corn, hay, and truck crops.

PORTSMOUTH SANDY LOAM

Group D

A black mucky sandy loam underlain at 8 to 10 inches by a whitish sandy loam to sandy clay that has gravel and a higher sand content in the lower subsoil.

Only a very small part of Portsmouth sandy loam is cleared.

When drained, this soil has fair to good agricultural possibilities. Tile drains probably will give better drainage results than open ditches, but the latter have frequently been employed effectively in draining this kind of land.

RECLAIMED TIDAL MARSH
Group D

Reclaimed tidal marsh comprises areas that have been protected from tidal inundation by extensive systems of dikes. The water is drained away by open ditches or dikes provided with one-way water gates. Many of these areas are below the level of high tide, and the meadows or cultivated fields are protected by rough dikes of mud reinforced on the tidewater side by stone facings.

Considerable variation in color, structure, and degree of saturation occurs throughout the areas of reclaimed tidal marsh, particularly where the ditching is not complete.

It is reported that these areas were not immediately productive after diking, and in places nothing could be produced for 3 years. The river soil material does not respond so quickly as that on the more inland areas.

ROANOKE SILT LOAM
Group D

A brownish-gray or gray silt loam underlain at about 6 inches by a whitish silt loam that passes into a mottled gray and yellow silty gritty clay at 10 to 15 inches. In places reddish-yellow mottlings are noted in the deep subsoil.

It occurs on low poorly drained bottoms. The material appears to have been washed from upland soils.

Roanoke silt loam has been cleared, and it is used largely for pasturing dairy cattle.

ROANOKE SILTY CLAY LOAM
Group D

A gray to whitish silty clay loam to heavy silt loam underlain at 4 to 6 inches by a mottled gray and yellow or bluish-gray and yellow silty clay loam that passes into bluish-gray or a mottled gray and yellow silty clay that has a tough clay layer at depths ranging from 15 to 24 inches. The material in this layer has a mottled bluish, red, yellow, and gray color, which has the structure of a clay pan. In forested areas the gray surface layer is only 1 or 2 inches thick.

It occurs on flat or depressed areas, and it is poorly drained.

Roanoke silty clay loam, while of rather small extent, is important locally. About half of it is cleared. The existing forest growth consists of maple, birch, white oak, pin oak, hickory, and elm. Many of the larger areas are used for pasturing dairy cattle. Open ditches are used in the wettest places, and tile drains are used elsewhere. As a rule the yields are rather poor.

ROCK OUTCROP
Group F or E

Almost without exception, rock outcrop is valued only for its ability to produce timber.

ROUGH STONY LAND
Group F or E

Almost without exception, rough stony land is valued only for its ability to produce timber.

SASSAFRAS COARSE SAND
Group D

A brownish-gray or light-brown coarse sand underlain at about 6 to 8 inches by a yellow or reddish-yellow gravelly coarse sand. In wooded areas the surface soil is brownish gray to gray; in cultivated fields it is light brown.

This soil occurs mainly on gentle slopes where the drainage is good to excessive.

The cost of production on such a coarse-textured soil is so high that there is considerable doubt whether it can be farmed profitably under present economic conditions. Generally such land can best be used for forestry.

SASSAFRAS COARSE SANDY LOAM
Group C

A brown to grayish-brown coarse sandy loam to loamy coarse sand underlain at 5 to 6 inches by a yellowish to reddish-yellow coarse sandy loam that passes into a reddish-yellow to dull-red or yellowish-red coarse sandy clay at 8 to 12 inches.

This is a good soil, but it is not so productive as the sandy loam. It is used for much the same crops as the Sassafras gravelly sandy loam and sandy loam. It is not extensive, and only a small acreage is under cultivation.

SASSAFRAS FINE SAND
Group B

A grayish-brown to light-brown or brown fine sand underlain at about 6 inches by an orange-colored fine sand that passes into slightly reddish-yellow fine sand. Gravel and a considerable amount of medium or coarse

sand are present in the lower subsoil. In places the surface soil is a brown fine sand that passes into a yellow fine sand or first into a slightly reddish-yellow fine sand and then into a yellow fine sand at 10 to 12 inches. In timbered areas, the surface soil is a grayish-brown fine sand or in places a white fine sand to a depth of a few inches.

Prolonged droughts have less effect on this soil than on the Sassafras sand or coarse sand. This makes it a slightly better soil for crops.

The principal crops are potatoes, peppers, tomatoes, and melons. Some of this soil is still in forest.

SASSAFRAS FINE SAND, ROLLING PHASE Group C

Sassafras fine sand, rolling phase, is in all respects identical with Sassafras fine sand except in its occurrence on uneven rolling areas. It is less important as an agricultural soil because of its greater tendency to drift.

See Sassafras fine sand for more information.

SASSAFRAS FINE SANDY LOAM Group B

A light-brown to brown fine sandy loam that grades into a heavy reddish-yellow fine sandy loam at about 8 to 10 inches. This passes into a reddish-yellow friable fine sandy clay at about 20 inches. In the lower part of the 3-foot section, coarser material is commonly present.

Most of this soil is cleared, and it is cultivated in much the same manner as the Sassafras sandy loam and Sassafras loam with which it is closely associated. Yields on this soil are slightly lower than those obtained on the Sassafras loam.

SASSAFRAS GRAVELLY LOAM Group B

Sassafras gravelly loam resembles Sassafras loam, but the heavy layer in the subsoil is generally not so thick, and in places it is entirely lacking. Small rounded quartz gravel is plentiful over the surface and through the soil.

The presence of gravel does not restrict the agricultural use of the land since it does not interfere with cultivation. Crops in general do not appear to suffer from prolonged dry spells, but some excessively gravelly spots are droughty.

SASSAFRAS GRAVELLY SANDY LOAM
Group B

A brownish-gray gravelly sandy loam or loamy sand that passes within a few inches into a reddish-yellow gravelly sandy loam that forms the lower part of the soil and upper part of the subsoil. This grades into a gravelly sandy loam or gravelly sandy clay in which the gravel and sand are coarser. Below a depth of 24 to 30 inches this grades into a still coarser material that consists of a mixture of gravel and sand or coarse sand and sand. The gravel throughout the profile consists of rounded, waterworn quartz fragments.

This soil is variable in texture. In many places in wooded areas the surface soil is gray to nearly white. Below depths of 2 to 4 inches, however, the color is brownish gray, light brown, or yellowish brown.

This soil usually occupies the slopes and caps of the higher parts of low hills in rolling country. A number of large tracts, however, has a level or nearly level to gently undulating topography. The drainage is good, and it is excessive in some of the higher situations.

It is well adapted to a wide range of crops, and it is extensively used for potatoes, corn, clover, and grass. A small acreage is devoted to small grains and fruit.

SASSAFRAS GRAVELLY SANDY LOAM,
FLAT PHASE
Group B

The flat phase differs from the typical Sassafras gravelly sandy loam in its nearly level surface and in its frequently yellowish upper subsoil and moister lower subsoil. The latter becomes coarser and redder with depth except in small areas that occupy the lowest places. In such places the subsoil approaches the yellow color of Norfolk subsoil. Drainage is not so good as in the more rolling areas of Sassafras gravelly sandy loam.

In general, it is used for the same crops as Sassafras gravelly loam. This soil is devoted largely to corn, hay, tomatoes, potatoes, and peppers. It has practically the same agricultural characteristics as Sassafras gravelly sandy loam, but it cannot be worked as early in the spring.

SASSAFRAS LOAM
Group A

A brown mellow loam underlain at 8 to 10 inches by a reddish-yellow friable silty clay or sandy clay that becomes looser and coarser below 28 to 30 inches. In many places a layer of gravel is encountered at 30 to 36 inches. In other places the surface soil is a light-brown loam

underlain by a reddish-yellow friable loam that becomes coarser and lighter as depth increases.

Surface and internal drainage of this soil is adequate though not excessive. The topography is level to gently undulating.

It is of great agricultural importance, and practically all of it is under careful cultivation. It is considered the most desirable soil in the area for the production of potatoes and other crops.

SASSAFRAS LOAM, SHALLOW PHASE
Group A

A heavy brown loam or silt loam underlain at 6 to 8 inches by a reddish-yellow or yellowish-red clay that does not change much throughout the 3-foot section except that the lower subsoil takes on a slight reddish tinge.

It occupies undulating topographic positions where drainage is good.

Practically all of this soil is used to produce general farm crops.

SASSAFRAS LOAMY COARSE SAND
Group C

A brownish loamy coarse sand underlain at 5 to 7 inches by a reddish-yellow loamy coarse sand or coarse sandy loam. In some places the subsoil below 30 inches is a vivid orange-yellow loamy coarse sand to coarse sandy loam.

Sassafras loamy coarse sand is used principally for truck crops. The leading crops are beans, peppers, potatoes, onions, and sweet potatoes. Some corn and hay are produced. It ranks as one of the less important soils of the area.

SASSAFRAS LOAMY FINE SAND
Group B

A grayish-brown, yellowish-brown, or brown loamy fine sand underlain at 8 to 10 inches by a dark-yellow or orange loamy sand that persists to a depth of 3 or more feet and rests on light-orange or reddish sand. In certain places the light layer or subsoil comes close to the surface, and the surface loamy fine sand rests on reddish-yellow or yellowish-red sand.

Included with this soil are a few spots where the surface soil is gray. Such areas may occur where this soil adjoins Lakewood sand. In a few local spots drainage is imperfect.

Most areas are gently rolling and well drained.

This is an easy soil to work, and good early truck crops are produced.

SASSAFRAS LOAMY SAND
Group B

A light-brown to grayish-brown loamy sand underlain at about 8 inches by a reddish-yellow loamy sand that assumes the texture of a sandy loam or coarse sandy loam in places at a depth of about 30 inches.

In wooded areas the surface soil is gray to light grayish brown and passes abruptly at about 4 or 5 inches into the typical subsoil.

Sassafras loamy sand occupies level to gently rolling areas. Drainage is good. This soil is used to produce fruit and truck crops. Peaches and apples are grown, also.

SASSAFRAS LOAMY SAND,
FLAT PHASE
Group C

A brown loamy sand underlain at about 10 inches by an orange-colored loamy sand. The lower subsoil consists of yellow sand along with some gravel. The lower part of the 3-foot section is generally pale yellow and wet.

This soil occupies level areas -- mainly in low situations where drainage is restricted.

Probably 50 percent of this soil is farmed. Good yields of corn, potatoes, and truck crops are obtained under skillful management.

SASSAFRAS SAND
Group D

A brownish-gray or light-brown coarse sand underlain at about 6 to 8 inches by a yellow or reddish-yellow gravelly coarse sand. In wooded areas the surface soil is brownish gray to gray; in cultivated fields it is light brown.

Heavy applications of fertilizer or manure are necessary for the production of good crops. The cost of production on such a coarse-textured soil is so high that there is considerable doubt as to whether it can be farmed profitably under present economic conditions. Generally such land can best be used for forestry.

In general this soil has a nearly level to gently undulating topography. It is found also on knolls and slopes. Drainage is good to excessive. In dry seasons, crops are likely to suffer greatly from drought, especially if a liberal supply of organic matter has not been worked into the soil.

SASSAFRAS SAND, FLAT PHASE
Group C

A light-brown to brown sand that passes into an orange, reddish-yellow, or yellow sand at 6 to 8 inches. This usually passes into a pale-yellow wet sand in the lower part of the 3-foot section. In places a gravel stratum is present at 24 to 36 inches.

This soil is associated with the better drained Sassafras soils. But it occupies flat areas where the drainage is not always adequate and where the lower subsoil is generally wet.

SASSAFRAS SAND, MIXED PHASE
Group D

Sassafras sand, mixed phase, was originally mapped as Norfolk sand, but owing to its extreme lack of uniformity it has been thought best to class it as a mixed phase of the Sassafras sand. It includes patchy areas of (1) Sassafras sand with a grayish-brown surface soil to a depth of 6 or 7 inches that overlies reddish-yellow sand throughout the 3-foot section; (2) Norfolk sand with a light-gray to whitish surface soil and a pale-yellow subsoil; and (3) an intermediate soil between the Sassafras and Norfolk sands that has a grayish to whitish surface soil in the forested areas and a grayish-brown soil in the cleared areas.

The surface of the Sassafras sand, mixed phase, is usually flat to gently rolling, but the drainage is good and noticeably better than on the flat phase. Its light color indicates that oxidation has not proceeded so far as it has in the typical Sassafras sand. This soil is not so productive as Sassafras sand, but in general its use and adaptations are similar.

SASSAFRAS SANDY LOAM
Group A

A brown sandy loam underlain at 8 to 10 inches by a yellowish-brown sandy loam that grades into a reddish-yellow friable sandy clay at 10 to 14 inches. In some places where drainage is more or less imperfect, faint gray mottlings occur in the lower subsoil.

It occupies gently rolling to flat areas. Drainage is good.

It is an excellent soil for general farm crops. Corn and potatoes occupy a large acreage. Other crops grown are peppers, tomatoes, cabbage, and orchard fruits, especially apples and peaches.

SASSAFRAS SANDY LOAM, DEEP PHASE
Group A

Sassafras sandy loam, deep phase, differs from Sassafras sandy loam in that its sandy clay subsoil extends to a depth of 24 to 30 inches. The subsoil underneath this thick layer of light-textured and relatively light-colored sandy material is essentially the same as the material that underlies Sassafras sandy loam. This soil is less productive than Sassafras sandy loam because of its lower water-holding capacity.

**SASSAFRAS SANDY LOAM,
DEPRESSIONAL PHASE**
Group C

The soil of the depressional phase of Sassafras sandy loam differs from Sassafras sandy loam in that the friable sandy part of the subsoil is slightly mottled with yellow and gray, and in many places it rests on lighter materials that are less compact.

Most of this soil is used for pasture or for the production of general farm crops. In dry years heavier yields are obtained from this soil than from Sassafras sandy loam, but crops are later in starting and slower in maturing.

SASSAFRAS SANDY LOAM, FLAT PHASE
Group A

This soil differs from Sassafras sandy loam in that it has a level or nearly level surface and usually a moist subsoil. In texture it is nearly identical with Sassafras sandy loam. This soil includes some small areas with a yellow subsoil mottled slightly with gray. These areas represent inclusions of the Norfolk sandy loam, poorly drained phase. Sassafras sandy loam, flat phase, occurs in small bodies associated mainly with flat phases of the other Sassafras soils. Its agricultural uses and adaptations are very similar to those of Sassafras gravelly sandy loam and Sassafras sandy loam.

SASSAFRAS SILT LOAM
Group A

A brown or light-brown silt loam underlain at 4 to 8 inches by a yellowish-brown or brownish-yellow silt loam that grades to yellow or slightly reddish-yellow friable silty clay loam or light silty clay within a depth of 16 inches. This is underlain by a light material of variable texture at 24 to 36 inches. Much of the surface soil has a well-developed crumb-like structure, but there are places where it is very compact. When moist or wet it is brown in color, but it has a decided grayish cast during prolonged dry spells.

Locally the color of the heavy subsoil layer may be more nearly red or reddish brown, and in places the texture of the lower part of this layer changes to sandy clay loam or sandy clay. There is considerable variation in texture and structure near a depth of 3 feet, depending on the proximity of the underlying gravel bed. In most places the gravel bed occurs at a greater depth than in the associated Sassafras loam.

SCRANTON SANDY LOAM
Group D

A black mucky loamy sand or sandy loam underlain at 8 to 10 inches by a yellow or orange-yellow sandy loam or friable sandy clay that becomes more sandy as depth increases. The surface of this soil is similar to that of Portsmouth and St. Johns soils, whereas the subsoil closely resembles the subsoil of the imperfectly drained phases of Norfolk soils. In places there is some gray and orange-yellow mottling in the lower subsoil, which is usually moist.

This soil occupies flat, rather low situations that have imperfect drainage. Except along the bay shore, most of it is in forest.

SHREWSBURY FINE SANDY LOAM
Group C

A grayish-brown loamy fine sand or heavy fine sandy loam underlain at 10 inches by a yellow or pale-yellow fine sandy clay loam that passes into a greenish-yellow heavy fine sandy loam at 15 to 20 inches. This becomes lighter in texture as depth increases, and in some places it becomes a mottled drab and yellow fine sandy clay. Quartz pebbles are present in certain areas.

Some small areas of this soil are poorly drained, but the larger bodies are as well drained as the bodies of Sassafras sandy loam and Sassafras fine sandy loam.

Shrewsbury fine sandy loam is differentiated from Sassafras sandy loam by the presence of mottling in the subsoil. In some places mottling consists of merely rust-brown spots in the sandy material. In other places

the deep subsoil material consists of sandy clay or clay that has not yet become uniformly oxidized.

SHREWSBURY LOAM

Group D

A brown or grayish-brown loam underlain at 5 to 8 inches by a mottled bluish-gray and yellowish-brown silty loam or silty clay loam. This is underlain at 20 to 36 inches by a greenish-yellow or mottled reddish-yellow clay. The degree of mottling depends on the drainage. The better drained areas show less mottling than those in which the drainage is undeveloped. The greenish color results from the presence of greensand marl, which is conspicuous in the lower part of the subsoil.

Shrewsbury loam occurs in flat or depressed areas, and most of it is imperfectly drained. Drainage is effected in places by the use of open ditches or tile. The soil does not warm up early in the spring. Great care has to be exercised in preparing it for crops. Most of the soil is compact and close even in areas that have a heavy undergrowth and a scattered growth of trees.

Only a small proportion of this soil is used for farming. Most of it is covered with brush or a thin forest. When the forest is removed and the land is artificially drained, it is used to produce corn and hay. Imperfectly drained areas are used for pasture.

SHREWSBURY SANDY LOAM

Group D

A brown or dark-brown sandy loam underlain at 6 to 12 inches by a gray or light-gray sandy clay that grades into a greenish-gray sandy loam or sandy clay mottled with rust brown or red at 15 to 24 inches.

Greensand marl is present in this soil, and in most places it becomes more conspicuous as depth increases. The mottles, so characteristic of subsoils in this series, are largely attributed to the presence of greensand under poor drainage.

Tracts occupy flats or depressions, and drainage is imperfect. About half of the soil is used for agricultural purposes.

Adequate drainage must be established on all this soil before it can be used to best advantage.

SHREWSBURY SILT LOAM
Group E

A grayish-brown, gray, or drab silty loam or silty clay loam underlain at about 10 inches by a thin layer of yellow silty clay. This passes into a plastic silty clay mottled with yellow, green, or drab spots.

Practically all the areas of Shrewsbury silt loam lie close to the coast and in low-lying situations. Together with the loam, this soil occurs in close association with tidal marsh, and it is only slightly higher.

Nearly all the land has been cleared. Forested areas support a growth of various deciduous trees -- mainly white oak, which gives rise to the local name "white oak land." Although a large part of the land is cleared, very little is used for crops. Most of it is in residential sites; the remainder is used for hay and pasture. Poor drainage and the fact that the soil is inclined to bake during dry weather are the reasons this soil is not used for cultivated crops.

ST. JOHNS FINE SAND
Group -- Improved, B; Unimproved, E

A dark-gray to black fine sand underlain at 5 to 8 inches by a dingy-gray to white fine sand. This is underlain by a compact coffee-brown fine sand that changes to a looser lighter brown sand. In the lower subsoil this becomes an orange-colored fine sand as depth increases.

Only the more loamy areas are under cultivation. These areas have been reclaimed by the installation of tile drains, and they give good yields of late truck crops and corn. Most of the land is forested with a growth similar to that on St. Johns sand. Some areas have been converted to cranberry bogs.

ST. JOHNS SAND
Group -- Improved, B; Unimproved E

A black sand underlain at about 7 inches by a white sand that extends to a depth of about 16 inches. At this depth a 4-inch thick layer of dark-brown compact sand that has the characteristics of a hardpan is encountered. This is underlain by a dingy orange-yellow sand that extends to a depth of 36 inches or more. The lower sand stratum is usually saturated with water, and it flows slowly into excavations. A considerable proportion of coarse quartz fragments appears in the lower subsoil of some areas. The material from the surface down is strongly acid in reaction.

This soil is developed in depressions and in areas adjacent to or at the heads of swamps. The drainage is poor, and much of this soil is under water during periods of excessive rainfall.

St. Johns sand is used in the production of cranberries.

Artificial drainage is necessary before this soil can be satisfactorily cultivated.

SWAMP

Group -- Improved, B; Unimproved, E

Swamp represents various soil materials that are almost continuously in a state of water saturation. The predominating material consists of black muck underlain at 15 to 30 inches by whitish sand. Some areas included consist of muck to depths of 2 to 3 feet, and the surface material is brownish peat. In the mapping of large areas of this type, especially about the heads of streams and in broad stream bottoms, there are included island-like areas of Portsmouth sandy loam, St. Johns sand, and Leon sand.

Much of the swamp is still in trees that include white cedar, black gum, maple, bay, birch, and some pine.

TIDAL MARSH

Group E

A dark-colored oozy material of silty clay that often contains much organic matter.

Costly diking and drainage operations are necessary to put this soil in condition for farming. Until the areas of available well-drained land have been brought more completely under cultivation, it appears unwise to attempt extensive reclamation of these marshes for agriculture.

UNCLASSIFIED CITY LAND

Urban areas. -- Not applicable and usually not surveyed.

WALLKILL SILTY CLAY LOAM

Group D

A compact fairly friable dark-drab silt loam to clay that is about 9 inches deep. The subsoil, from 9 to 36 inches, is usually a black muck that rests on a deposit of dark-brown organic matter.

This soil is practically level since it is found but a few feet above streams and is subject to inundation during periods of extremely heavy rains.

This soil owes its origin to an accumulation of organic matter that underlies the fine-earth materials washed from the adjoining uplands. It is derived from both colluvial and alluvial materials. In some cases the areas of this soil are being increased by fresh accretions of earth during recurring inundations.

The native growth on this soil consists principally of maple, but most of it is cleared and used for grass and pasture.

WALLPACK FINE SANDY LOAM
Group C

A brown fine sandy loam. The upper subsoil is a light-brown to yellowish-brown sandy loam that is somewhat heavier in texture than the surface soil. At 36 inches a still heavier loamy material is frequently encountered. Glacial boulders distinct from the fine earth are found throughout the soil section.

Gently sloping topography and the rather porous texture of the soil allow free drainage.

There is some doubt as to the origin of this soil. The lower subsoil is generally ascribed to the weathering and decomposition of glacial till, whereas the upper part of the soil has been modified to a considerable extent by wind action.

WALLPACK SHALE LOAM
Group C

A gray shaly silt loam that is about 7 inches thick. It becomes a light ashy gray when dry. To a depth of 20 inches or more, the subsoil is a pale yellow to a grayish yellow silt loam when dry. The shale content, representing from 60 to 75 percent of the soil mass, increases with depth, and the rock fragments become larger until the bedrock is encountered at 20 to 36 inches.

General farming is the predominating form of agriculture, and fair yields of corn and rye are produced.

WALLPACK SILT LOAM
Group B

A friable silty loam to silt loam that is about 6 to 8 inches thick. It contains a large number of thin, cherty, and shaly fragments. The soil is brown when moist and a decided gray when dry. Shaly fragments and a large amount of silt give this soil a decidedly friable structure. The subsoil is a yellowish-brown to grayish-brown silty loam to loam. It contains fragments of limestone larger than those usually found in the surface soil.

Topography is gently rolling to rolling, and it affords sufficient drainage.

Wallpack silt loam owes its origin to glacial till that has been derived principally from cherty and shaly limestones of Devonian age.

The forest growth is similar to that of the other upland soils of the area. Wallpack silt loam is considered the best of the upland soils west of the Kittatinny Mountain.

WALLPACK SILT LOAM, HEAVY SUBSOIL PHASE

Group B

A brown silt loam about 8 inches deep that becomes gray when dry. The subsoil is yellow, and to a depth of 20 to 24 inches it is practically the same in texture as the surface soil. It gradually becomes lighter in color and more compact in structure until at 24 inches a slight hardpan is developed. In the lower portion of the soil section the subsoil is often a grayish yellow.

Drainage, as a rule, is well established.

WALLPACK STONY LOAM

Group E

A brown loam underlain by a brown to yellowish-brown subsoil of about the same texture. On account of its rugged topography, this soil is not used for cultivated crops. Only a small amount of it is used for pasture. The forest growth consists mainly of oak and maple.

Wallpack stony loam is composed largely of residual material from cherty limestone.

WASHINGTON LOAM

Group A

A brown mellow loam underlain at 10 to 15 inches by a reddish-yellow moderately friable silty clay that is usually very gritty, especially in the lower part. Also, it contains small fragments of partly decomposed rock. In places the surface soil is distinctly reddish-brown when moist, and the subsoil is dull red.

Washington loam is an extensive and very important agricultural soil. Corn, oats, wheat, and hay are the principal crops.

WASHINGTON LOAM, GRAVELLY PHASE
Group B

A brown gritty loam underlain at about 8 to 10 inches by a yellow gritty clay that passes into a reddish-yellow friable gritty clay. In many places the subsoil is reddish-yellow even in the upper part. In a few places near Penn soils the lower subsoil has an Indian-red color. This shows that this subsoil is derived mainly from underlying shales of Triassic age. On the surface and through the soil and subsoil there is an abundance of rounded gravel and cobblestones. These stones consist of gneiss, chert, quartzite, sandstone, and other hard rocks.

This soil is nearly all cleared, and it is used extensively for farming. It is managed in the same way as Washington loam, and the yields are usually as good as those on Washington loam. The only agricultural difference is that the slightly steeper or more rolling topography and higher content of gravel make it more difficult to till.

WASTELAND
Group F

Not suitable for farming.

WATCHUNG SILT LOAM
Group D

A mottled brown and gray or mottled gray and yellow silt loam that passes into a bluish-gray or blue silty clay with yellow and limonitic-yellow mottling. In many places large fragments of traprock occur on the surface. Such areas represent inclusions of Watchung stony loam. In places yellow concretionary material is present in the lower subsoil.

Watchung silt loam occupies imperfectly drained areas that adjoin areas of Montalto soils. Practically none of it is under cultivation. It is used chiefly as pasture land. It supports a vigorous forest growth that consists of various oaks, dogwood, ash, and hickory.

This soil should be used for pasture land and forestry.

WATCHUNG SILTY CLAY LOAM
Group D

A gray to brownish-gray silty clay loam underlain at 6 to 10 inches by a mottled yellow and gray plastic silty clay loam or clay that usually becomes tougher and more plastic as depth increases. In places the lower layer consists of an impervious plastic clay or clay pan mottled

with light gray or bluish-gray and yellow. Locally the surface soil is a shallow light-brown silt loam, and the subsoil is a yellow clay that passes into a compact clay that contains some brownish concretionary material.

This soil occurs in small patches on seepy poorly drained slopes and in depressions along the heads of drainageways. It is poorly drained to swampy.

Watchung silty clay loam is of little agricultural importance owing to its small area and poor drainage.

WEHADKEE SILT LOAM

Group D

A light-brown or gray silt loam underlain at 3 to 5 inches by a light-gray silt loam mottled with yellow. This is underlain at a depth of 10 to 12 inches by a light bluish-gray plastic clay mottled with pale yellow and yellow at a depth of 36 inches. In places the lower part of the subsoil is mottled grayish yellow or pale yellow and bluish gray. In other places, especially near or adjacent to Westersfield soils, the subsoil frequently contains considerable mottling of chocolate red, dark reddish brown, or Indian red.

This soil, which consists of material washed from adjacent glaciated materials of Triassic age, occurs in one small area that covers about one-half square mile. It is imperfectly drained.

Agriculturally Wehadkee silt loam is of little importance. Where cleared, it is used for pasture, but most of it remains in forest.

WEHADKEE SILTY CLAY LOAM

Group D

A gray silty clay loam that passes abruptly into a bluish-gray or a mottled bluish-gray and yellow plastic clay or silty clay. In some places the lower subsoil is a dull-reddish tough plastic clay that has some gray and yellow mottling.

This is a first-bottom soil that is subject to frequent overflow. It is derived for the most part from wash from the Montalto soils. In extent and use it is of minor importance in the area. Much of it is still covered with pin oak, maple, birch, hickory, and elm. Where cleared, it is used as pasture land.

WETHERSFIELD GRAVELLY FINE SANDY LOAM

Group B

See WETHERSFIELD GRAVELLY LOAM.

WETHERSFIELD GRAVELLY LOAM
Group B

A dark-brown, reddish-brown, Indian-red or chocolate-red loam underlain at 6 to 8 inches by a reddish-brown, Indian-red, or chocolate-red loam that becomes more reddish as depth increases. Gravel, consisting of red sandstone together with considerable trap, gneiss, and quartzite, is found in varying quantities both on the surface and throughout the soil.

Although practically all this soil is cleared, it is not extensively cultivated as much of the land is either developed as real estate or awaits early development.

WETHERSFIELD LOAM
Group A

A brownish-red, chocolate-red, or dark reddish-brown loam underlain at 8 to 10 inches by an Indian-red or chocolate-red friable loam that extends to a depth of 36 inches or more. In many places considerable grit is present. In places a considerable amount of sandy material occurs in the lower part of the subsoil, and in other places the material is a sandy loam. Both these variations are inextensive and unimportant.

It occupies nearly level or gently rolling topographic positions, and it is well drained. The soil is mellow and easily cultivated. It is suited to general farm crops, fruit, and late truck crops.

WETHERSFIELD LOAM, LIGHT-COLOR PHASE
Group A

A brown or slightly reddish-brown loam underlain at 6 to 8 inches by a yellowish-brown loam that becomes a reddish-yellow below a depth of 18 to 20 inches. The reddish shade increases with depth, and in many places Indian-red and chocolate-red loam are found in the deeper subsoil.

This soil occupies level or rolling positions. Drainage is good.

Much of this soil is used for building sites, but some of it is planted to fruit and general farm crops. On other areas more favorably situated in respect to markets, it is used to produce garden and truck crops.

WETHERSFIELD SILT LOAM

Group A

A brown mellow loam underlain at 8 to 10 inches by a yellow, brownish-yellow, or slightly reddish-yellow silt loam that grades into a light chocolate-red silt loam or silty clay loam at 18 to 20 inches. This is underlain by a chocolate-red or Indian-red friable silty clay or silty clay loam below a depth of 30 inches. In places, the lower part of the subsoil is sandy. In slight depressions where drainage is rather imperfect, this soil is slightly mottled with gray and reddish yellow.

Wethersfield silt loam is an excellent agricultural soil that is especially suited to corn, grass, and other general farm crops.

WHIPPANY LOAM, SANDY SUBSOIL PHASE

Group D

A grayish-brown or bluish-gray loam underlain at about 10 inches by a pale-yellow loam mottled with gray or bluish gray. This is underlain at 12 to 15 inches by a pale-yellow sandy loam or sandy clay that passes into a yellow sandy loam or loamy sand with bluish-gray and rust-brown mottles.

An included area consists of bluish-gray silt loam underlain at 3 inches by a gray silty loam or silty clay loam that grades into a mottled bluish-gray and yellow or yellowish-brown plastic clay at 10 inches. This becomes less yellow with depth and passes into a bluish-gray sandy clay slightly mottled with yellow at about 20 inches. Below about 26 inches the material is mottled bluish-gray and yellow sandy clay loam. The lower sand stratum is saturated with water, and it varies considerably in color and texture.

The areas occupy low depressions adjacent to streams, and they are poorly drained.

Reclamation by drainage is necessary if this soil is to be brought under cultivation.

Most of this land is covered with sedges and timber.

WHIPPANY SILTY CLAY LOAM

Group D

A gray or brownish-gray to grayish-brown silty clay loam underlain at 6 to 10 inches by a mottled yellow and gray or bluish-gray heavy plastic clay that passes into a tough dull Indian-red claypan that is faintly mottled in places with blue and yellow at 24 to 30 inches. The claypan is tough and stiff. It is usually dry even when the surface is saturated with water. The higher parts are not so poorly drained, and they differ

from Whippany loam, sandy subsoil phase, in that they consist of a gray-brown or light-brown silt loam to a depth of about 8 inches. This is underlain by a mottled yellow and gray silty clay that becomes stiffer as depth increases.

It is a low-lying swampy soil, and much of it is under water during parts of the year. Some better drained areas occur on higher elevations along the sides of hills or mountains, but all areas are poorly drained.

The cleared areas are used chiefly for pasture. In places where the drainage is naturally better or where it has been improved artificially, corn, hay, and truck crops, such as cabbage and tomatoes, are produced.

WHITMAN SILTY CLAY LOAM
Group D

A gray or grayish-brown silty clay loam underlain at 8 to 10 inches by a mottled bluish-gray and pale-yellow rather plastic silty clay or clay that passes into a compact mottled chocolate-red, yellow, and bluish-gray clay at about 28 inches.

Virtually none of this soil is under cultivation, but in places it is used as pasture land. Much of it still remains in timber. In places the material is stony; such areas are indicated on the map with stone symbols.

If this soil is to be brought under cultivation, underdrainage is necessary.

WOODSTOWN LOAM
Group C

A brown or light-brown loam underlain at 6 to 10 inches by a pale-yellow or yellow loam that rarely exceeds a depth of 15 inches. This grades into a yellowish-gray, grayish-yellow, or mottled bluish-gray and yellow sandy clay or sandy clay loam. As the depth approaches 3 feet, the grayish colors usually predominate, and in places there is a layer of gray sand.

This soil occurs in flat or depressed areas. Drainage has not been generally developed in the subsoil, and in many places water is present within a depth of 3 feet.

Some effort has been made to drain the soil by open ditches or by the use of tile. When this soil is drained, it produces good crops of corn, wheat, and hay.

WOODSTOWN SANDY LOAM
Group C

A light-brown or brown loamy sand, sandy loam, or heavy sandy loam underlain at about 10 inches by a mottled yellowish-brown or yellow and bluish-gray sandy clay, which in most places grades into a mottled bluish-gray and yellow friable and somewhat plastic clay at a depth of 20 inches. The bluish-gray color predominates in the lower part of the subsoil. In most places the clay rests on sand or gravel or a combination of sand and gravel within a depth of 4 feet.

Woodstown sandy loam occurs in flat, depressed, or sloping areas close to stream heads or tidal marsh. The subsurface drainage is imperfectly developed, and in many places water is found within a depth of 3 feet. Some effort has been made in places to improve drainage conditions by open ditches and tile. Most of the land is cleared. It is used principally for pasturing cattle. The better drained areas are planted to the same crops as Sassafras sandy loam, but they are not considered so productive.

GLOSSARY OF SPECIAL TERMS

- Alluvial soils -- A group of soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.
- Bedrock -- Solid rock underlying soils and other superficial formations.
- Bog soils -- A group of soils with a muck or peaty surface soil underlain by peat.
- Calcareous soil -- Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly to the naked eye when treated with hydrochloric acid. Soil alkaline in reaction owing to the presence of free calcium carbonate.
- Clay -- Small mineral soil grains; less than 0.002 mm in diameter.
- Claypan -- A dense and heavy soil horizon underlying the upper part of the soil; hard when dry and plastic or stiff when wet; presumably formed in part by the accumulation of clay brought in from the horizons above by percolating water.
- Crystalline rock -- A general term including igneous and metamorphic rocks composed of minerals in crystalline form.
- Drift -- Material of any sort deposited in one place after having been moved from another. Glacial drift includes glacial deposits, unstratified (till), and stratified glacial outwash materials.
- Fertility, soil -- The quality that enables a soil to provide the proper compounds in the proper amounts and in the proper balance for the growth of specified plants when other factors such as light, temperature, and the physical condition of the soil are favorable.
- First bottom -- The normal flood plain of a stream, part of which may be flooded only at infrequent intervals.
- Flood plain -- The nearly flat surface subject to overflow along stream courses.
- Friable -- Easily crumbled in the fingers; nonplastic.
- Glacial soil material -- Parent material of soil that has been moved and redeposited by glacial activity.
- Glei -- Denotes a wet condition within the soil.
- Hardpan -- A hard or cemented soil horizon. The soil may have any texture and is compacted or cemented by iron oxide, organic material, silica, calcium carbonate, or other substances.

Horizon, soil -- A layer of soil approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil-building processes.

Humus -- The well-decomposed organic matter of the soil.

Igneous rock -- A rock produced through the cooling of melted mineral material.

Land -- The total natural and cultural environment within which production must take place. Its attributes include climate, surface configuration, soil, water supply, and subsurface conditions together with its location with respect to centers of commerce and population. It should not be used as synonymous with soil or in the sense of the earth's surface only.

Marl -- An earthy deposit consisting chiefly of calcium carbonate mixed with clay or other impurities in varying proportions. It is used frequently as an amendment for soils deficient in lime.

Mellow soil -- A soil that is easily worked or penetrated.

Mottled (mottling) -- Irregularly marked with spots of different colors, which generally indicates poor drainage. (See glei.)

Muck -- A fairly well decomposed organic soil material that is relatively high in mineral content and dark in color. It is accumulated under conditions of imperfect drainage.

Nutrients, plant -- The elements essential for plant growth that are taken in by the plant and used by it in the production of food and tissue. They include nitrogen, phosphorus, calcium, potassium, magnesium, sulphur, iron, manganese, copper, boron, zinc, and perhaps others obtained from soil, and carbon, hydrogen, and oxygen obtained largely from air and water.

Parent material -- The unconsolidated mass from which the soil profile develops.

Peat -- Unconsolidated soil material consisting largely of undecomposed or slightly decomposed organic matter accumulated under conditions of excessive moisture.

Productivity, soil -- The capability of a soil for producing a specified plant or sequence of plants under a specified system of management.

Profile, soil -- A vertical section of the soil through all its horizons and extending into the parent material.

Reaction -- The degree of acidity or alkalinity of the soil mass expressed in pH values, or in words as follows:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 8.0
Strongly acid	5.1 to 5.5	Strongly alkaline	8.1 to 9.0
Medium acid	5.6 to 6.0	Very strongly	
Slightly acid	6.1 to 6.5	alkaline	9.1 and higher

Relief -- The elevations or inequalities of a land surface considered collectively.

Residual or sedentary material -- Soil material presumably developed from the same kind of rock as that on which it lies.

Second bottom -- The first terrace level of a stream valley lying above the flood plain; rarely or never flooded.

Sedimentary rock -- A rock composed of particles deposited from suspension in water. The chief groups of sedimentary rocks are (1) conglomerates (from gravels), (2) sandstones (from sands), (3) shales (from clays), and (4) limestones (from calcium carbonate deposits), but there are many intermediate types.

Silt -- Small mineral soil grains the particles of which range in diameter from 0.05 to 0.002 mm.

Stratified -- Composed of or arranged in strata or layers, such as stratified alluvium. The term is applied to geological materials. Those layers in soils that are produced by the processes of soil formation are called horizons, whereas those inherited from the parent material are called strata.

Structure, soil -- The morphological aggregates in which the individual soil particles are arranged.

Examples are:

Prismatic	Crumb
Nutlike	Granular
Columnar	Fragmental
Platy	

Surface soil -- That part of the upper arable soil commonly stirred by tillage implements.

Terrace, geological -- A flat or undulating plain, commonly rather narrow and usually with a steep front, bordering a river, a lake, or the sea. Many streams are bordered by a series of terraces at different levels, indicating the flood plains at successive periods. Although many older terraces have become more or less hilly through dissection by streams, they are still regarded as terraces.

Texture, soil -- The relative proportion of the various size groups of individual soil grains.

Topsoil -- A general term applied to the surface portion of the soil, including the average plow depth (surface soil) or the A horizon where this is deeper than plow depth. It cannot be precisely defined as to depth or productivity except in reference to a particular soil type.

Weathering -- The physical and chemical disintegration and decomposition of rocks and minerals.

