Series 1953, No. 5 Issued May 1959

SOIL SURVEY

Norfolk County Virginia

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
VIRGINIA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Norfolk County will help you plan the kind of farming that will protect your soils and provide good yields. It describes the soils outside the built-up areas; shows their location on a map; and tells what they will do under different kinds of management.

Find Your Farm on the Map

In using this survey, start with the soil map, which consists of the sheets bound in the back of this report. These sheets, if laid together, make a large photographic map of the county as it looks from an airplane. You can see woods, fields, roads, rivers, and many other landmarks on this map.

To find your farm on the large map, use the index to map sheets. This is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located.

When you have found the map sheet for your farm, you will notice that boundaries of the soils have been outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map.

Suppose you have found on your farm an area marked with the symbol Pc. You learn the name of the soil this symbol represents by looking at the map legend. The symbol Pc identifies Portsmouth loam.

Learn About the Soils on Your Farm

Portsmouth loam and all the other soils mapped are described in the section, Descriptions of the Soils. Soil scientists walked over the fields and through the woodlands. They described and mapped the soils; dug holes and examined surface soils and subsoils; measured slopes with a hand level; noted differences in growth of crops, weeds, brush, or trees; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming.

After they mapped and studied the soils, the scientists judged what use and management each soil should have, and then they placed it in a capability unit. A capability unit shows the uses that can be made of the soil and the kind and amount of management needed to protect the soil and to obtain useful crops and other plants.

Portsmouth loam is in capability unit IVw-1. Turn to the section, Use and Management of the Soils, and read what is said about soils of capability unit IVw-1. You will want to study the table that tells you how much you can expect to harvest from Portsmouth loam under two levels of management.

Make a Farm Plan

For the soils on your farm, compare your yields and farm practices with those given in this report. Look at your fields for signs of runoff and erosion. Then decide whether or not you need to change your methods. The choice, of course, must be yours. This survey will aid you in planning new methods, but it is not a plan of management for your farm or for any other farm in the county.

If you find that you need help in farm planning, consult the local representative of the Soil Conservation Service or the county agricultural agent. Members of the staff of your State agricultural experiment station and others familiar with farming in your county will also be glad to help you.

Fieldwork for this soil survey was completed in 1953. Unless otherwise specified, all statements in this publication refer to conditions in Norfolk County at that time.

Henry, Elvin Francis, 1911–

Soil survey, Norfolk County, Virginia [by Elvin F. Henry, James Chudoba, and H. C. Porter. Correlation by William S. Ligon. Washington, U. S. Govt. Print. Off.] 1958.

i, 53 p. illus., maps (part fold. col.) 29 cm. (U. S. Soil Conservation Service. Soil survey, ser. 1953, no. 5)

Cover title.
In cooperation with Virginia Agricultural Experiment Station.
Bibliographical footnotes.

1. Soil-surveys—Virginia—Norfolk Co. 2. Soils—Virginia—Norfolk Co. (Series)

[S591.A22 ser. 1953, no. 5] 631.47 Agr 58-298

U. S. Dept. of Agr. Libr. 1So32F 1953, no. 5
for Library of Congress

Contents

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price $1.75

Series 1953, No. 5

Issued May 1959

SOIL SURVEY OF NORFOLK COUNTY, VIRGINIA

By ELVIN F. HENRY, Virginia Agricultural Experiment Station, in Charge; JAMES CHUDOBA, Soil Conservation Service; and H. C. PORTER, Virginia Agricultural Experiment Station

Correlation by WILLIAM S. LIGON, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Virginia Agricultural Experiment Station

General Nature of the Area

Norfolk County, which was established in 1691, is in the extreme southeastern part of Virginia (fig. 1). It is about 20 miles from the Atlantic Ocean. The county is bounded on the east by Princess Anne County, on the west by Nansemond County, on the south by Camden and Currituck Counties of North Carolina, and on the north by the waters of Chesapeake Bay and Hampton Roads.

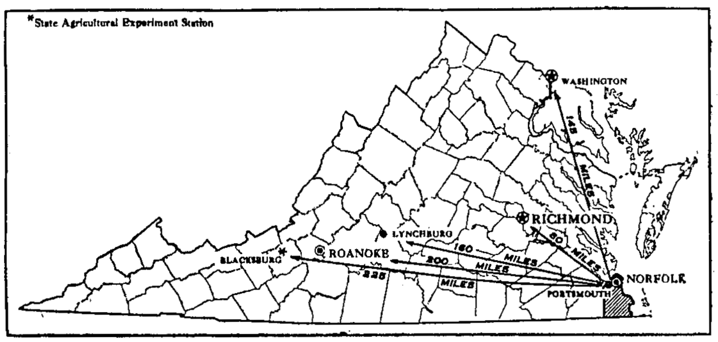

***Figure 1.*—Location of Norfolk County in Virginia.**

Of the total land area of 230,400 acres, about 50,000 acres form part of the Dismal Swamp of Virginia.

The principal cities—Portsmouth, the county seat, and Norfolk—are on opposite sides of the Elizabeth River. They border Hampton Roads, one of the deepest harbors in the world. In 1950 the population of the city of Norfolk was 213,513, and that of Portsmouth was 80,039. The population of the rest of the county was 99,937.

Physiography, Relief, and Drainage

Physiographically, Norfolk County lies within the Coastal Plain province. The soils occur on two geological marine terraces—the Dismal Swamp and the Princess Anne. The Dismal Swamp terrace, on which most of the soils occur, rises to elevations of 15 to 25 feet above sea level. It lies just above the Princess Anne terrace, which has elevations up to 15 feet. About one-fifth of the county is in the Dismal Swamp.

The county is nearly level. The northern part borders the Chesapeake Bay. Here, the coastline is long, and the action of the wind and tides has made it uneven. It is characterized by a narrow beach that fronts on narrow hummocks of windblown sand.

There are many small streams and runs throughout the county. These are bordered by low narrow ridges—100 to about 600 feet wide—that are occupied by well-drained soils. These ridges slope sharply to the broad flat plains that are occupied principally by poorly drained soils. One of the ridges, the Mount Pleasant, extends eastward from Great Bridge along the Chesapeake and Albemarle (Albemarle and Chesapeake) Canal and into Princess Anne County.

The overall drainage pattern is not well established. The reason is that many of the soils occur at low elevations. Also, surface water moves slowly in the Dismal Swamp in the western part of the county and at the places where the three branches of the Elizabeth River join the main stream. Natural drainage moves northward through these branches of the Elizabeth River and eastward through the Northwest River and the Chesapeake and Albermarle Canal. Many small streams empty into the larger waterways. Farther back from the mouths of these streams, the drainage becomes progressively more sluggish and many depressed areas are ponded during periods of heavy rainfall.

Climate

The climate of Norfolk County is oceanic. The temperatures are modified by breezes from the Atlantic Ocean and Chesapeake Bay. Summers are long and temperate. In July the average temperature is 78.7° F. Winters are mild. On only a few days is the temperature below freezing. Destructive wind, hail, and ice storms are infrequent.

Data on climate for Norfolk County are given in table 1. This information was compiled from records taken at the United States Weather Bureau Station at Norfolk.

Precipitation is usually well distributed throughout the year. The average annual precipitation at Norfolk is 43.26 inches, but at Wallaceton, on the edge of the Dismal Swamp, it is 51.19 inches.

The average growing season is 237 days. Spinach, kale, collards, and other hardy leafy greens withstand the winter temperatures, which average 43.1° F. in January. Fieldwork can be done throughout the winter.

TABLE 1.—*Temperature and precipitation at Norfolk Station, Norfolk County, Va.*

[Elevation, 11 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1930)	Wettest year (1889)	Average snowfall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	44. 5	76	5	2. 88	3. 02	0. 77	1. 8
January	43. 1	80	5	3. 17	4. 09	4. 88	2. 2
February	43. 5	81	2	3. 06	1. 24	4. 21	2. 8
Winter	43. 7	81	2	9. 11	8. 35	9. 86	6. 8
March	50. 5	92	14	3. 27	1. 68	7. 52	1. 8
April	57. 9	95	23	3. 16	2. 38	11. 87	(3)
May	67. 3	98	38	3. 45	1. 63	4. 58	0
Spring	58. 5	98	14	9. 88	5. 69	23. 97	1. 8
June	76. 0	102	49	4. 16	5. 90	4. 75	0
July	78. 7	102	57	6. 05	2. 50	10. 69	0
August	77. 8	105	56	5. 08	. 64	5. 93	0
Summer	77. 5	105	49	15. 29	9. 04	21. 37	0
September	73. 4	100	40	3. 86	. 57	5. 41	0
October	63. 0	91	31	2. 45	2. 00	7. 56	(3)
November	53. 2	81	17	2. 67	1. 26	2. 55	. 2
Fall	63. 2	100	17	8. 98	3. 83	15. 52	. 2
Year	60. 7	105	2	43. 26	26. 91	70. 72	8. 8

[1] Average temperature based on an 85-year record, through 1955; highest and lowest temperatures on a 60-year record, through 1930.
[2] Average precipitation based on an 85-year record, through 1955; wettest and driest years based on an 85-year record, in the period 1871–1955; snowfall based on a 40-year record, through 1930.
[3] Trace.

Water Supply

Most of the water used on farms is obtained from dug wells. In most places a good supply of water is available at a depth of about 100 feet. In general, the water is fairly good, but in some places it contains iron and other undesirable minerals. Some water is pumped from wells that are 15 to 25 feet deep, but as a rule the quantity and quality of this water is unsatisfactory for home use. A few free-flowing artesian wells provide a good supply of excellent water.

Water for irrigation is obtained from wells and streams that have been influenced but little by salt water. Small dams are used for storing irrigation water on a few farms.

Norfolk, Portsmouth, and the surrounding urban areas are supplied with water from a municipal system that is fed by the many lakes and large streams. Some of this water is piped from Lake Prince in Nansemond County.

Vegetation

When Virginia was first settled, the area that is now Norfolk County was densely forested. The forests apparently consisted of a mixture of loblolly pines and hardwoods such as poplar, beech, hickory, red maple, and species of oak and gum. At present almost all of the forests have been cut over. Many areas have either reseeded to sweetgum or to other hardy, less desirable species or have been covered by dense stands of waxmyrtle, gallberry, greenbrier, and reeds.

The Dismal Swamp was once a valuable source of whitecedar. Most of the cedar is being replaced by red maple, poplar, water oak, willow oak, loblolly pine, pond pine, tupelo-gum, sweetgum, and swamp blackgum. In many places where extensive peat fires have occurred, there is a dense stand of myrtle, gallberry, and cane reeds.

The ditch banks and hedgerows support almost impenetrable stands of smilax, myrtle, honeysuckle, blackberry, wild cherry, poison-ivy, English creeper, tall cane, wild grape, and weeds. The tidal marshes and fresh-water marshes are thickly covered with coarse reedy grass, cattails, and canes.

Except in the swamps, there is little relationship between the type of soil and the kind of vegetation that grows on it. Skutch cane, or reed, however, seems to be more prevalent on the gray wet soils. The fine sandy loams are the most favorable for loblolly pines. Pond pines and inferior hardwoods such as red maple, sweetgum, and tupelo-gum are more prevalent on the wetter soils that border the swamps. For a detailed discussion of the forests of Norfolk County, see the section, Forests.

Agriculture

The agriculture of Norfolk County is based largely on the growing of corn and soybeans and, to a lesser extent, on the growing of vegetable crops. Livestock has become more important during the last few years. Poultry raising is important, and beef cattle and dairy cattle are raised extensively. The most popular breed of cattle is the Aberdeen-Angus, but there are many herds of Herefords and one or more herds of Shorthorns in the county.

In the pages that follow, the more outstanding features of the agriculture of the county are pointed out. The statistics used are from reports published by the United States Bureau of the Census.

Agricultural History

Norfolk County was the first county in Virginia to be farmed intensively. Even before 1607, when the first settlers landed in Virginia, the Indians grew corn. Shortly after that date, the settlers began to grow tobacco and to use it as a medium of exchange. They also grew corn, flax, peas, and some small grains, mainly for use on the farm. The early settlers farmed the high sandy ridgelands near Great Bridge and Hickory. In the Churchland area, they grew vegetables and shipped them by water to the northern markets. The three branches of the Elizabeth River and the Dismal Swamp Canal, which was opened in 1836, were excellent outlets for shipping vegetables and other agricultural products from all parts of the county.

In recent years Norfolk County has been producing fewer vegetables. This is partly because improved transportation and better agricultural methods have increased the competition from other areas. This competition, along with the steadily increasing cost of labor, is gradually changing the agriculture of the county from truck farming to the growing of corn and soybeans.

Land Use and Size of Farms

In 1954, 78,293 acres of the land in the county was in farms. A total of 42,245 acres was harvested cropland, 17,860 acres was farm woodland, and 12,307 acres was pasture. There were 791 farms in the county.

Most of the farms are small. Farms of less than 30 acres are the most numerous; many of them are less than 10 acres in size. In 1954, only 4 farms in the county were 1,000 acres or more in size, and the average-sized farm was 99 acres.

Types of Farms

Norfolk County has always been important for its truck crops. Recently, however, the acreage in pasture has increased, and beef cattle, hogs, and poultry have become more numerous. In 1954, approximately 58 percent of the farms in the county were miscellaneous and unclassified. These were largely operated on a part-time basis to grow vegetables for local use. The rest were listed by type as follows:

	Number
Cash grain farms	166
Vegetable farms	25
Dairy farms	21
Poultry farms	25
Livestock farms other than dairy and poultry	46
General farms	35

The high cost and the scarcity of labor for truck farms have been responsible to some extent for bringing about the change from truck farming to using more of the acreage for pasture; consequently, the number of beef cattle, hogs, and poultry has been increasing. To offset the high cost of labor, many farmers have shifted from growing vegetables to growing corn and soybeans, which require less labor than truck crops. This shift has taken place in many areas where the soils, although suited to corn and soybeans, are also especially well suited to vegetables. One such area, near Churchland, was one of the oldest truck-farming areas in the Tidewater section of Virginia.

Crops

The present agriculture of the county centers largely around the growing of corn and soybeans, but vegetables are also important. A fairly large acreage is in small grains. On a few farms in the Churchland area, some acreage is in peanuts and cotton.

Figure 2.—**Harvest of snap beans in a field near Hickory.**

Figure 3.—**Kale, nearly ready for harvesting, in a field near Churchland. This and other hardy winter vegetables are important cash crops in this county. Many of them can be grown throughout the year.**

Corn and soybeans are grown in all parts of the county and on most of the soils. They are grown most extensively in the southern part of the county on the low, level, wet Elkton, Fallsington, Othello, and Portsmouth soils. The vegetable crops, small grains, peanuts, and strawberries are grown mainly on the Dragston, Galestown, Sassafras, and Woodstown soils near Churchland and Deep Creek and on the high sandy ridges near Great Bridge and Hickory (figs. 2 and 3).

Corn was grown on 17,489 acres in 1954, and 678,473 bushels were harvested for grain. Soybeans were grown on 16,719 acres. The soybeans yielded 284,547 bushels of beans. In addition, a yield of 335 tons of hay was obtained from 313 acres of soybeans harvested for hay. Soybeans were first grown extensively in the county in 1940 and have increased in importance since that time.

Oats and wheat are the most important of the small grains. In 1954, oats were grown on 1,732 acres, and wheat, on 1,441 acres. The oats yielded 79,230 bushels of grain, and the wheat, 46,581 bushels.

Lespedeza has become an important crop because livestock is being raised more extensively. In 1954, lespedeza was grown for hay on 821 acres, and a yield of 1,179 tons was obtained. It was grown for seed on 46 acres.

A total of 2,393 acres of vegetables was harvested for sale in 1954. Snap beans, sweet corn, cabbage, and kale were grown on the largest acreages. In addition, on farms of 20 or more acres in size, Irish potatoes were grown on 469 acres, and sweetpotatoes on 95. Strawberries, tree fruits, grapes, and nuts are grown to a lesser extent.

How a Soil Survey is Made

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and maps their boundaries on an aerial photograph or other map.

FIELD STUDY.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern but are located according to the lay of the land. Usually they are not more than 100 yards apart, and sometimes they are much closer. In most soils there are several distinct layers, called horizons, which collectively are known as the soil profile. Each layer is studied to see how it differs from others in the profile and to learn the things about this soil that influence its capacity to support plant growth.

Color is usually related to the amount of organic matter. The darker the surface soil, as a rule, the more organic matter it contains. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers and is later checked by laboratory analysis. Texture determines how well the soil retains moisture, plant nutrients, and fertilizer, and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger grains and the amount of pore space between grains, gives us clues to the ease or difficulty with which the soil is penetrated by plant roots and moisture.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil to underlying material and the nature of the underlying material; the steepness and pattern of slopes; the degree of erosion; and the acidity or alkalinity of the soil as measured by chemical tests.

CLASSIFICATION.—On the basis of the characteristics observed by the survey team or determined by laboratory tests, soils are classified by series, types, and phases.

As an example of soil classification, consider the Woodstown series of Norfolk County. This series is made up of two soil types, subdivided into phases, as follows:

Series	*Type*	*Phase*
Woodstown	Fine sandy loam	Nearly level phase.
		Undulating phase.
	Loamy fine sand	Nearly level phase.
		Undulating phase.

Soil series.—Soils similar in kind, thickness, and arrangement of soil layers are normally designated as a soil series. In a given area, however, it frequently happens that a soil series is represented by only one soil type. Each series is named for a place near which it was first mapped.

Soil type.—Soils having the same texture in the surface layer and similar in kind, thickness, and arrangement of soil layers are classified as one soil type.

Soil phase.—Because of differences other than those of kind, thickness, and arrangement of layers, some soil types are divided into two or more phases. Slope variations, degree of erosion, depth of soil over the substratum, and natural drainage are examples of characteristics that may require dividing a soil type into phases.

The soil phase (or the soil type if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. Use and management practices for it therefore can be specified in more detail than for soil series or yet broader groups that contain more variation.

Miscellaneous land types.—Fresh stream deposits, marshlands, and other areas that have little true soil are not classified into types and series but are identified by descriptive names, such as Coastal beach and Tidal marsh.

Soil complex.—If two or more soils are so intricately associated in small areas that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. An example of this is the Elkton-Othello very fine sandy loams.

Other technical terms used in describing the soils of Norfolk County are defined in the glossary at the back of this report.

Soil Associations

The map of soil associations at the back of this report shows the general patterns of the soils in Norfolk County. This map is helpful in studying the soils of the county in general or for broad program planning. It is not sufficiently detailed to be useful in studying the soils of a farm. Each association contains two or more different soils that are arranged in a characteristic pattern. In most places the pattern is related to the nature of the soil materials. The nine soil associations in Norfolk County are described in the following pages.

Association 1

This association is comprised mainly of Woodstown, Dragston, and Sassafras fine sandy loams. In general, the soils have a subsoil that is open and fairly permeable.

The largest areas are near Great Bridge. They extend eastward on the narrow ridges along the southern bank of the Chesapeake and Albermarle Canal and southward from Fentress to near Saint Brides. Some of the smaller areas lie next to the swamps. These are on the higher ridges on both sides of the Northwest River. Other areas lie northeast of Crestwood (see detailed soil map).

The soils of association 1 occupy about 5 percent of the county. The Dragston and Woodstown soils make up about 70 percent of the association. The Sassafras soils account for about 20 percent. The rest consists of Fallsington, Othello, Matapeake, Mattapex, and Bertie soils. Most of the areas of Fallsington and Othello soils are low and poorly drained.

Association 1 includes some of the most productive soils of the county. The Sassafras and Woodstown soils can be farmed without artificial drainage. Small truck farms predominate. Approximately 85 percent of the acreage is used intensively to grow truck crops, corn, soybeans, small grains, hay, and pasture. The rest is woodland, which consists mainly of woodlots on farms.

Association 2

Mattapex, Bertie, and Matapeake soils are predominant in association 2. These soils normally have a finer textured subsoil than the soils of association 1. In general, they are permeable and well aerated, and they retain water and plant nutrients well.

The largest area of this association is just southwest of Hickory. Other areas are near Benefit, and some lie west of Northwest on fairly narrow ridges on both sides of the Northwest River. Smaller areas are north of Grassfield; north, east, and west of Great Bridge; and east and west of Hutchins near the boundary of Princess Anne County. The Matapeake soils that are on the narrow ridges along streams have been moderately damaged by accelerated erosion.

This association covers about 5 percent of the county. The Bertie and Mattapex soils make up about 75 percent of the total acreage, and the Matapeake soils, about 15 percent. The rest of the acreage consists of Sassafras, Woodstown, Dragston, Othello, and Elkton soils.

Most of this association is in small farms. A few large areas near Hickory are still in forest. The cultivated soils are used principally for corn, soybeans, small grains, hay, and pasture. The well-drained Matapeake soils and the moderately well drained Mattapex soils are well suited to vegetables. Except for a small area near Great Bridge, however, these soils are not used for that purpose. The Bertie soils and the less extensive Othello and Elkton soils are used chiefly for corn and soybeans, but they must be artificially drained for maximum yields.

Association 3

This association consists mainly of Woodstown, Sassafras, and Dragston loamy fine sands. The soils are coarse textured and open, or porous. They occur at slightly higher elevations than the soils of most of the other soil associations.

The largest area lies north of United States Highway No. 58 and north and east of Churchland. It occupies most of the northwestern corner of the county. Another large area extends from the mouth of Deep Creek westward to Yadkin (see detailed soil map). It includes a fairly large area on the western bank of the Southern Branch Elizabeth River.

About 8 percent of the total area of the county is occupied by association 3. The Woodstown, Sassafras, and Dragston soils make up about 70 percent of the association. Most of the rest consists of Galestown and Klej soils (fig. 4). Small areas of Othello and Fallsington soils occur on many of the low, level, poorly drained areas. Narrow strips of Tidal marsh extend from the Western Branch Elizabeth River and its estuaries for short distances into areas of this association. The area along Deep Creek is composed mainly of the Galestown and Klej soils, and small areas of these soils also occur south of Churchland.

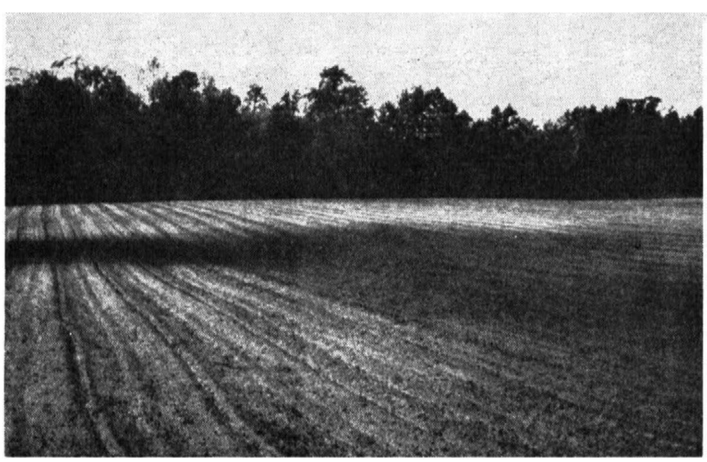

Figure 4.—**Cultivated field near Hodges Ferry. Moderately well drained, light-colored Woodstown soils are in the left foreground and background, and the somewhat poorly drained, dark-colored Klej soil is in the right foreground and center.**

When Virginia was first settled, the soils of this association were used for growing tobacco. Since about 1850, however, they have been used primarily for growing truck crops. Recently, because of the high cost and scarcity of labor, many vegetable growers, particularly in the Churchland area, have begun to use these soils for corn and soybeans. Much of the small grain produced in the county is grown in areas of this association. All of the soils are used for hay and pasture.

Most of the farms are small, but there are larger ones near Churchland. A few farms near Deep Creek have elaborate irrigation systems.

Association 4

This association, the second most extensive in the county, is made up principally of the grayish, poorly drained Othello and Fallsington soils. The principal area lies in the southern part of the county. It is about 3 miles wide in places and extends from Fentress to the vicinity of Northwest. Smaller areas occur near Grassfield, Churchland, Cornland, Benefit, and Wallaceton. The areas of this association occupy low, poorly drained flats that are next to swamps or between low ridges.

About 16 percent of the total area of the county is occupied by soils of association 4. The Fallsington soils are the most extensive in the Churchland area, and the Othello soils are predominant in all the other areas. Minor soils of this association are the somewhat poorly drained Dragston, Bertie, and Lenoir; the poorly drained Elkton and Pasquotank; and the very poorly drained Portsmouth. Mixed alluvial land occurs on narrow bottom lands along the larger streams that extend into areas of this association.

In general, the soils of this association are very strongly acid, and they retain water and plant nutrients well. In many places movement of air is somewhat restricted because of excess water and the unfavorable structure and consistence of the soil.

The principal crops are corn and soybeans, which are usually grown in a 2-year rotation. Pastures of Ladino clover, orchardgrass, and some species of fescue do well on these soils. The soils are so low and poorly drained that artificial drainage is required. The areas of Mixed alluvial land are in forest or are covered with a dense growth of shrubs and weeds. Water stands on them most of the time, so they are not used for agriculture.

Association 5

Association 5 is made up mainly of Portsmouth, Bayboro, and Bladen soils. These soils have a dark surface layer. The principal areas of the association fringe the Dismal Swamp. An isolated area occurs north of Butts, and other areas lie north and east of Hickory.

About 12 percent of the county is made up of soils of association 5. The Portsmouth soils are by far the most extensive. They comprise more than 60 percent of the total acreage. The Bayboro soils; Othello loam, dark surface phase; and Bladen silt loam each make up about

10 percent of the association. The rest of it consists of Weeksville and Pocomoke soils. Most of the soils are fertile and are very strongly acid to extremely acid. If cultivated, they must be artificially drained.

About 70 percent of the association is under cultivation. The rest is in forest or is covered by brush that has been cut or burned over. The area north of Butts, which consists mainly of Portsmouth soils, is used for growing nursery stock. During periods when both prices and the demand for crops are high, the areas that fringe the swamp are cleared and cultivated. Nearly all these areas are now used to grow corn and soybeans or for pasture. Because many areas have been reclaimed in recent years, the total acreage of the Dismal Swamp is diminishing.

Association 6

The Elkton, Keyport, and Lenoir soils are predominant in association 6. These range from medium textured to fine textured and are poorly drained.

This association occupies about 4 percent of the county. Nearly all of it occurs in the eastern half of the county. The principal areas extend from southeast of the town of Northwest, along the Princess Anne County line, to the Chesapeake and Albemarle Canal. A small area lies south of Hutchins.

Except for narrow strips of undulating and rolling soils that lie next to the larger waterways, the soils are level. Most of the areas consist of the level Elkton soils, so association 6 is more uniform in soil characteristics than most of the others.

The Elkton soils occupy at least 80 percent of the association, and the Keyport and Lenoir soils, about 15 percent. The rest of the association is made up of Bladen, Portsmouth, and Bertie soils; Tidal marsh; and Mixed alluvial land.

Much of this association is woodland, and timber is harvested in many areas. One of the largest uncleared areas is in the southeastern part of the county near the Princess Anne County line. Here, the poorly drained Elkton soil predominates. In most of these soils, water infiltrates slowly and air does not move freely. Corn and soybeans are grown, but some farmers have converted small fields to pasture. During wet periods crops are severely damaged if adequate artificial drainage is lacking.

Association 7

Association 7 is made up of Tidal marsh and Mixed alluvial land. It is the smallest association in the county and occupies only about 2 percent of the total acreage.

The areas occur on first bottoms along all the rivers and other principal streams. At the headwaters of the streams, these areas occupy narrow strips consisting mainly of mixed materials that have been recently deposited. As the streams extend toward the sea, the bottom lands gradually become wider and wetter and merge with fairly wide flats of Tidal marsh. The largest areas are along the Northwest River and along the three branches of the Elizabeth River.

Areas of this association occur next to the other associations, but they are too wet to be farmed. The areas of Mixed alluvial land are known locally as swamps and are covered with water most of the time. They support water-tolerant trees, such as cypress, red maple, and various species of gum. Marshgrasses and reeds are the principal vegetation on areas of Tidal marsh.

Association 8

Association 8 is comprised mainly of Mucky peat, which occurs in the Dismal Swamp and other areas. It is the most extensive association in the county and makes up about 25 percent of the total area. The principal area covers the entire southwestern part of the county. Fairly large areas occur along the Northwest River between Wallaceton and the town of Northwest. Others are along the Chesapeake and Albemarle Canal and extend from Great Bridge eastward to the Princess Anne County line.

In addition to Mucky peat soils, this association is made up of Portsmouth, Bayboro, Othello, and Fallsington soils. The water table fluctuates greatly, and the areas of peat dry out rapidly. When extremely dry, these areas are subject to fires that are difficult to control. During wet seasons many of the areas are flooded.

Most of the soils are extremely acid, but they are very fertile. Because of poor drainage, they have little agricultural value. Nevertheless, good crop yields have been obtained in adequately drained areas.

A few areas near Wallaceton, which lie next to better drained soils, have been reclaimed recently, but most of the association cannot be drained efficiently. Much of the land is owned by lumber companies and is leased to hunt clubs. There are many hunting cabins, particularly near Lake Drummond, but no farms in the association. The areas, especially those in the Dismal Swamp, are favorite haunts of Virginia deer and black bear.

Association 9

This association is made up of Wet soils. It occupies about 5 percent of the county. It occurs in a single large area in the center of the county. This area is considered to be a part of the Dismal Swamp and is known locally as the "Green Sea" because of the dense, uniform vegetation.

The principal components of the Wet soils are the Portsmouth and Othello soils, which occur in about equal proportions. Minor soils are the Bayboro, Elkton, Bladen, and Fallsington. Because of the lack of natural drainage outlets and the level relief, the overall drainage pattern is unfavorable and the land is extremely wet most of the time. Much of the area has been stripped of its best timber, and only the inferior types are reseeding. Sweetgum, blackgum, red maple, and pond pine are predominant species. Burned areas support a dense stand of blackberry, smilax, waxmyrtle, gallberry, Virginia creeper, and tall canes.

There is little evidence that much of this association was ever used for agriculture. A few tracts on small farms near the fringes of the area are used for limited agriculture. No farms occur within the "Green Sea." Three secondary State highways extend across the area.

Descriptions of the Soils

This section contains detailed descriptions of the soils mapped in Norfolk County. After the name of each soil is the letter symbol that identifies that particular soil on the map in the back of this report. Under the heading, Use and Management of the Soils, the capability unit of each soil is given. The approximate acreage and proportionate extent of each soil are shown in table 2.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Proportionate extent
	Acres	*Percent*
Bayboro silt loam	434	0.2
Bayboro mucky loam	1,587	.7
Bertie very fine sandy loam	5,314	2.3
Bertie fine sandy loam, olive-gray subsoil variant	186	.1
Bladen silt loam	2,921	1.3
Coastal beach	9	(1)
Dragston fine sandy loam	7,593	3.3
Dragston loamy fine sand	2,997	1.3
Elkton silt loam	9,214	4.0
Elkton-Othello very fine sandy loams	4,917	2.1
Fallsington fine sandy loam	7,721	3.4
Galestown loamy fine sand	1,106	.5
Keyport very fine sandy loam	536	.2
Klej loamy fine sand	749	.3
Lenoir very fine sandy loam	2,209	1.0
Made land	2,574	1.1
Matapeake fine sandy loam:		
Nearly level phase	902	.4
Eroded undulating phase	190	.1
Mattapex very fine sandy loam:		
Nearly level phase	1,912	.8
Undulating phase	46	(1)
Mixed alluvial land	2,843	1.2
Mucky peat	51,413	22.3
Mucky peat, shallow over loams	8,402	3.6
Mucky peat, shallow over sands	739	.3
Othello very fine sandy loam	17,055	7.4
Othello loam, dark surface phase	3,644	1.6
Othello-Fallsington fine sandy loams	14,937	6.5
Pasquotank very fine sandy loam	782	.3
Pocomoke fine sandy loam	648	.3
Portsmouth loam	14,480	6.3
Portsmouth mucky loam	4,415	2.0
Sassafras fine sandy loam:		
Nearly level phase	568	.2
Undulating phase	383	.2
Sassafras sandy loam, nearly level phase	778	.3
Sassafras loamy fine sand:		
Nearly level phase	2,271	1.0
Eroded undulating phase	502	.2
Eroded rolling phase	667	.3
Tidal marsh	3,152	1.4
Weeksville silt loam	723	.3
Wet soils	9,102	4.0
Woodstown fine sandy loam:		
Nearly level phase	3,344	1.5
Undulating phase	228	.1
Woodstown loamy fine sand:		
Nearly level phase	3,295	1.4
Undulating phase	176	.1
Pits	16	(1)
Urban and farmsteads	32,720	14.1
Total	230,400	100.0

[1] Less than 0.1 percent.

Bayboro silt loam (Bb).—This soil is very poorly drained and is strongly acid. Most of it occurs near the edge of the Dismal Swamp. It is associated with the Portsmouth and Bladen soils.

This soil has a deep, black surface layer that contains a large amount of organic matter. The subsoil is fine textured, slowly permeable, and poorly aerated. The water-holding capacity is good. Surface runoff and internal drainage are slow.

Representative profile:

Surface soil—
0 to 10 inches, black, friable silt loam.
Subsoil—
10 to 30 inches, dark grayish-brown, very plastic and sticky silty clay with a few, medium, faint mottles of gray and yellowish brown.
Substratum—
30 to 50 inches, gray, slightly plastic and slightly sticky very fine sandy clay loam.

In a few small areas, the surface soil is only 6 to 8 inches thick. In some places a sandy layer occurs at a depth of about 4 feet.

Use and management.—Most of this soil is in forests of tupelo-gum, sweetgum, swamp blackgum, red maple, loblolly pine, pond pine, poplar, beech oak, and water oak. Areas that have been burned over are covered mostly by myrtle, gallberry, smilax, and reeds. Some areas are used to grow corn, soybeans, and hay, or for pasture.

Corn and soybeans are usually grown in a 2-year rotation. Corn commonly receives applications of a complete fertilizer. Fields to be planted to soybeans following corn seldom receive additional fertilizer. Crops on this soil respond well to moderately heavy applications of phosphate and potash. This soil is strongly acid and needs large amounts of lime.

Lateral drainage ditches with good outlets are necessary to remove excess surface water. Because the subsoil is clayey, the ditches must be placed close together; they are less likely to collapse, however, than those in coarser textured soils. This soil is wet during the growing and harvesting seasons, and as a result, fieldwork is restricted in may places. Deep plowing and thorough harrowing make the soil more permeable to water and air.

Because this soil is fertile and has good water-holding capacity, weeds grow early in the fields of corn and soybeans. Some farmers control them effectively by using commercial sprays. Others reduce the amount of fertilizer used in the initial application for corn, so that the weeds will not make such a rank growth. This soil is in capability group IVw–1.

Bayboro mucky loam (Ba).—Except for the texture of the surface layer, this soil is similar to Bayboro silt loam in most characteristics. The surface layer is slightly deeper, more porous, and better aerated than that of Bayboro silt loam. Although the light, spongy surface soil absorbs water readily, the fine-textured subsoil is only slowly permeable. Most of this soil is within the Dismal Swamp, but some of it lies along the principal rivers and waterways. The sandy substratum occurs at a depth of about 36 inches in most places.

Use and management.—This soil is mainly in forest, but a few areas have been cleared and are used for corn and soybeans. Management practices are similar to those used on Bayboro silt loam. Drainage of excess surface water is necessary in cultivated areas. The soil retains moisture and plant nutrients well. But because it has a high base-exchange capacity, it is acid and requires heavy applications of lime. The soil warms slowly in spring. It can be worked fairly soon after rains because the surface soil absorbs water readily and dries out rapidly. This soil is in capability group IVw–1.

455251—59——2

Bertie very fine sandy loam (Bd).—This is a somewhat poorly drained soil. It commonly occurs in association with Mattapex and Othello soils. In color and drainage it is similar to the Dragston soils, but its subsoil is made up of finer textured mixed materials. This soil is moderately permeable to water and air, and it has moderate water-holding capacity. It is fairly easy to work and conserve and is moderately productive. In most places sandy strata occur at a depth of about 35 inches.

Representative profile:

Surface soil—
- 0 to 8 inches, pale-yellow, friable very fine sandy loam with a few, fine, faint mottles of pale olive and brownish yellow.

Subsoil—
- 8 to 30 inches, mottled brownish-yellow and light-gray silty clay loam with thin layers of heavy very fine sandy loam; slightly sticky and slightly plastic; many, medium, distinct mottles of brownish yellow.
- 30 to 35 inches, olive-gray, slightly sticky very fine sandy clay loam with common, coarse, prominent mottles of strong brown.

Substratum—
- 35 to 45 inches, pale-olive, very friable very fine sandy loam with common, coarse, distinct mottles of yellowish brown.

Use and management.—This soil is commonly used to grow corn, soybeans, vegetables, small grains, and hay, or it is pastured. Corn and soybeans are usually grown in a 2-year rotation. Where vegetables are grown, corn, a small grain, or a hay crop follow the vegetable crop, which is heavily fertilized. On some dairy farms a small grain is seeded with vetch for use as silage. Many farmers grow oats and other small grains to make mixed concentrates for their dairy cattle. Some dairy farmers seed the rotated pastures to a mixture of Ladino clover, orchardgrass, tall fescue, and lespedeza.

At least 1 or 2 tons of lime per acre are required in most places to bring the soil to the pH required for good pasture. This soil is somewhat poorly drained; a system of drainage ditches is needed to carry off excess water. This soil is in capability unit IIw–1.

Bertie fine sandy loam, olive-gray subsoil variant (Bc).—This soil is distinguished by its olive-colored, slightly sticky subsoil. It occurs mainly in areas around Churchland and Doziers Corner. Most of it is associated with the Woodstown, Dragston, and Othello soils. Although drainage is somewhat poor, there is no mottling in the subsoil. Internal drainage and permeability of the subsoil are medium to slow. The water-holding capacity is moderate. The soil is fairly difficult to work and conserve, but it is moderately productive.

Representative profile:

Surface soil—
- 0 to 8 inches, dark grayish-brown, very friable fine sandy loam.

Subsoil—
- 8 to 14 inches, pale-olive fine sandy loam with a few, medium, faint, dark grayish-brown mottles.
- 14 to 17 inches, olive, slightly plastic and slightly sticky, heavy fine sandy loam.
- 17 to 27 inches, olive, slightly plastic and slightly sticky, heavy fine sandy clay loam.
- 27 to 40 inches, olive, slightly plastic and sticky light sandy clay loam.

Substratum—
- 40 to 50 inches, light yellowish-brown loose sand.

A few small areas that have rolling relief are included in this mapping unit. Some of them have been moderately damaged by sheet erosion.

Use and management.—Practically all of this soil is used for corn, small grains, soybeans, vegetables, and hay, or for pasture. Hardy winter vegetables such as spinach, kale, and collards are grown.

Corn is usually grown in a 2- or 3-year rotation. It generally receives a fertilizer that is low in nitrogen. In addition, it is sidedressed with nitrogen. Some farmers increase the yields of soybeans slightly by applying small amounts of phosphate and potash fertilizer.

Many farmers apply up to 1,500 pounds of a complete fertilizer per acre for vegetable crops. Liming is essential to get the desired pH. The excess surface water can be drained off the soil by simple methods, such as using small diversion ditches. This soil is in capability unit IIw–1.

Bladen silt loam (Bg).—This is a fine-textured, poorly drained level soil. Most of it occurs next to large areas of swamp. It is associated with the Bayboro, Portsmouth, and Elkton soils.

This soil has medium-textured marine deposits in the lower part of the profile. These are stratified with very fine sandy clay loam. The subsoil is tough, dense, and plastic. Surface runoff, internal drainage, and permeability are all slow, and as a result, the soil is poorly aerated. The water-holding capacity is good. This soil is difficult to work and to drain adequately. It is moderate in productivity.

Representative profile:

Surface soil—
- 0 to 6 inches, dark-gray, friable silt loam.

Subsoil—
- 6 to 34 inches, light-gray, very plastic and very sticky silty clay with many, medium, prominent mottles of light gray and strong brown.
- 34 to 42 inches, brownish-yellow, plastic and very sticky silty clay loam with many, medium, prominent mottles of light gray and strong brown.
- 42 to 56 inches, gray, slightly plastic and sticky very fine sandy loam stratified with very fine sandy clay loam that contains many, coarse, prominent mottles of yellowish brown.

Substratum—
- 56 to 68 inches, olive-gray, slightly plastic very fine sandy clay loam with common, coarse, distinct mottles of strong brown.

In a few small areas, this soil has a loam surface texture. In some places a sandy layer occurs at a depth of about 3 feet.

Use and management.—About one-half of this soil is in forest of sweet-gum, tupelo-gum, water oak, willow oak, red maple, poplar, loblolly pine, pond pine, beech, and sourwood. Areas that have been cut over or burned over are covered mainly with waxmyrtle, smilax, briers, poison-ivy, Virginia-creeper, water grasses, and reeds.

Cultivated areas are used primarily to grow corn and soybeans. Corn ordinarily receives a fertilizer that is low in nitrogen, which is supplemented with small amounts of nitrogen used as a sidedressing. Some farmers do not fertilize the corn at planting time but apply the fertilizer as a sidedressing during the early part of the growing period. This practice helps to control the weeds. If soybeans follow corn, they are not fertilized.

This soil is very strongly acid; consequently, from 2 to 4 tons of lime per acre must be applied every 3 or 4 years to maintain the proper pH. A complete system of closely spaced lateral ditches is necessary to drain the soil well enough to grow corn and soybeans. In many places small furrows between the lateral ditches will help to carry off excess surface water. The heavy clay texture of the subsoil causes this soil to clod easily, and plowing can be done only within a narrow range of moisture content. This soil is in capability unit IIIw–1.

Coastal beach (Ca).—This miscellaneous land type occupies narrow strips, mainly along the Chesapeake Bay. It occurs near Ocean View and along Hampton Roads from West Norfolk to the Nansemond County line. It consists of loose white sand, which in most places is littered with driftwood and tidal debris. This land has no agricultural value and is used principally for recreational purposes. It is in capability unit VIII–1.

Dragston fine sandy loam (Da).—This somewhat poorly drained soil is level or nearly level. Sandy marine deposits are at a depth of about 34 inches. The soil occurs throughout the county in association with the Woodstown and Sassafras soils. It is characterized by a distinctly mottled subsoil. Permeability is moderately rapid in the surface soil and moderate in the subsoil. The water-holding capacity and aeration are moderate. The soil is easy to work and to conserve.

Representative profile:

Surface soil—
- 0 to 4 inches, dark grayish-brown, very friable fine sandy loam.
- 4 to 8 inches, dark grayish-brown, friable fine sandy loam with a few, medium, faint mottles of dark yellowish brown and strong brown.

Subsoil—
- 8 to 14 inches, light yellowish-brown, light fine sandy clay loam with many, coarse, faint mottles of dark yellowish brown and strong brown.
- 14 to 28 inches, pale-yellow, slightly plastic and slightly sticky, heavy fine sandy loam with many, coarse, prominent mottles of yellowish brown.
- 28 to 34 inches, gray, slightly plastic fine sandy clay loam with a few, medium, distinct mottles of yellowish brown.

Substratum—
- 34 to 64 inches, light brownish-gray, nearly loose fine sand with a few, coarse, distinct mottles of yellowish brown.

In cleared areas the dark grayish-brown material in the uppermost layer is thoroughly mixed with that in the layer immediately below. In some areas the subsoil is sandier than that in the normal profiles. The depth to the sandy substratum ranges from 30 to 65 inches.

Use and management.—Much of this soil is used to grow corn, soybeans, vegetables, small grains, and hay, or it is pastured. Corn and vegetables are grown in a rotation with small grains and soybeans. Corn receives applications of a fertilizer that is high in phosphorus and potassium. For good yields, lime must be applied frequently so that the soil is kept at the proper pH. Lateral drainage ditches are essential.

Many farmers use this soil for rotated pasture. Grass mixtures consisting of Ladino clover, orchardgrass, fescue, and lespedeza are satisfactory. Large amounts of a complete fertilizer are needed to establish the pastures and to maintain enough forage for cattle. This soil is in capability unit IIw–1.

Dragston loamy fine sand (Db).—This coarse-textured, somewhat poorly drained soil is level or nearly level and occurs mainly on the higher marine terraces. Most of it is in the northwestern part of the county near Churchland, but a few small areas are near Deep Creek. Much of it lies between the areas of coarse-textured, well-drained soils located near the principal streams and areas of finer textured soils that lie next to the lowlands and swamps. Surface runoff is slow, and internal drainage is medium to rapid. Permeability is moderate to rapid. The soil is moderately low to low in fertility, fairly easy to work, and moderately productive.

Representative profile:

Surface soil—
- 0 to 11 inches, grayish-brown, very friable loamy fine sand.

Subsoil—
- 11 to 22 inches, yellowish-brown, plastic and sticky fine sandy clay loam with many, coarse, prominent mottles of pale olive and light gray.
- 22 to 40 inches, light brownish-gray, slightly plastic fine sandy loam with many, coarse, prominent mottles of yellowish brown.

Substratum—
- 40 to 50 inches, brownish-yellow, loose fine sand with many, medium, distinct mottles of light olive gray.

Use and management.—About 75 percent of this soil is cultivated. It is used principally for corn, soybeans, vegetables, small grains, peanuts, cotton, and pasture. Most of it is used in the same way as the associated better drained soils that have a similar texture.

Most of this soil needs artificial drainage for maximum yields. In many places drainage ditches are placed between 200 and 300 feet apart. These lead into main outlet ditches or streams. In some areas near Churchland, this soil was tile drained between 40 and 50 years ago, but the drainage systems are no longer in use.

A 3-year rotation is generally used. It consists of corn or a vegetable crop, followed by a small grain, and then by soybeans or hay. In some places crimson clover is seeded with rye or another small grain and is used to provide cover and green manure.

This soil is permeable, and it responds well to large amounts of commercial fertilizer. Corn receives applications of a fertilizer that is low in nitrogen, and this is supplemented with at least one sidedressing of nitrogen during the early part of the growing period. Most vegetable crops respond well to applications of between 600 and 1,200 pounds per acre of a complete fertilizer. Soybeans that follow vegetables or corn are not fertilized. If a vegetable crop that has been heavily fertilized is grown between corn and soybeans in the rotation, weeds can be controlled more easily. Frequent small applications of lime help in maintaining the proper pH. This soil is in capability unit IIw–1.

Elkton silt loam (Ea).—This is a fine-textured, poorly drained, level soil. It occurs principally in the extreme eastern part of the county next to the Princess Anne County line. It is moderately deep over the underlying material. Like the associated Lenoir and Keyport soils, this soil has restricted drainage. Surface runoff and permeability are slow to very slow. This soil is difficult to work, poorly aerated, and low in natural productivity. It retains plant nutrients and water well.

Representative profile:

Surface soil—
- 0 to 4 inches, dark-gray, friable silt loam.
- 4 to 11 inches, dark-gray, friable silt loam with a few, fine, faint mottles of olive brown.

Subsoil—
- 11 to 39 inches, gray, very plastic and sticky silty clay with many, coarse, distinct mottles of light olive brown.
- 39 to 49 inches, light olive-gray, slightly plastic and slightly sticky fine sandy clay loam with many, coarse, distinct mottles of yellowish brown.

Substratum—
- 49 to 60 inches, gray, friable very fine sandy loam with many, coarse, prominent mottles of yellowish brown; many small flakes of yellow mica.

In cultivated fields the surface soil is light gray or light olive gray. In fields that have been intensively cultivated with heavy farm machinery, the surface soil and upper subsoil are packed and hard. In some places clay underlies this soil.

Use and management.—Most of this soil is under forest. Although it is one of the most difficult soils in the county to cultivate, it is used for corn and soybeans, and some is used for pasture.

A good drainage system, with closely spaced lateral ditches and diversion channels to carry off excess surface water, is essential. This soil has a high base-exchange capacity and is very strongly acid. At least 2 to 3 tons of lime per acre must be applied during each rotation to keep the pH at a proper level.

Corn and soybeans are commonly grown in a 2-year rotation. Fertilizer is generally applied only to corn, which receives applications of complete fertilizer. Many farmers sidedress corn with about 40 pounds of nitrogen when the crop is last cultivated. Yields of corn and soybeans are generally low, partly because it is difficult to plow and prepare a good seedbed and to cultivate and harvest at the proper time. This soil is well suited to Ladino clover and water-tolerant pasture grasses. Many pastures are unproductive, however, because not enough lime and fertilizer have been used. In some places pastures fail because they have been overgrazed. This soil is in capability unit IIIw–1.

Elkton-Othello very fine sandy loams (Eb).—This soil complex is made up of the level, poorly drained Elkton and Othello very fine sandy loams. The soils occur in such an intricate pattern that it was not practical to map them separately. The complex occurs principally in the southeastern part of the county.

The Othello soil differs from the Elkton soil in having less uniform texture in the subsoil. Thin layers or pockets of sandy material occur throughout its profile. In many places where these soils occur next to each other, however, their subsoil is similar. Surface runoff is slow, and permeability is slow to moderately slow. The water-holding capacity is good. Fertility and productivity are moderate to low.

Representative profile of Elkton very fine sand loam:

Surface soil—
- 0 to 5 inches, light olive-gray, friable very fine sandy loam.
- 5 to 12 inches, light-gray, friable loam with a few, fine, faint mottles of olive yellow.

Subsoil—
- 12 to 30 inches, gray, very plastic and sticky silty clay with a few, coarse, distinct mottles of olive yellow.

Substratum—
- 30 to 40 inches, brownish-yellow very fine sandy loam with a few, medium, distinct mottles of gray.

Representative profile of Othello very fine sandy loam:

Surface soil—
- 0 to 6 inches, olive-gray, friable very fine sandy loam.
- 6 to 10 inches, light-gray, firm silt loam with a few, medium, distinct mottles of strong brown.
- 10 to 15 inches, light-gray, friable very fine sandy loam.

Subsoil—
- 15 to 34 inches, gray, plastic and slightly sticky silty clay loam with a few, coarse, distinct mottles of strong brown and brownish yellow.
- 34 to 40 inches, pale-olive, firm very fine sandy clay loam with a few, fine, medium mottles of strong brown and light gray.

Substratum—
- 40 to 45 inches, white, loose fine sandy loam.

In some small areas the surface soil is loam or silt loam.

Use and management.—About half of this complex is used for corn, soybeans, small grains, hay, and pasture. A close network of lateral ditches is necessary to drain the soils adequately.

Some farmers grow corn and soybeans in a 2-year rotation. After the soybean crop, other farmers grow lespedeza or another hay crop for 1 or 2 years before replanting to corn.

Corn receives a complete fertilizer, which is supplemented with small side dressings of nitrogen. The soil is very strongly acid and requires from 2 to 3 tons of lime per acre during the rotation to keep the pH at a proper level. Hay crops produce fair yields if liberal amounts of a fertilizer low in nitrogen are applied. This soil is in capability unit IIIw–1.

Fallsington fine sandy loam (Fa).—This poorly drained soil occurs in all parts of the county, generally in association with the Woodstown and Dragston soils. The largest area lies along the Nansemond County line near Churchland. Small areas, which consist partly of shallow colluvium, occur in depressions and along the smaller drainageways. This soil is similar to Othello fine sandy loam, but it has a coarser textured subsoil. Internal drainage is medium, and the soil is moderate in permeability and in water-holding capacity. The soil is easy to work and conserve. It is moderately fertile and productive.

Representative profile:

Surface soil—
- 0 to 4 inches, dark grayish-brown, friable fine sandy loam.
- 4 to 11 inches, light brownish-gray, friable fine sandy loam with a few, fine, distinct mottles of strong brown.

Subsoil—
- 11 to 30 inches, gray, slightly sticky, light fine sandy clay loam with common, medium, distinct mottles of brownish yellow.

Substratum—
- 30 to 50 inches, light-gray, nearly loose fine sand with many, coarse, distinct mottles of brownish yellow and yellowish red.

In some places the surface soil is sandy loam. In a few places the texture of the subsoil is like that of the finer textured Othello soils.

Use and management.—Approximately 60 percent of this soil is cultivated, and most of the rest is in forest. Although poorly drained, it is used for growing corn, soybeans, hay, Irish potatoes, strawberries, spinach, kale, and collards. Vegetables are grown intensively in large areas in the northwestern part of the county.

Most of the excess surface water is drained off through closely spaced open ditches. During prolonged wet spells, however, water stands on the surface. Artificial drainage is necessary for all crops. In some extremely dry seasons, this soil produces better yields than the well-drained associated soils, mainly because of its good water-holding capacity.

A 2-year rotation, consisting of a vegetable crop or corn followed by soybeans, is commonly used. Corn receives a complete fertilizer. Sidedressings of nitrogen are applied, as needed, up to the last cultivation. Many farmers apply up to 1,500 pounds per acre of a fertilizer that is low in nitrogen to Irish potatoes. Turning under a green-manure crop such as crimson clover or residues from a vegetable crop helps maintain the supply of organic matter. In many places potash is needed. This soil is in capability unit IIIw–2.

Galestown loamy fine sand (Ga).—This is a well drained to somewhat excessively drained soil. Most of it is near Deep Creek. Along the larger streams it occurs in association with the Klej, Sassafras, and Woodstown loamy fine sands. Most of this soil is gently undulating, but the areas near the streams have stronger slopes.

This soil has developed over sand, and it is moderately deep and coarse textured. The layers do not show distinct differences in texture. Damage caused by sheet erosion is slight.

Because the soil absorbs water readily, there is little surface runoff. Permeability is very rapid, and the water-holding capacity is low. Although the soil is easy to work, it is difficult to conserve.

Representative profile:

0 to 8 inches, very dark grayish-brown, nearly loose loamy fine sand.
8 to 52 inches, brownish-yellow, loose, porous loamy fine sand.
52 to 62 inches, pale-yellow, loose fine sand with a few, medium, faint mottles of yellowish brown.

In some places the surface soil is grayish brown. In a few areas, especially near Deep Creek, the subsoil is a little lighter colored than is typical. Small pockets or balls of clay occur in some places at depths between 25 and 40 inches.

Use and management.—Many farmers use this soil to grow vegetables or peanuts. Others rotate vegetable crops with corn, soybeans, or a small grain. Many large areas near Deep Creek are covered with brush, myrtle, and hardwood sprouts.

If this soil is left bare, it is likely to be damaged by wind erosion, particularly the more sloping areas. It is sandy and droughty, and many crops are severely damaged during dry seasons. Some farmers irrigate such crops as snap beans, spinach, kale, collards, and sweetpotatoes and obtain excellent yields.

Corn ordinarily receives a complete fertilizer, but yields are poor. Peanuts receive about 500 pounds of a fertilizer that is low in nitrogen. The peanuts are planted about the middle of May. They need to be cultivated frequently to control weeds. The peanuts are dug early in November and are stacked in cocks for curing.

This soil is low in organic matter, but good response is received from green-manure crops turned under. All crop residues should be plowed under to increase the amount of organic matter in the soil and to help conserve moisture. Many farmers sow a green-manure crop, such as a small grain or clover, after the peanuts have been harvested. This soil is in capability unit IIIs–1.

Keyport very fine sandy loam (Ka).—This moderately well drained soil occurs mainly in the eastern part of the county. It is associated with the Elkton, Lenoir, and Othello soils. In most places a sandy layer occurs at a depth of about 3 feet.

The permeability of the subsoil is moderately slow, and the water-holding capacity is good. The soil is fairly difficult to work and to conserve, but it is moderately productive.

Representative profile:

Surface soil—
0 to 2 inches, dark grayish-brown, friable very fine sandy loam.
2 to 10 inches, brown, friable very fine sandy loam.
Subsoil—
10 to 13 inches, light yellowish-brown, firm silty clay loam with a few, fine, faint mottles of yellowish brown.
13 to 21 inches, yellowish-brown, plastic and sticky silty clay.
21 to 31 inches, light yellowish-brown, plastic and sticky silty clay with many, coarse, prominent mottles of gray and brown.
Substratum—
31 to 46 inches, brownish-yellow, nearly loose fine sandy loam with common, coarse, distinct mottles of gray and brown.

In a few areas this soil overlies clay instead of sand. Some areas that have slopes of up to 8 percent have been included in this mapping unit. Some of these areas have been damaged slightly to moderately by sheet erosion.

Use and management.—Nearly all of this strongly acid soil is in forest. It is not cropped extensively because it is associated with poorly drained soils of similar texture and it is easily compacted and becomes cloddy if plowed when too wet.

A few small areas near the town of Northwest are used to grown corn and soybeans, but yields are generally low. Corn grown in a 2-year rotation with soybeans receives between 400 and 600 pounds of a complete fertilizer per acre. This soil is in capability unit IIw–2.

Klej loamy fine sand (Kb).—Most of this somewhat poorly drained to moderately well drained soil is near Deep Creek. In general it is level to nearly level, and as a result, surface runoff is slow. Permeability is rapid, and the water-holding capacity is low. This soil is easily worked and conserved, and it is moderately productive.

Representative profile:

Surface soil—
0 to 9 inches, dark grayish-brown, nearly loose to very friable loamy fine sand.
Subsoil—
9 to 30 inches, pale-yellow, nearly loose loamy fine sand with common, medium, faint mottles of light yellowish brown and light gray.
Substratum—
30 to 50 inches, white, loose fine sand with a few, fine, distinct mottles of yellowish brown.

In a few places the surface soil is light fine sandy loam. The subsoil ranges in color from pale yellow or yellowish brown to grayish brown or light olive brown.

Use and management.—Approximately 60 percent of this soil is idle and covered mainly with reeds, myrtle, briers, smilax, second-growth pines, and sprout hardwoods. Many areas have been burned over recently. On cultivated areas vegetables, corn, and soybeans are the principal crops. Vegetables yield well, particularly if they are irrigated.

This soil is low in organic matter, but crops respond well if green-manure crops are turned under. In most places the soil is deficient in nitrogen and potassium. Corn and vegetable crops respond favorably if large amounts of a complete fertilizer are applied. This soil is in capability unit IIIs–1.

Lenoir very fine sandy loam (La).—Most of this somewhat poorly drained soil is in the extreme eastern part of the county. It is associated with the better drained Keyport and the more poorly drained Elkton soils. The soil has formed over stratified sand and clay. In many places sandy material occurs at a depth of between 40 and 50 inches. The soil is distinguished by its yellow, brown, and gray mottling.

This soil is nearly level, and surface runoff is slow. It has slow internal drainage and permeability, but its water-holding capacity is good. The soil is moderate in fertility and productivity, but it is difficult to work.

Representative profile:

Surface soil—
0 to 2 inches, very dark brown, friable very fine sandy loam.
2 to 11 inches, brown, friable very fine sandy loam with some faint mottlings of dark brown.

Subsoil—
11 to 15 inches, light yellowish-brown silty clay loam with many, fine, faint mottles of brown.
15 to 36 inches, pale-yellow, plastic and sticky silty clay loam to silty clay with many, fine, faint mottles of brown.
36 to 45 inches, brownish-yellow, slightly plastic and sticky fine sandy clay loam to fine sandy clay with many, coarse, distinct mottles of light gray.

Substratum—
45 to 54 inches, brownish-yellow, loose loamy fine sand with common, medium, distinct mottles of strong brown, yellowish red, and gray.

In a few areas the surface soil is silt loam. The soil is gently undulating in some places and is slightly eroded.

Use and management.—This soil is mainly in forest consisting of sweetgum and tupelo-gum; red maple; loblolly pine; and red, swamp, white, willow, and water oaks. A small acreage is used for corn, soybeans, hay, and pasture.

The soil is strongly acid. At least 2 tons of lime per acre must be applied every 2 or 3 years. Plowing and tilling are restricted by the somewhat poor drainage. The soil clods if plowed too wet. Artificial drainage is essential for satisfactory yields of cultivated crops.

Corn and soybeans are grown in successive years, but in many places the land lies idle for 2 or 3 years before it is replanted to corn. Liberal applications of a complete fertilizer are commonly applied to corn. Weed control is a serious problem. Hensnestgrass, quackgrass, and broomsedge quickly invade idle fields. This soil is in capability unit IIIw–1.

Made land (Ma).—Areas of Made land occur throughout the county. Many of the areas lie along the Chesapeake and Albermarle Canal and the Elizabeth River and its branches. This Made land is not used for agriculture.

Matapeake fine sandy loam, nearly level phase (Mb).—This is a well-drained, productive soil. It occurs in scattered areas throughout the south-central part of the county, mainly just west of Saint Brides and near Hickory and Northwest. Most of it occurs near the larger streams and drainageways. In general this soil overlies marine deposits of sand and clay. It has a finer textured subsoil than the Sassafras soils. It is distinguished by the color of its subsoil, which ranges from strong brown to yellowish red.

This soil is permeable and well aerated. It has good water-holding capacity. Surface runoff is medium. The soil is easy to work.

Representative profile:

Surface soil—
0 to 2 inches, dark-brown, friable fine sandy loam.
2 to 9 inches, yellowish-brown, friable fine sandy loam.

Subsoil—
9 to 20 inches, brown, slightly plastic and slightly sticky, heavy silty clay loam.
20 to 30 inches, strong-brown, slightly sticky, light silty clay loam with a few, medium, faint yellowish-brown mottles.
30 to 47 inches, yellowish-brown, firm, heavy fine sandy clay loam with a few, fine, faint mottles of strong brown.

Substratum—
47 to 54 inches, brownish-yellow, very friable loamy fine sand with common, medium, faint mottles of yellowish brown; many hard iron concretions intermixed.

Some small areas have a very fine sandy loam, loam, or silt loam surface soil. In a few places the uppermost layer of the subsoil contains thin strata and pockets of sandy materials.

Use and management.—This is one of the most productive soils in the county, and it is suited to many different uses. Nevertheless, some areas are still in forest. On cultivated areas the principal crops are corn, soybeans, and vegetables such as sweet corn, cabbage, kale, spinach, and Irish potatoes.

To keep the pH at a proper level, most farmers apply about 2 tons of lime per acre every 3 or 4 years. Corn receives about 600 to 800 pounds of a complete fertilizer per acre. This is supplemented by sidedressings of nitrogen during the early growing stages. Most farmers use no additional fertilizer for soybeans grown after corn. Some farmers improve their yields by applying about 400 pounds of a fertilizer that is high in phosphorus and potassium. Small grains receive between 200 and 400 pounds of a complete fertilizer per acre and small amounts of nitrogen as a topdressing. Many farmers apply up to 1,500 pounds of a complete fertilizer per acre to vegetable crops. This soil is in capability unit I–2.

Matapeake fine sandy loam, eroded undulating phase (Mc).—Except that it has stronger slopes and is eroded, this soil is similar to Matapeake fine sandy loam, nearly level phase. It occupies gently undulating to rolling areas that have been slightly to moderately damaged by accelerated sheet erosion. In most places this soil lies on narrow ridgelike terrain, slightly above the associated Mattapex and Bertie soils.

When the land was cleared, many fields were "squared" for easy cultivation. Little attention was paid to other important factors of management. As a result, over a long period of close cultivation, the more sloping areas lost much of their surface soil through erosion. Some farmers now cultivate the soil on the contour, but others have let the eroded areas revert to brush or second-growth forest.

Use and management.—This soil is cropped and managed in about the same way as Matapeake fine sandy loam, nearly level phase, except that fewer vegetable crops and more small grains, corn, and soybeans are generally grown. The yields of all crops are slightly lower. This soil is in capability unit IIe–2.

Mattapex very fine sandy loam, nearly level phase (Md).—This is a productive, moderately well drained soil. Most of it occurs in small, scattered spots throughout the south-central part of the county. It is distinguished by its moderately fine textured subsoil that has distinct mottles in the lower part.

Surface runoff and internal drainage are medium, and permeability is moderate. The water-holding capacity is good, and the soil is easy to work and to conserve.

Representative profile:

Surface soil—
0 to 8 inches, brown, friable very fine sandy loam.

Subsoil—
8 to 18 inches, light yellowish-brown, friable very fine sandy clay loam with a few, fine, faint mottles of brown.
18 to 32 inches, yellowish-brown, slightly plastic and slightly sticky clay loam with common, fine, faint mottles of strong brown, pale brown, and light gray.
32 to 56 inches, yellowish-brown, slightly plastic and slightly sticky, heavy fine sandy clay loam with many, coarse, distinct mottles of light gray and pale yellow.

Substratum—
56 to 66 inches, light yellowish-brown, very friable fine sandy loam with few, medium, faint mottles of yellowish brown.

Some areas have a silt loam, loam, or fine sandy loam surface soil. These are too small to be mapped separately. In some places the subsoil is sandier than in the normal profile.

Use and management.—This soil is used to grow many kinds of crops. The areas near Great Bridge are used mainly for vegetables. Those in other parts of the county are used chiefly for corn, soybeans, hay, small grains, and pasture. Large areas remain in forest.

Corn commonly receives a complete fertilizer. This is supplemented by small amounts of nitrogen applied as a sidedressing. Soybeans are not fertilized if they follow corn or a vegetable crop. Small grains commonly receive between 200 and 400 pounds per acre of a fertilizer that is low in nitrogen. In addition, small amounts of nitrogen are applied as a topdressing early in spring. For vegetable crops, between 500 and 1,800 pounds per acre of a complete fertilizer is applied. Many farmers turn under all residues of vegetable crops to increase the amount of organic matter. Others turn under a green-manure crop, such as crimson clover, before planting corn. This soil is in capability unit I–2.

Mattapex very fine sandy loam, undulating phase (Mg).—This soil occurs on slopes of 2 to 8 percent. Except that it has stronger slopes and has been slightly to moderately damaged by accelerated erosion, it is similar to Mattapex very fine sandy loam, nearly level phase. Erosion has been the most severe on the steeper slopes near drainageways.

Use and management.—This soil is used mainly for corn, soybeans, some small grains, hay, and pasture. Management is similar to that of Mattapex very fine sandy loam, nearly level phase. Many farmers grow fewer vegetable crops on this soil than they do on the nearly level phase and use more of the soil for hay and pasture. This soil is in capability unit IIe–2.

Mixed alluvial land (Mh).—This miscellaneous land type occurs on the flood plains, mainly in the south-central and eastern parts of the county. It is made up mainly of well-mixed sand, clay, and silt that has washed from sloping areas that lie next to streams. The areas are under water much of the time.

The alluvial material accumulates near the heads of streams and is carried slowly by sluggish water that becomes ponded in many places. The soil material that is deposited near the large outlets is finer in texture. In many places it is topped by dark-colored layers that are high in organic matter. The flood plains are wider near the large outlets. In most places the coarser textured material is near the streambanks and the finer textured material lies near the center of the flood plains.

Use and management.—This land type is entirely in forest consisting mainly of cypress, swampgum, sweetgum, blackgum, red maple, water ash, and poplar. In almost all places, there is an undergrowth of alder bushes, greenbrier or smilax, small cane, blackberry, wild grape, and other water-tolerant grasses and reeds. This land type is in capability unit VIIw–1.

Mucky peat (Mk).—This is by far the most extensive organic soil in the Dismal Swamp. It occurs in association with Mucky peat, shallow over loams, and Mucky peat, shallow over sands. In appearance it is about halfway between a true peat, in which the plant species are easily recognized, and a muck, in which it is difficult or impossible to identify the plant remains.

Throughout the swamp the areas of Mucky peat vary in thickness, color, ash content, stage of decomposition, and in kinds of organic materials. The height of the water table and kinds of plant cover also vary. In thickness Mucky peat ranges from about 3 to 15 feet. The organic material is shallow in the many places that are burned over. In many places old, well-preserved logs, stumps, and roots are imbedded in this soil. The underlying soil materials range from loose sand to clay, and they contain shell marl in some places. Mucky peat is extremely acid in reaction.

Representative profile:

0 to 6 inches, very dusky red, partially decomposed forest duff that contains many small roots.
6 to 14 inches, black, firm, highly decomposed, finely divided peaty material.
14 to 40 inches, dusky-red to reddish-black, soft, decomposed peaty muck.
40 to 44 inches, dark reddish-brown, partly decomposed, fibrous woody material.
44 to 96 inches, dusky-red to reddish-black, highly decomposed peaty material; contains identifiable fragments of plant remains.

The content of organic matter ranges from 85 to 95 percent. In some places this mapping unit includes a few areas of Mucky peat, shallow over sands, and Mucky peat, shallow over loams, as well as small areas of Portsmouth, Othello, and Bayboro soils.

Use and management.—Mucky peat is not used for agriculture. It is in forest and provides habitats for wildlife. The trees are mainly red maple, ash, swamp oak, cypress, pine, poplar, beech, and the various species of gums. A few young stands of whitecedar or juniper occur on scattered sites. The shrubs are mainly myrtle, alder, sumac, holly, and gallberry. There is an undergrowth of moss, sedges, marshgrass, ferns, blackberry, honeysuckle, wild grape, and large to small cane reeds. This organic soil is in capability unit VIIw–1.

Mucky peat, shallow over loams (Mm).—This extremely acid organic soil occurs in the Dismal Swamp. Most of it lies in the northern part of the swamp near Nansemond County and in the vicinity of Wallaceton. One area is just west of Deep Creek. This soil is made up of about 20 to 25 inches of a black mucky peat that has developed over layers of mixed soil materials. In most places the underlying material is loam, but in some places it is silty clay loam, clay loam, or silty clay.

The relief is level to nearly level, and in some places water is ponded in the holes made by the burning of peat. Most of the areas are near the outer edges of the swamp; as a result the water table is somewhat low and the organic material burns readily. Before it was burned over, the soil probably resembled Mucky peat. In many places a reddish or orange-colored ash residue occurs in the surface layer. This soil was not surveyed in detail, but it was examined in many places along trails and traverse lines.

Representative profile:

0 to 6 inches, reddish-black to black, partly decomposed organic matter mixed with small roots and dark-colored, fine-textured, ashy soil material.
6 to 15 inches, reddish-black, finely divided mucky peat containing some roots and decomposed woody fragments.

15 to 25 inches, reddish-black, fibrous mucky peat containing some partly decomposed sedge peat.
25 to 40 inches, light-gray to gray silty clay loam or loam; slightly plastic and sticky.
40 to 50 inches, mottled gray and light-gray fine sandy clay loam.

Use and management.—This organic soil is not used for agriculture. The vegetation consists mainly of myrtle, gallberry, greenbrier, blackberry, honeysuckle, wild grape, large and small canes, moss, and ferns. The soil is in capability unit VIIw-1.

Mucky peat, shallow over sands (Mn).—Except for the texture of the underlying mineral material, this organic soil is, in most characteristics, similar to Mucky peat, shallow over loams. Fine sandy loam, light sandy clay loam, or loamy fine sand underlie the organic material. This extremely acid organic soil occurs in the Dismal Swamp in association with Mucky peat and Mucky peat, shallow over loams. Because of its location, the soil was not surveyed in detail.

Representative profile:

0 to 6 inches, black, partly decomposed organic matter and small roots mixed with mucky peat.
6 to 20 inches, reddish-black, finely divided mucky peat containing some small roots and fragments of wood.
20 to 30 inches, gray, nearly loose fine sandy loam to loamy fine sand.

Use and management.—This organic soil is not used for agriculture. It is in capability unit VIIw-1.

Othello very fine sandy loam (Ob).—This is one of the most extensive and most important agricultural soils in Norfolk County. It occurs in all parts of the county. The larger areas are in the southern part near Saint Brides and Hickory. The distinguishing feature of this soil is its medium textured to moderately fine textured subsoil, which is predominantly gray—an indication of poor drainage.

Surface runoff, internal drainage, and permeability are all slow. The soil is strongly acid to very strongly acid. Fertility and productivity are moderate, even though the soil is fairly difficult to work.

Representative profile:

Surface soil—
0 to 2 inches, grayish-brown, friable very fine sandy loam.
2 to 10 inches, light olive-gray, plastic and sticky, heavy very fine sandy loam.

Subsoil—
10 to 15 inches, light olive-gray, plastic and sticky, heavy very fine sandy clay loam with a few, medium, distinct mottles of yellowish brown.
15 to 30 inches, gray, very plastic and very sticky, heavy silty clay loam with a few, distinct, medium mottles of yellowish brown and a few lenses of sand.
30 to 35 inches, gray, slightly plastic and very sticky fine sandy clay loam with a few, medium, distinct mottles of yellowish brown.

Substratum—
35 to 45 inches, olive-gray, loose loamy very fine sand with many, coarse, distinct mottles of yellowish brown.

In small areas the texture of the surface soil is loam or silt loam. In some places the substratum is finer textured than that in the normal profile.

Use and management.—Much of this soil is in forest. Corn and soybeans are the main crops, but in recent years the acreage in hay, pasture, and some small grains has increased.

In many places corn and soybeans are grown in rotation, and no winter cover crop is grown. This type of management has severely depleted the organic-matter content of the soil. As a result water infiltrates more slowly than formerly, and the soil has become packed and harder to work. The use of heavy machinery has greatly aggravated these conditions.

Corn receives large applications of a complete fertilizer. This is supplemented with small amounts of nitrogen that are applied as a sidedressing.

A close network of drainage ditches is necessary to remove excess surface water. This soil is in capability unit IIIw-1.

Othello loam, dark surface phase (Oa).—Most of this level, poorly drained soil occurs along the fringes of the Dismal Swamp. It lies between areas of gray Othello and Elkton soils and the very poorly drained, dark-colored Portsmouth soils.

This soil has moderately slow permeability and slow internal drainage. It is very strongly acid. The soil is fairly difficult to work, but it is moderately fertile and productive.

Representative profile:

Surface soil—
0 to 6 inches, very dark brown, friable loam.

Subsoil—
6 to 10 inches, light brownish-gray, firm, light fine sandy clay loam; a few, fine, faint mottles of light olive brown.
10 to 30 inches, gray, very plastic and very sticky, heavy fine sandy clay loam with strata and pockets of silty clay loam; common, coarse, distinct mottles of strong brown.
30 to 35 inches, gray, slightly sticky, heavy fine sandy loam with pockets of firm fine sandy clay loam; common, medium, distinct strong-brown mottles.

Substratum—
35 to 45 inches, light-gray, loose loamy fine sand; a few, medium, faint mottles of light olive brown.

Use and management.—More than 50 percent of this soil is in forest consisting principally of sweetgum, water oak, willow oak, red maple, loblolly pine, and pond pine. The soil is also used to grow corn, soybeans, small grains, and hay, or for pasture. Corn receives large applications of a complete fertilizer. This is supplemented by small amounts of nitrogen applied as a sidedressing.

Because this soil occurs along the Dismal Swamp, it is difficult to drain off the surface water. Areas to be cropped need intensive artificial drainage. Weeds often limit the yields of corn and soybeans. This soil is in capability unit IIIw-1.

Othello-Fallsington fine sandy loams (Oc).—This soil complex consists of two poorly drained, nearly level soils. They occur throughout the county in fairly small areas, closely associated with other Othello and Fallsington soils. These soils are similar in many characteristics, but the texture of the subsoil differs. In some places the texture differs greatly, but in others it differs only slightly. The subsoil of the Othello soil is made up of alternate layers of silty clay loam and heavy fine sandy clay loam mixed with sandy clay loam. The subsoil of the Fallsington soil consists of sandy clay loam and lighter, coarse-textured material.

Surface runoff and internal drainage are slow. Permeability is moderately slow to slow, and the water-holding capacity is good. The soil is strongly acid. It is moderately fertile and productive and is easy to conserve, but it is moderately difficult to work.

Representative profile of Othello fine sandy loam:

Surface soil—
0 to 6 inches, dark-gray, friable fine sandy loam.
Subsoil—
6 to 10 inches, grayish-brown, friable fine sandy clay loam.
10 to 30 inches, gray, slightly sticky and slightly plastic silty clay loam with pockets of sandy clay loam; common, distinct, medium mottles of strong brown and light brownish gray.
30 to 38 inches, gray, sticky and plastic, heavy sandy clay loam.
Substratum—
38 to 43 inches, light-gray loamy fine sand; a few, coarse, prominent mottles of strong brown and yellowish brown.

In a few small areas, the surface soil is loam.

Representative profile of Fallsington fine sandy loam:

Surface soil—
0 to 9 inches, dark-gray, friable fine sandy loam.
Subsoil—
9 to 16 inches, dark grayish-brown loam with common, medium, distinct mottles of brown.
16 to 24 inches, gray, fine sandy clay loam; firm when moist, slightly sticky when wet.
24 to 36 inches, light olive-gray, friable fine sandy loam.
Substratum—
36 to 40 inches, light-gray, friable loamy fine sand with common, medium, distinct mottles of yellowish brown.

Use and management.—Approximately 60 percent of this complex is cultivated. The rest is in forest or is idle. The principal crops are corn and soybeans. Some large areas near Deep Creek are used for pasture. Ladino clover, orchardgrass, and fescue do well.

Corn, soybeans, and other crops are grown under about the same management as that used for Othello very fine sandy loam. Well-spaced lateral ditches are needed to drain off excess surface water. This soil complex is in capability unit IIIw–1.

Pasquotank very fine sandy loam (Pa).—Most of this poorly drained soil occurs in the vicinity of Long Ridge. It is associated with the Weeksville, Othello, and Elkton soils. Typically, the texture is uniform throughout.

Surface runoff is slow, permeability is moderate, and the water-holding capacity is fair. The soil is moderate in fertility and productivity.

Representative profile:

Surface soil—
0 to 8 inches, dark grayish-brown, friable very fine sandy loam.
Subsoil—
8 to 30 inches, light brownish-gray, plastic and slightly sticky very fine sandy loam with common, coarse, distinct mottles of yellowish brown.
30 to 52 inches, light brownish-gray, plastic and slightly sticky very fine sandy loam with lenses and pockets of silty clay loam; many, coarse, distinct mottles of yellowish brown.
Substratum—
52 to 62 inches, light-gray, friable very fine sandy loam with common, medium, distinct mottles of yellowish brown.

In a few areas the surface soil is silt loam or loam instead of very fine sandy loam.

Use and management.—Nearly all of this soil is used for crops, principally corn and soybeans. Corn commonly receives large applications of a complete fertilizer in addition to small amounts of nitrogen. Soybeans following corn receive no additional fertilizer.

Well-spaced ditches are needed to drain off the surface water. Because the subsoil is permeable, this soil is suited to many vegetable crops if properly drained and adequately fertilized. It is in capability unit IIIw–2.

Pocomoke fine sandy loam (Pb).—This soil occurs in the vicinity of Bowers Hill and along the edge of the Dismal Swamp. It is distinguished by its deep, black surface layer that contains a large amount of organic matter. Except that the subsoil contains more sand and less clay, this soil is similar to the Portsmouth soils.

Relief is level to nearly level. Consequently, surface runoff is slow. Permeability is moderate, and internal drainage is medium. The soil is moderately high in fertility and productivity.

Representative profile:

Surface soil—
0 to 15 inches, black, friable fine sandy loam.
Subsoil—
15 to 28 inches, dark grayish-brown, sticky and slightly plastic, light sandy clay loam with a few, fine, faint mottles of yellowish brown.
Substratum—
28 to 34 inches, light-gray, friable fine sand.

In a few areas the surface soil is sandy loam or loam. Depth to the sandy substratum ranges from 25 to 32 inches. In some places only a thin subsoil has developed over the substratum.

Use and management.—Areas of this soil not in forest are used mainly to grow corn, soybeans, and nursery stock. The soil is extremely acid. It requires liberal applications of lime every 2 or 3 years to maintain the proper pH for growing corn and soybeans. Under the common management, corn receives between 400 and 500 pounds of a complete fertilizer. Surface water must be drained from areas that lie next to the swamps. This soil is in capability unit IVw–1.

Portsmouth loam (Pc).—This is one of the most extensive soils in the county. Most of it occurs in a wide continuous fringe along the Dismal Swamp and in a smaller isolated area near Butts. The soil is distinguished by its thick, black surface layer.

This soil is nearly level. Therefore, surface runoff is slow. Internal drainage is medium, and permeability is moderate. The soil is extremely acid. It is well supplied with organic matter so that it absorbs and retains a good supply of water for plant use. It is moderately high in fertility and productivity.

Representative profile:

Surface soil—
0 to 12 inches, black, very friable loam.
12 to 15 inches, grayish-brown, light fine sandy clay loam with a few, coarse, distinct yellowish-brown mottles.
Subsoil—
15 to 23 inches, light olive-gray, slightly plastic and sticky, heavy fine sandy clay loam with a few, fine, distinct mottles of yellowish brown and strong brown.
23 to 27 inches, light brownish-gray, slightly sticky fine sandy loam with a few, coarse, prominent mottles of yellowish brown.
Substratum—
27 to 45 inches, light-gray, loose fine sand.

In some areas the surface soil is silt loam or fine sandy loam. The thickness of the subsoil ranges from about 6 to 15 inches. In a few places the surface layer immediately overlies light-gray loose sand. Shell marl occurs at a depth of several feet in some places.

Use and management.—Approximately 65 percent of this soil is in forest of red maple, oak, loblolly pine, pond pine, and various species of gum. Tracts that were once cleared or burned over are covered with myrtle, gallberry, hardwood sprouts, tall cane, briers, smilax, and honeysuckle. Although it is very poorly drained and somewhat shallow, this soil is well suited to crops if it is adequately drained. Corn, soybeans, small grains, and hay are the chief crops. A few farmers grow cabbage, snapbeans, kale, peas, and onions in small fields, largely for sale to local markets. Small areas are used for pasture.

The usual rotation consists of 1 year of corn followed by 1 year of soybeans or a small grain. From 3 to 5 tons of lime per acre must be applied during the rotation to maintain the proper pH. Corn normally receives a complete fertilizer. In many places the soil is deficient in potassium. Consequently, for vegetable crops many farmers apply a fertilizer that is high in potassium and phosphorus. This soil is in capability unit IVw–1.

Portsmouth mucky loam (Pd).—Except that it has more organic matter in the surface layer, this very poorly drained soil is similar, in most characteristics, to Portsmouth loam. It occurs along the edge of the Dismal Swamp in areas between Portsmouth loam and the Mucky peat soils.

The areas are level to nearly level, and surface runoff is very slow. Permeability is moderately slow to slow, and the water-holding capacity is good. The soil is fertile, but it is difficult to work. In reaction, it is extremely acid.

Representative profile:

Surface soil—
- 0 to 8 inches, very dark brown, very friable mucky loam.
- 8 to 13 inches, dark grayish-brown mucky loam.

Subsoil—
- 13 to 22 inches, grayish-brown to gray, plastic, heavy fine sandy clay loam.
- 22 to 30 inches, light brownish-gray, plastic, heavy fine sandy clay loam with a few, medium, distinct mottles of light brown.

Substratum—
- 30 to 40 inches, light-gray loose sand.

In thickness, the surface soil ranges from 7 to 18 inches, and the subsoil, from 8 to 17 inches.

Use and management.—Practically all of this soil is in forest. The trees are similar to those that grow in the Dismal Swamp. A few small tracts at the edge of the swamp are used primarily to grow corn and soybeans.

This soil is managed in about the same way as Portsmouth loam. It is difficult to drain because it lies so close to the swamp. As a result, cultivation is seriously restricted. In addition, many areas are inaccessible to heavy farm equipment. This soil is in capability unit IVw–1.

Sassafras fine sandy loam, nearly level phase (Sa).—This well-drained soil occurs principally near Great Bridge and in areas that extend eastward along the Chesapeake and Albermarle Canal. It lies at fairly high elevations, mostly along streams, where it is associated with the more extensive Dragston and Woodstown soils. The soil is distinguished by the reddish-brown to strong-brown and yellowish-red colors in the subsoil.

Internal drainage and aeration are medium, permeability is moderate, and the water-holding capacity is fair. The soil is easy to work and conserve and is highly productive.

Representative profile:

Surface soil—
- 0 to 4 inches, dark reddish-brown, very friable fine sandy loam.
- 4 to 10 inches, brown to dark-brown, very friable fine sandy loam.

Subsoil—
- 10 to 14 inches, reddish-brown, friable fine sandy clay loam.
- 14 to 26 inches, yellowish-red, slightly sticky fine sandy clay loam.
- 26 to 38 inches, strong-brown, friable fine sandy loam with a few, fine, faint mottles of pale yellow.

Substratum—
- 38 to 50 inches, reddish-yellow, nearly loose loamy fine sand with common, medium, faint mottles of brownish yellow.

In a few areas the surface layer is dark grayish brown and between 8 and 12 inches thick. In small areas the subsoil is slightly sandier than that of the typical profile and the loamy fine sand occurs at a shallower depth.

Use and management.—Nearly all of this soil is used for the crops commonly grown in the county. It is especially suited to alfalfa, but it is also suited to kale, spinach, potatoes, sweet corn, beans, cabbage, and leafy greens.

Leaching is fairly rapid in this soil, and therefore a good supply of organic matter and plant nutrients should be maintained. Many farmers do this by regularly turning under green-manure crops and crop residues and by applying large amounts of soil amendments. The soil is strongly acid. It requires from 1 to 1½ tons of lime per acre about every 2 years.

Most farmers apply up to 2,000 pounds of a complete fertilizer per acre to vegetable crops. Corn receives from 500 to 800 pounds of a complete fertilizer. After the corn has been harvested, many farmers sow crimson clover or rye as a cover crop. This soil is in capability unit I–1.

Sassafras fine sandy loam, undulating phase (Sb).—Except for erosion and stronger slopes, this soil, in most characteristics, is similar to Sassafras fine sandy loam, nearly level phase. Accelerated erosion has caused slight to moderate damage.

Surface runoff is medium, and the water-holding capacity is fair. The soil is moderately difficult to conserve, particularly in areas that have slopes of up to 8 percent.

Use and management.—Nearly all of this soil is cultivated. It is managed in about the same way as Sassafras fine sandy loam, nearly level phase. To minimize losses from erosion on the stronger slopes, many farmers use longer rotations that include hay crops. A few strips that are moderately eroded are used as wildlife habitats. This soil is in capability unit IIe–1.

Sassafras sandy loam, nearly level phase (Sh).—Except for the texture of its surface layer, this soil is similar to Sassafras fine sandy loam, nearly level phase. Most of it occurs on Mount Pleasant Ridge in the central part of the county. Here, it is associated with the Woodstown and Dragston soils. In a few places the surface soil is loamy fine sand.

Internal drainage is medium. Permeability is moderately rapid. This soil is easily conserved and is moderately productive.

Use and management.—Most of this soil is used for growing vegetables, melons, peanuts, corn, small grains, and hay. It is managed in about the same way as Sassafras fine sandy loam, nearly level phase. The soil is in capability unit I–1.

Sassafras loamy fine sand, nearly level phase (Sc).—This well drained to excessively drained soil occurs mainly in the northwestern part of the county. It is associated with the Woodstown and Dragston loamy fine sands.

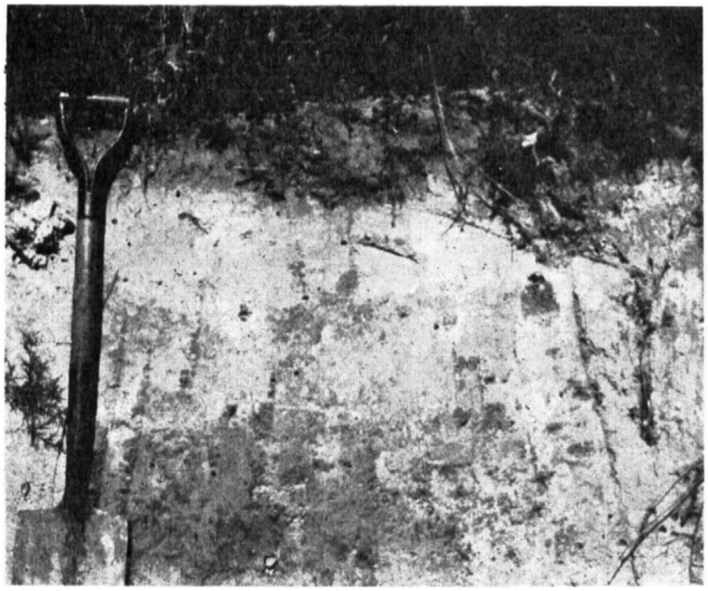

Figure 5.—**Profile of Sassafras loamy fine sand, typical of many soils in the northwestern part of the county. The surface layer is deep, very sandy, light colored, and leached. The clayey subsoil is finer textured and darker.**

This soil is one of the most extensive Sassafras soils in Norfolk County. It differs distinctly from the Sassafras fine sandy loams in having a thicker, coarser, lighter colored, and more severely leached surface soil that overlies a paler, slightly finer textured subsoil (fig. 5).

Internal drainage is rapid. The soil is deficient in organic matter and has a comparatively low water-holding capacity. It is moderate to low in fertility but moderately high in productivity.

Representative profile:

Surface soil—
- 0 to 9 inches, grayish-brown, very friable loamy fine sand.
- 9 to 16 inches, pale-yellow, friable loamy fine sand.

Subsoil—
- 16 to 26 inches, yellowish-brown, friable, heavy fine sandy loam to light sandy clay loam with a few, fine, faint mottles of light yellowish brown.
- 26 to 45 inches, yellowish-brown, slightly sticky, light fine sandy clay loam; common, medium, distinct mottles of brownish gray and light yellowish brown in the lower part.

Substratum—
- 45 to 55 inches, light yellowish-brown, loose loamy fine sand with common, medium, distinct mottles of light brownish gray and pale yellow.

The surface soil ranges in thickness from 12 to 18 inches. In a few areas it is a light fine sandy loam.

Use and management.—Practically all of this soil is cultivated. It is used to grow corn, soybeans, vegetables, strawberries, peanuts, small grains, and hay.

The soil is somewhat droughty and must be carefully managed to retain enough moisture to grow plants. Manures are essential to improving the moisture-holding capacity. Most farmers turn under crimson clover, rye, millet, or some other green-manure crop to improve the moisture-holding capacity. Many farmers plow under all the residues from vegetable crops.

Snapbeans, kale, collards, Irish potatoes, spinach, radishes, onions, and other vegetable crops receive between 600 and 2,000 pounds of a complete fertilizer per acre, and corn receives from 600 to 900 pounds. Soybeans are often grown after the corn or vegetables and produce high yields. This soil is in capability unit IIs–1.

Sassafras loamy fine sand, eroded undulating phase (Sd).—This soil differs from Sassafras loamy fine sand, nearly level phase, principally in the degree of slope and in the extent of erosion. It occurs on gently undulating slopes of 2 to 5 percent. Some of the surface soil has washed down and accumulated in small depressions. The degree of erosion varies from slight to moderate.

Use and management.—Nearly all of this soil is cultivated. It is used and managed in about the same way as Sassafras loamy fine sand, nearly level phase. Some farmers cultivate on the contour and use long rotations to control erosion. This soil is in capability unit IIIe–1.

Sassafras loamy fine sand, eroded rolling phase (Sg).—Except that it occupies stronger slopes and has been damaged by erosion, this soil is similar to Sassafras loamy fine sand, nearly level phase. Most of it is near Churchland, where it occurs next to creeks and rivers. Here, it is associated with undulating areas of Sassafras and Woodstown loamy fine sands. The slopes range from 5 to 8 percent and, in general, the relief is choppy. Erosion ranges from slight to moderate.

This soil is easy to work but fairly difficult to conserve. It is moderate in water-holding capacity, fertility, and productivity.

Use and management.—Much of this soil is cultivated intensively along with the more extensive nearly level and undulating Sassafras soils. Management practices are similar to those used on Sassafras loamy fine sand, nearly level phase. Accelerated erosion has caused crop yields to decline and has increased management problems. Some farmers have allowed the eroded areas to revert to brush or weeds. This soil is in capability unit IIIe–1.

Tidal marsh (Ta).—This miscellaneous land type consists mainly of a mixture of mineral soil materials. Most of it occurs along the branches of the Elizabeth River and at the mouths of creeks and larger streams. All of the areas are subject to tidal overflow and are under water part of the time.

The soil material is not uniform in texture. In many places it is made up of gray, dark-gray to black, or dark-brown clay or silty clay that is mixed with various amounts of sand. This material is capped in many places by fine-textured, partly decomposed organic matter that is mixed with dense mats of roots and water grasses.

Use and management.—This miscellaneous land type is not used for agriculture. The vegetation consists mainly of close-growing marsh grasses and reeds. This land type is in capability unit VIII–1.

Weeksville silt loam (Wa).—This very poorly drained soil is level to nearly level. Most of it is near Long Ridge, where it is associated with the Othello, Pasquotank, and Elkton soils. This soil is characterized by a very dark gray to grayish brown surface layer. The surface soil and the subsoil are medium to moderately fine textured. Except that it has a darker colored and finer textured surface soil, this soil closely resembles the Pasquotank soil.

Internal drainage and surface runoff are slow, and permeability is moderate. The soil is very strongly acid to extremely acid.

Representative profile:

Surface soil—
0 to 15 inches, dark grayish-brown, very friable silt loam.
Subsoil—
15 to 26 inches, dark-gray, firm silt loam with many, medium, faint mottles of dark yellowish brown.
26 to 42 inches, light-gray, slightly plastic and slightly sticky silt loam with pockets of silty clay loam; many, medium, distinct mottles of yellowish brown.
42 to 54 inches, light-gray, slightly plastic and slightly sticky very fine sandy clay loam with many, coarse, prominent mottles of yellowish brown.
Substratum—
54 to 64 inches, light-gray loamy fine sand with common, coarse, distinct mottles of yellowish brown.

In a few small areas the surface soil is very fine sandy loam. The thickness of the surface layer ranges from 10 to 18 inches. There are a few small depressional areas.

Use and management.—Approximately 80 percent of this soil is used to grow corn and soybeans. A small part is in pasture. In forested areas the trees are mainly water oak, willow oak, red maple, sweetgum, swampgum, tupelo-gum, poplar, beech, and pine.

Corn and soybeans are commonly grown in a 2-year rotation. Corn receives most of the fertilizer, which is applied in the rows at planting time. Liberal applications of lime must be applied during each rotation period.

A system of closely spaced drainage ditches is needed to adequately drain off the excess surface water. This soil is in capability unit IVw–1.

Wet soils (Wb).—This mapping unit occurs in the central part of the county, northeast of Wallaceton. It is considered to be an isolated part of the Dismal Swamp and is known locally as the "Green Sea." A detailed survey was not made, but the soils were examined along traverse lines throughout the area. The principal ones observed were the Portsmouth, Othello, Elkton, Bayboro, and Bladen.

All of the soils are poorly drained to very poorly drained. There is no natural outlet for drainage water, and an overall drainage pattern is not well established. Shallow water covers the surface in many places throughout the year.

Use and management.—If an adequate drainage system could be established, the soils in this mapping unit could be used to a limited extent for agriculture. Most of them have been cut over for timber, but only a small acreage has been used for farming. The vegetation consists principally of a dense thicket of sprout hardwoods, pine, and myrtle, mixed with an almost impenetrable undergrowth of cane reeds, smilax, blackberry, wild grape, and other weeds and grasses. This mapping unit is in capability unit VIIw–1.

Woodstown fine sandy loam, nearly level phase (Wc).—This moderately well drained soil occurs in all parts of the county. Much of it lies on the wide interstream ridges in the central and southern parts. It is associated with the Sassafras and Dragston fine sandy loams. This soil is similar to the Mattapex soils in color and drainage, but it has a coarser textured subsoil.

Internal drainage is medium, and the water-holding capacity is moderate. The content of organic matter is low in most places, and the soil is strongly acid. This soil is easy to work and conserve and is moderately high in productivity.

Representative profile:

Surface soil—
0 to 6 inches, very dark brown, very friable fine sandy loam.
6 to 11 inches, yellowish-brown, friable fine sandy loam faintly streaked with dark brown.
11 to 14 inches, yellow to brownish-yellow fine sandy loam; slightly sticky when wet.
Subsoil—
14 to 22 inches, yellow, light sandy clay loam with many, medium, distinct yellowish-brown mottles.
22 to 36 inches, yellow, slightly plastic and slightly sticky fine sandy clay loam with many, coarse, prominent mottles of strong brown and light yellowish brown.
Substratum—
36 to 60 inches, yellowish-brown loose sand with common, coarse, distinct mottles of light gray.

In a few areas the surface soil is sandy loam or very fine sandy loam. The sandy substratum is at depths ranging from 28 to 36 inches.

Use and management.—Most of this soil is cultivated. It is well suited to corn, soybeans, small grains, vegetables, hay, and pasture.

The soil is deficient in organic matter, but cultivated crops respond favorably if green-manure crops are turned under. At least 1 ton of lime per acre should be applied every 2 or 3 years to maintain the proper pH.

Corn is usually grown in either a 2-year rotation with soybeans or in a 3- or 4-year rotation with a small grain or a hay crop. Corn is fertilized with about 700 pounds per acre of a complete fertilizer and is sidedressed with nitrogen as needed. For soybeans, some farmers apply up to 400 pounds of a fertilizer that is high in phosphoric acid and potassium.

Good pastures, made up of mixtures of Ladino clover, fescue, and orchardgrass, can be established. Many farmers get good results by fertilizing the pastures with up to 1,000 pounds per acre of a fertilizer that is high in phosphorus and potassium. This soil is in capability unit I–1.

Woodstown fine sandy loam, undulating phase (Wd).—Except that it has stronger slopes, this soil is similar to Woodstown fine sandy loam, nearly level phase. Most of it occurs on mild slopes along streams. This soil has been slightly to moderately damaged by accelerated erosion. Surface runoff and internal drainage are medium.

Use and management.—Approximately 50 percent of this soil is cultivated. The rest of it is in forest or is idle. It is used and managed in about the same way as Woodstown fine sandy loam, nearly level phase.

To "square" the fields so that they will be easier to cultivate, most farmers crop the more strongly sloping eroded areas along with the nearly level areas. Less soil will be lost through erosion if a longer rotation is used in which hay is grown for 2 or 3 years. Yields are generally lower than on Woodstown fine sandy loam, nearly level phase. This soil is in capability unit IIe–1.

Woodstown loamy fine sand, nearly level phase (Wg).—Most of this soil occurs near the towns of Churchland and Deep Creek. It lies mainly on broad interstream ridges along Hampton Roads, along the Western Branch Elizabeth River, and in smaller areas around Deep Creek. It is associated with the Sassafras and Dragston loamy fine sands. This soil is similar to the Woodstown fine sandy loams, except that it has a thicker, paler, more severely leached surface soil.

Internal drainage is medium, permeability is moderately rapid, and the water-holding capacity is moderate to low. The soil is low in organic matter and is strongly acid.

Representative profile:

Surface soil—
- 0 to 2 inches, dark grayish-brown, nearly loose to very friable loamy fine sand.
- 2 to 17 inches, pale-yellow, very friable loamy fine sand faintly mottled with light gray and brownish yellow.
- 17 to 20 inches, yellowish-brown, heavy fine sandy loam with a few, coarse, faint mottles of pale yellow and light gray.

Subsoil—
- 20 to 28 inches, strong-brown, slightly sticky and slightly plastic fine sandy clay loam.
- 28 to 34 inches, strong-brown, slightly sticky, heavy fine sandy loam with a few, fine, faint mottles of yellowish brown.

Substratum—
- 34 to 50 inches, brownish-yellow, loose loamy fine sand faintly mottled with pale yellow.

Use and management.—Approximately 75 percent of this soil is cultivated or used for pasture. Vegetables, particularly spinach, snapbeans, kale, collards, and Irish potatoes are commonly grown.

This soil is used and managed in about the same way as the Sassafras loamy fine sands. During dry years, it becomes droughty, especially late in summer and in fall. Some farmers get good results by irrigating.

Some farmers use a 3-year rotation of corn, soybeans, and a vegetable crop. Others grow vegetables continuously. These farmers turn under a green-manure crop of rye, millet, or crimson clover each year. On many livestock farms a rotation of corn, small grains, and soybeans is followed. Some dairy farmers in the Churchland area use this soil for pasture.

In most places the soil is deficient in organic matter, and in many places it lacks potassium. For vegetable crops, most farmers apply between 800 and 1,200 pounds per acre of a complete fertilizer. This soil is in capability unit IIs–1.

Woodstown loamy fine sand, undulating phase (Wh).—Except for stronger slopes, this soil is similar to Woodstown loamy fine sand, nearly level phase. The slopes range from 2 to 8 percent. This soil occurs mainly in association with the nearly level phases of Woodstown and Sassafras loamy fine sands. It has been slightly to moderately damaged by sheet erosion. A few small areas on the stronger slopes have eroded to the extent that the subsoil is exposed.

Use and management.—This soil is used and managed in about the same way as Woodstown loamy fine sand, nearly level phase. Some farmers practice contour stripcropping on the more severely eroded areas. Others use these areas mainly for pasture. This soil is in capability unit IIs–1.

Use and Management of the Soils

This section consists of four main parts. The first part gives general management practices that apply to all the soils of the county. In the second, the capability units are defined. In the third, the soils are grouped in capability units and use suitability and management suggestions are described for each unit. The fourth part gives estimated yields under two levels of management for the crops commonly grown on each soil.

General Management Requirements

Many of the soils of the county require markedly different management, even though they are suited to the same crops. In the main, however, the basic management practices for getting the highest practical yields are similar on all of the soils, even though certain soils are better suited to a specific crop than are others. In this section these basic practices are discussed.

Drainage

Improving soil drainage is one of the principal management problems in Norfolk County. About 85 percent of the soils used for agriculture need artificial drainage. Crops often yield poorly or fail completely because of excess water. This is especially true of crops grown in the southern part of the county.

Few of the farms are located entirely on well-drained soils. If the soils are only moderately well drained, some kind of artificial drainage is needed, although this depends largely on the kind of crop grown. The somewhat poorly drained soils must have artificial drainage for good yields of most crops. The somewhat poorly drained and poorly drained soils need extensive improvements in drainage. Many of the deeper, sandier soils in the Churchland and Deep Creek areas require little artificial drainage, but the gray, finer textured soils that are near swamps in the southern part of the county need extensive improvements in drainage to be cultivated efficiently.

Two kinds of drains—open ditch and tile—are used in Norfolk County. Cost is the main hindrance to installing either ditches or tile. The most serious problem in installing drainage is encountered in areas of "runny" sand. The parent material of many of the soils consists of this wet sand, which occurs at various depths. Here, the high cost of installation may make drainage impractical.

The kind of soil, its depth, and the type of underlying material should be considered when constructing and maintaining drainage ditches. In a fairly shallow soil such as the Portsmouth, which overlies loose sand, it is difficult to build stable ditchbanks. The water loosens the sand and causes the ditches to clog. In deep soils such as the Elkton, which have mixed clay and sand in the lower part of the profile, the ditches do not clog so quickly and are easier to maintain.

In cultivated areas drainage waters move out through a close network of small lateral ditches. These ditches feed the water into larger ditches and from there into a natural waterway.

The number of lateral ditches needed for adequate drainage depends largely on the kind of soil. The Dragston soils, for example, require only a few widely spaced laterals, but on the Elkton soils the laterals must be spaced 150 to 200 feet apart. Many farmers "land" the soil—build ridges midway between lateral ditches with a plow—so that the land slopes gently from the middle toward each lateral. This practice is especially effective on very wet soils. Many farmers, particularly those farming gray, wet soils, run small furrows crosswise to lateral drains after each cultivation to help carry off excess surface water. This is done with a horse- or mule-drawn plow.

For tile drainage the kind of soil and the degree of slope largely determine the spacing of the tile. In the finer textured, slowly permeable soils, the tiles are laid as close as 50 feet apart, but in the more porous, sandier soils, they are spaced as far as 120 feet apart. Spacing of the tile is a more difficult problem in areas that have little slope.

In the following list the soil series are grouped according to their drainage requirements:

1. Soils requiring no artificial drainage: Sassafras, Matapeake, Galestown.
2. Soils requiring little or no artificial drainage: Woodstown, Klej, Mattapex.
3. Soils requiring moderate artificial drainage: Bertie, Dragston, Lenoir, Keyport.
4. Soils requiring intensive artificial drainage: Fallsington, Othello, Pocomoke, Portsmouth, Pasquotank.
5. Soils requiring very intensive artificial drainage: Bayboro, Bladen, Elkton, Weeksville.

Soil amendments

In this section the needs of the soils for lime, organic matter, nitrogen, phosphoric acid, and potash are discussed. The kinds and amounts of amendments needed on the soils can be judged by a knowledge of how well crops have responded in the past, the yield level at which the farmer is operating, the record of previous treatments, and the results of chemical tests.

Lime requirements.—For satisfactory crop yields, all of the soils need lime. Water leaches the lime from the upper layers and makes the soil acid. Therefore, lime should be applied about once every 3 years. The following amounts of lime should keep the soil pH at a proper level for the crops commonly grown: 1 to 1½ tons per acre on the well drained and moderately well drained soils; 2 to 3 tons per acre on the wet, finer textured soils; and 3 to 5 tons per acre on soils such as the Bayboro, Portsmouth, and Pocomoke that are high in organic matter. On many farms some parts of a field will need more lime than others. In the same field, for example, an area of Sassafras soil will require less lime than an area of Bayboro soil.

For help in determining the specific requirements of the soils for lime and fertilizer, the farmer should contact the county agricultural agent or a local representative of the Soil Conservation Service.

Organic matter, nitrogen, phosphoric acid, and potash requirements.—The soils of Norfolk County are farmed intensively. Therefore, many of them need both organic matter and nitrogen. The soils vary greatly in content of organic matter. In the northern part of the county, some of the highly leached, coarse-textured soils, which have been cultivated since the 17th century, have less than 1 percent organic matter in the surface layer. The deep, black mucky peats of the Dismal Swamp, however, have as much as 90 percent organic matter in the upper layers.

As soils are cultivated year after year, they become deficient in nitrogen, phosphorus, and potassium unless the supply is replenished by applying soil amendments. Unlike phosphorus and potassium, nitrogen is not one of the soil minerals, but nitrogen compounds are produced by plants, especially by soybeans and other legumes as they decompose. Nitrogen is also available in commercial fertilizers. Nitrogen fertilizer is needed on all crops except legumes. It increases yields of crops, and as a consequence, more organic matter is returned to the soil in the form of residues. The organic material, in turn, improves the water-holding capacity and tilth of the soil and helps reduce damage from erosion.

Manure, if available, will supply a considerable amount of nitrogen and organic matter. The proper use of manure, nitrogen fertilizer, and crop residues depends mainly on the kind of crop to be grown. Complete fertilizer should be used for small grains; oats, winter wheat, and barley need a topdressing of nitrogen. Corn, particularly on sandy soils, needs nitrogen applied as a sidedressing. Most legumes need a mineral fertilizer that contains phosphorus and potassium. This should be applied at seeding time and later as a topdressing.

Rotations

The use of a good crop rotation is the most efficient way of maintaining organic matter in the soil. One good sysstem is that of growing a legume or a green-manure crop ahead of corn. When the legume or green-manure crop is plowed under, organic matter is added to the soil and the corn crop that follows should yield well. The corn will also withstand severe droughts better than if no green manure is supplied.

Good rotations also help to control erosion and some soilborne diseases, and they slow down the rate at which certain plant nutrients are depleted. In a few places, where insecticides have been applied to vegetable crops, it is considered a good practice to grow other crops for at least 1 or 2 years to rid the land of the carryover effect of the insecticides.

Tillage

Soils must be kept in good condition if they are to produce maximum yields. Tillage commonly breaks down the structure of the soil and results in the loss of organic matter. This breakdown, however, occurs gradually and is not easily noticed. The continued use of heavy machinery under the commonly used 2-year rotation of corn and soybeans has caused many of the poorly drained, finer textured soils to become compacted and hard to work. In addition, water infiltrates slowly and the soil is not well aerated.

Adding organic matter to the soil and growing sod-forming crops help to restore good soil structure. Cultivation should be held to a minimum to permit good growth of plants. Many of the soils of the county must be cultivated only within a narrow range of moisture content to prevent them from puddling.

Capability Groups of Soils

The soils of this county have been placed in groups within capability classes and subclasses. This is part of a nationwide system in which there are 8 land-capability classes, up to 4 subclasses within each class except class I, and units within each class or subclass. Capability units are groups of similar soils.

The 8 general classes are based on the degree to which natural features of each soil limit its use for crops, grazing, woodland, or wildlife. Soils in class I are good in every way. Those in class VIII, at the other end of the scale, are the soils or land types so severely limited by natural features that they cannot be used for crops, grazing, or woodland. A soil is placed in one of the 8 classes after study of the uses that can be made of it; the risks of erosion or other damage when it is used; and the need for practices to keep it suitable for use, to control erosion, and to maintain yields.

In classes I, II, and III are soils that can be used safely for the tillage needed in a cropping system of annual or short-lived crops. Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, predominantly well drained, and easy to work. They can be tilled with almost no risk of erosion and will remain productive if managed with normal care. Class II soils can be tilled in a regular system but either do not have quite so wide a range of suitability as class I soils or need more protection. Some class II soils are gently sloping and need care to prevent runoff and erosion; others are slightly droughty or slightly wet, or somewhat limited in depth. Class III soils also can be tilled in a regular system but have a narrower range of use and need still more careful treatment than those in class II.

In class IV are soils that should be tilled only occasionally or only under very careful management.

In classes V, VI, and VII are soils that should not be tilled but that can be used for pasture, for range, or for forest. Class V soils are level but are droughty, wet, low in fertility, or otherwise unsuitable for cultivation. Class VI soils are not suitable for crops because they are steep or droughty or otherwise limited, but they give fair yields of forage or forest products. Some soils in class VI can, without damage, be tilled enough so that fruit trees or forest trees can be set out or pasture plants seeded. Class VII soils provide only poor to fair yields of forage or forest products.

In class VIII are soils and land types that have practically no agricultural use. Some have value for wildlife and recreation, and they may also form parts of valuable watersheds. Classes V and VI of the national system do not occur in Norfolk County.

Capability subclasses.—The soils in any one capability class are limited to the same degree, but they may be limited for different reasons. To show the main kind of limiting factor, any one of classes II through VIII may be divided into from one to four subclasses, each identified by a letter following the capability class number. The letter "e" indicates that the risk of erosion is what limits the uses of the soil; the letter "w" is used if the soil is too wet for general use; the letter "s" shows that the soil is shallow, droughty, or unusually low in fertility; and the letter "c" is used to indicate that the climate is so hazardous that it limits the uses of the soil. There are no subclass "c" soils in this county.

Capability classes, subclasses, and units in Norfolk County are given in the following list:

Class I. Soils that are suitable for intensive cultivation over a long period if good farming practices are followed.
- I–1: Deep, nearly level, well drained or moderately well drained fine sandy loams and sandy loams.
- I–2: Deep, nearly level, well drained or moderately well drained fine sandy loams and very fine sandy loams.

Class II. Soils that have moderate limitations if cultivated.
- IIe: Undulating soils that are subject to erosion if not protected.
  - IIe–1: Friable, well-drained, undulating fine sandy loams.
  - IIe–2: Friable, well-drained, undulating fine sandy loams and very fine sandy loams.
- IIw: Soils moderately limited by wetness.
  - IIw–1: Somewhat poorly drained, moderately permeable soils.
  - IIw–2: Somewhat poorly drained or moderately well drained soils that are moderately slow in permeability.
- IIs: Soils that are moderately limited in water-holding capacity.
  - IIs–1: Well drained and somewhat excessively drained loamy fine sands.

Class III. Soils that have moderately severe limitations if cultivated.
- IIIe: Undulating or rolling soils that are subject to erosion if not protected.
  - IIIe–1: Undulating or rolling loamy fine sands that have been damaged by erosion.
- IIIw: Somewhat poorly drained and poorly drained soils that have a high water table.
  - IIIw–1: Level or nearly level soils.
  - IIIw–2: Nearly level, moderately permeable soils.
- IIIs: Very sandy soils that are limited in water-holding capacity.
  - IIIs–1: Level to rolling soils that are rapid in permeability.

Class IV. Soils that are severely limited or subject to a high risk of damage when cultivated, unless carefully managed.
- IVw–1: Poorly drained or very poorly drained, dark-colored soils.

Class VII. Soils that are severely limited for use as pasture or woodland.
- VIIw–1: Soils that are continuously wet.

Class VIII. Miscellaneous land types that are not suited to cultivation, pasture, or to use as woodland but that are suitable for recreational facilities or for wildlife habitats.
- VIII–1: Tidal marsh and Coastal beach.

Capability Units in Norfolk County

In this section soils of the county that can be used and managed in about the same way are placed in a capability unit. The soils of a capability unit are somewhat similar in texture, drainage, permeability, and productivity. Management is suggested for each of the 13 capability units.

The suggestions as to the kinds and amounts of fertilizer to be used are meant to serve only as a general guide. For specific suggestions about use of fertilizer on an individual soil, see the county agricultural agent or the local representative of the Soil Conservation Service.

Many areas of Made land occur throughout the county. This miscellaneous land type is not used for agriculture, and it has not been placed in a capability unit.

Capability unit I–1

This capability unit consists of deep, nearly level, well drained to moderately well drained soils. The soils are medium acid to strongly acid, permeable, and well aerated. If good farming practices are followed, they can be cultivated intensively over a long period. They are composed of very friable sandy loams and fine sandy loams of marine origin.

The soils are inherently low in minerals and somewhat low in organic matter, but crops respond well to applications of a complete fertilizer. The moderately coarse textured surface soil is easily tilled within a wide range of moisture content. The subsoils contain enough clay, mixed with sand, to hold moisture and plant nutrients fairly well. In most places sand occurs at depths between 24 and 42 inches and provides excellent underdrainage for the growing of alfalfa and other deep-rooted crops.

The Sassafras soils are distinguished by a reddish-brown to yellowish-red and strong-brown subsoil. Except that it is mottled below a depth of 18 inches, the Woodstown soil is similar to the Sassafras. The following soils are in capability unit I–1:

Sassafras fine sandy loam, nearly level phase.
Sassafras sandy loam, nearly level phase.
Woodstown fine sandy loam, nearly level phase.

Management requirements.—Nearly all areas of these soils are used intensively for vegetables, corn, soybeans, small grains, hay, and pasture, and yields are high. Vegetables are the most important crop, because the soils warm early and can absorb and use large amounts of fertilizer.

Capability unit I–2

In this capability unit are deep, nearly level, well drained to moderately well drained very fine sandy loams and fine sandy loams. These soils have a finer textured subsoil than the soils of capability unit I–1. Under good management they are suited to intensive cultivation. They retain moisture and plant nutrients well and are easy to work. In general, they are suited to many uses and are highly productive.

The surface soil and subsoil are brown or yellowish brown. The subsoil is underlain by coarser textured material beginning at depths of as much as 56 inches, but in most places this material occurs at depths between 35 and 45 inches. The following soils are in capability unit I–2:

Matapeake fine sandy loam, nearly level phase.
Mattapex very fine sandy loam, nearly level phase.

Management requirements.—In many areas these soils are used along with the associated Othello and Fallsington soils for growing corn and soybeans and to a lesser extent for vegetables, small grains, hay, and pasture. Although the acreage in vegetables is not extensive, yields are high. The Matapeake soil is considered to be one of the best agricultural soils in the county, followed closely by the Mattapex soil. The Mattapex soil is not quite so well drained.

The management requirements of these soils are similar to those of soils in capability unit I–1. In general the soils are finer textured than those of capability unit I–1, so the loss of plant nutrients through leaching is slightly less. As a result, they may not need as much fertilizer. Most farmers apply between 600 and 800 pounds of a complete fertilizer per acre to corn and sidedress the crop with nitrogen during its early growth. Usually soybeans following corn are not fertilized.

If rainfall is below normal during the summer, these soils will retain more moisture in the subsoil than the soils of capability unit I–1 and consequently will produce higher yields.

Capability unit IIe–1

This capability unit consists of undulating, well-drained, friable fine sandy loams that occur on marine terraces. The soils, like those of the other capability units within class II, can be cultivated but have moderate limitations. They are subject to slight risk of erosion. The following soils are in capability unit IIe–1:

Sassafras fine sandy loam, undulating phase.
Woodstown fine sandy loam, undulating phase.

Management requirements.—These soils need about the same management practices as the soils of capability unit I–1. In addition, they require buffer strips and contour tillage to reduce the loss of soil through erosion.

Capability unit IIe–2

This capability unit is made up of undulating, well-drained soils that have a medium textured or moderately fine textured surface soil and predominantly moderately fine textured subsoil. They are subject to slight to moderate erosion. The following soils are in capability unit IIe–2:

Matapeake fine sandy loam, eroded undulating phase.
Mattapex very fine sandy loam, undulating phase.

Management requirements.—These soils need about the same management as the soils of capability unit I–2. Because of their undulating relief, they also require contour tillage and longer rotations, which include hay crops, to help reduce the loss of soil through erosion.

Capability unit IIw–1

In this capability unit are moderately wet, nearly level fine sandy loams and very fine sandy loams that occur on marine terraces. They are distinguished by the gray, yellow, and brown mottling in the subsoil. The soils are somewhat poorly drained and moderately permeable. They range from easy to moderately difficult to work and to conserve, but they are moderate in productivity. The following soils are in capability unit IIw–1:

Bertie very fine sandy loam.
Bertie fine sandy loam, olive-gray subsoil variant.
Dragston fine sandy loam.
Dragston loamy fine sand.

Management requirements.—These soils are used to grow corn, soybeans, some vegetables, small grains, and hay, or they are used for pasture. They are well suited to corn and soybeans and are used extensively for those crops. In extremely dry years, these soils store more moisture than many of the well-drained soils, and as a result, crops do better. Pastures stand up well in very dry summers.

Drainage is the primary management problem on these soils. Some type of artificial drainage is needed for the crops commonly grown. In most areas lateral V-type ditches, spaced 200 to 300 feet apart and having good outlets, will carry off the excess water.

Some farmers grow a small grain or a winter cover crop in the rotation with corn and soybeans. They apply up to 700 pounds of a complete fertilizer per acre. In addition they apply nitrogen, when needed, as a sidedressing for corn or as a topdressing for the small grain or cover crop. Soybeans grown in this rotation receive little additional fertilizer. These soils are acid in reaction. In many places from 1 to 2 tons of lime per acre is needed to maintain a suitable pH.

Capability unit IIw-2

The only soil in this capability unit is Keyport very fine sandy loam. This is a slightly wet soil that has a moderately fine textured to fine textured subsoil. This soil is moderately well drained. It occurs mainly in large forested areas in association with less well drained soils.

Permeability is somewhat retarded in the surface soil and subsoil. Water infiltrates fairly slowly, and aeration and the movement of plant nutrients are restricted. The surface soil tends to pack after heavy rains. This soil can be cultivated easily within only a narrow range of moisture content.

Management requirements.—This soil is used for corn, soybeans, some small grains, and pasture. The primary management problem is drainage. Open ditch drains are needed to remove water from low pockets.

Corn receives about 400 pounds of a complete fertilizer per acre at planting time. It receives an additional 200 pounds as a sidedressing and applications of nitrogen if needed. If these amounts of fertilizers are used, yields are fairly good. Soybeans seldom get additional fertilizer. The base-exchange capacity of these soils is fairly high. The desired pH can be maintained by applying lime every 3 or 4 years.

Capability unit IIs-1

This capability unit is made up of loamy fine sands that have a grayish-brown or pale-yellow surface soil. These soils are slightly limited in use by low water-holding capacity. They have a very friable to loose coarse-textured surface soil and a very friable subsoil. In most places sand underlies the subsoil at depths between 24 and 40 inches.

In general these soils occupy higher terraces than most of the other soils in the county. They have a thicker surface layer than most of the soils. The soils are moderate to low in water-holding capacity. The Woodstown soils have a somewhat higher water table than the Sassafras soil but are moderately well drained. The Sassafras soil is well drained to somewhat excessively drained. All of the soils are very low in organic matter and are strongly acid. Fertility is medium to very low. The following soils are in capability unit IIs-1:

- Sassafras loamy fine sand, nearly level phase.
- Woodstown loamy fine sand, nearly level phase.
- Woodstown loamy fine sand, undulating phase.

Management requirements.—These soils are well suited to vegetables, small grains, peanuts, and cotton (fig. 6). The principal management need is to retain moisture in the soil.

Capability unit IIIe-1

This capability unit consists of undulating and rolling loamy fine sands. The soils can be cultivated in a regular cropping system, but there is a moderately high risk of erosion. The following soils are in capability unit IIIe-1:

- Sassafras loamy fine sand, eroded undulating phase.
- Sassafras loamy fine sand, eroded rolling phase.

Management requirements.—These soils are suited to about the same crops as the soils of capability unit IIs-1. They occur on stronger slopes and are subject to erosion. In addition to the management practices described under the discussion of capability unit IIs-1, these soils need

***Figure 6.*—Peanut hay grown on a field of Woodstown loamy fine sand near Churchland. Peanuts are grown extensively in the northern part of the county on the deep Sassafras and Woodstown loamy fine sands.**

longer rotations. They also require the use of buffer strips along with contour tillage to reduce the loss of soil through erosion.

Capability unit IIIw-1

This capability unit consists of predominantly light colored, poorly drained soils that have a high water table. The soils are level to nearly level. They occur on marine terraces throughout the county. Most of the areas are in the southeastern part.

These soils are predominantly strongly acid, moderately difficult to work, and only moderately productive. They are slowly permeable, and they retain moisture and plant nutrients well. Infiltration is slow and aeration is restricted. The soils have a grayish surface layer, and the subsoil is mottled. The following soils are in capability unit IIIw-1:

- Bladen silt loam.
- Elkton silt loam.
- Elkton-Othello very fine sandy loams.
- Lenoir very fine sandy loam.
- Othello loam, dark surface phase.
- Othello very fine sandy loam.
- Othello-Fallsington fine sandy loams.

Management requirements.—Because of poor drainage, most areas of these soils are suited only to corn, soybeans, and pasture. Some, however, are used for vegetable crops and for small gardens.

The principal management requirement is one of providing adequate drainage. In recent years many effective drainage systems have been constructed and maintained on the soils. Consequently, large idle or wooded areas have been reclaimed for agriculture. As a result of improvements in farm implements and in cultivation practices and because of the increased use of commercial fertilizers, these soils are now suited to a greater variety of uses.

In the past it was difficult to establish effective drainage systems in many areas of these soils. Many of the ditches were dug across the slope. Consequently, the water could not be carried to the lead outlets. Properly plowed ditches that are approximately 2 feet deep and spaced at intervals of about 200 feet are adequate for most of these soils. The spoil banks should be leveled so that the surface water will drain off rapidly. In most places the surface water drains off rapidly if small cross drains or furrows are made after each cultivation.

Ditches on the deep, finer textured Elkton soil will not clog up so soon as those on some of the other soils that have strata of sand in the subsoil and underlying layers. The sloping V-type drains are more efficient than those with vertical sides. A plant cover on the banks will help stabilize the soil. The number of lateral ditches should be kept to a minimum. Many of the present drainage layouts have too many laterals. In such places the use of farm equipment is greatly restricted.

The amount of organic matter in these soils can be increased by turning under cover crops. If a legume cover crop is turned under before corn is planted, the corn yields can be increased significantly.

Corn and soybeans, the principal crops, are grown in a 2-year rotation. For corn, many of the farmers get good yields by applying between 500 and 1,000 pounds of a complete fertilizer per acre in two applications—one at planting time and the other when the corn is laid by. In addition, 40 to 60 pounds of nitrogen per acre is applied during the early growing period.

Most farmers plant hybrid corn. Others still use open-pollinated varieties. The hybrid corn produces excellent yields, but farmers report that some of the hybrids do not stand up well, have a high content of moisture, and have poor storage qualities. Some farmers plant early varieties for "hogging off." After the corn or soybeans have been harvested, other farmers enclose their fields with electric fences and fatten livestock on the crop residue.

Soybeans grown for beans follow corn in the rotation. Most farmers apply all of the fertilizer to the corn. A few apply between 200 and 400 pounds per acre of a fertilizer containing potassium and phosphorus to soybeans at planting time. In some places harvesting of soybeans is extremely difficult because of late fall rains that make the use of heavy combines difficult or impossible.

A rotary hoe is used to cultivate corn and soybeans. Weeds are controlled in some places by using commercial sprays. Weeds are a greater problem in corn because, during the harvest of the previous soybean crop, the weed seeds are scattered throughout the field.

Some of these soils are being used increasingly for pasture. For good stands of pasture, soils must be limed to keep the pH at 6.0 or higher. Many pastures fail because they are overgrazed, because not enough fertilizer is used in the first application, or because the supply of plant nutrients is not maintained. Large amounts of water are absorbed by a heavy grass sod. Therefore good pastures seem to improve the overall drainage on these soils.

Capability unit IIIw–2

This capability unit consists of moderately permeable, nearly level, poorly drained soils. The plow layers are 5 to 8 inches thick and are lighter colored and lower in organic matter than are those of the soils in capability unit IVw–1. The soils are medium to strongly acid, and the content of plant nutrients is moderate. The soils have a better supply of moisture during dry seasons than the higher lying soils in which runoff and internal drainage are more rapid. The following soils are in capability unit IIIw–2:

Fallsington fine sandy loam.
Pasquotank very fine sandy loam.

Management requirements.—Unless they are drained, these soils are not well suited to cultivation. Nevertheless, they are porous and friable, which makes them respond well to drainage. Drainage in much of the acreage has been improved by open ditches. The sloping, V-type ditches are better for these soils than steep-sided ditches. The sandy substratum in the soils makes the ditches difficult to maintain because the soil material on the sides of the banks sloughs off and falls into the ditch. The ditches are especially difficult to maintain where the sandy substratum is shallow enough to outcrop in the ditch cuts.

These soils, when adequately drained, are suited to corn, soybeans, oats, wheat, and other field crops, and to truck crops such as Irish potatoes, strawberries, snapbeans, and kale. If the supply of plant nutrients and organic matter is maintained at a high level, intensive cultivation can be practiced. The soils need heavy applications of a complete fertilizer for pasture or for field crops to grow well. The more desirable legumes and grasses need light applications of lime if a thick stand of high-quality plants is to be obtained. The supply of available moisture makes these soils among the most productive in the county for pasture plants during the drier part of the growing season.

These soils are easy to work and do not clod readily when plowed wet. Surface runoff, however, is a little slow, even on the drained areas, because of the nearly level relief. As a result field operations on these soils may be delayed longer after heavy rains than they are on the sandier, more sloping, higher lying soils. Weeds grow rapidly and are abundant, especially in the more fertile areas. Harvesting of late-maturing crops is difficult during years when rainfall is heavy in fall.

Capability unit IIIs–1

In this capability unit are sandy soils that have moderate to low water-holding capacity. The soils are among the least fertile in Norfolk County. They are level to rolling and occur on higher terraces than many of the other soils. In general, these soils have rapid permeability, and they have a thicker surface soil and are coarser textured than many of the other soils in the county.

Galestown loamy fine sand has rapid internal drainage and is moderately acid in reaction. The water table is much higher in the Dragston and Klej soils than in the Galestown. The Dragston and Klej soils are somewhat poorly drained to moderately well drained and range from medium acid to strongly acid in reaction. The following soils are in capability unit IIIs–1:

Galestown loamy fine sand.
Klej loamy fine sand.

Management requirements.—These soils are used principally to grow corn, soybeans, peanuts, strawberries, and vegetables (fig. 7). They are used to a lesser extent for small grains, cotton, and pasture.

These coarse-textured soils have restricted water-holding capacity. For efficient management, soil moisture and plant nutrients must be conserved. Corn and vegetable crops respond well to large amounts of fertilizer. Small amounts of lime should be applied to the soils frequently because of the rapid leaching and the comparatively low base-exchange capacity.

It is best to apply fertilizer in more than one application. Crops grown on these coarse-textured soils are likely to be damaged by lack of nitrogen; therefore additional nitrogen should be applied to a specific crop as required. Corn grown after soybeans or a vegetable crop responds readily to applications of between 200 and 400 pounds per acre of a complete fertilizer placed in the row at planting time. A like amount is applied later as a sidedressing, and additional nitrogen is applied as needed. Soybeans grown after corn may respond to small applications of a complete fertilizer.

Pastures produce fair yields on the Dragston soil, if adequately fertilized and properly grazed. The Galestown and Klej soils are used little for pasture.

For most crops the Dragston and Klej soils need artificial drainage to remove excess surface water. In the past they were drained by an elaborate system of tile drains. On most farms these drains have become clogged and are no longer used. Well-spaced open ditches now provide adequate drainage.

Capability unit IVw–1

This capability unit is made up of poorly drained and very poorly drained, dark-colored loams, fine sandy loams, silt loams, and mucky loams. The soils occur in all parts of the county, and many areas lie next to swamps. Poor drainage severely limits their use for tilled crops.

In general, these soils are characterized by a medium- to fine-textured subsoil. In most of them internal drainage is slow to very slow. Most of these soils are moderate to moderately high in fertility and productivity. They are moderately difficult or difficult to work. The following soils make up capability unit IVw–1:

Bayboro silt loam.
Bayboro mucky loam.
Pocomoke fine sandy loam.
Portsmouth loam.
Portsmouth mucky loam.
Weeksville silt loam.

Management requirements.—Large areas of these soils, especially of Bladen silt loam, Bayboro silt loam, Bayboro mucky loam, and Portsmouth mucky loam, are in forest. The soils occur near swamps and are extremely difficult to drain adequately. Many small tracts, however, are slowly being reclaimed to meet the increasing demand for land suitable for cultivation. The forests consist of water-tolerant trees, principally red maple, loblolly pine, pond pine, and various species of gums and oaks. Areas that have been cut over or burned over have a thick growth of myrtle, smilax, canes, coarse water reeds and grasses, briers, poison-ivy, and creeper. Other large tracts are leased to clubs for the hunting of deer and bear.

Cleared areas are used mainly for corn and soybeans and to a lesser extent for hay and pasture. Small areas on the highest and best drained sites are being cleared for pastures and home gardens. A few farmers use these soils, especially the Portsmouth, for growing nursery stock and flowers. One of the largest nurseries in the world is located on the Portsmouth soils.

These soils must be adequately drained if they are to be cultivated successfully. Lateral ditches should be spaced from 150 to 200 feet apart and should have good outlets to deep, well-spaced lead ditches. The ditchbanks stand up well in most of the soils because of the deep, moderately fine textured subsoil. The Portsmouth and Pocomoke soils, however, have a fairly shallow subsoil that overlies loose sand. As a result the ditchbanks do not hold up well, and the ditches must be cleaned frequently. Although natural drainage is very poor in the Portsmouth, Pocomoke, Othello, and Weeksville soils, all of these soils are moderately permeable.

Figure 7.—**Soybeans on a field of Dragston loamy fine sand near Churchland. Soybeans are one of the principal crops grown in Norfolk County.**

Corn and soybeans are generally grown in a 2-year rotation. Corn usually receives all of the fertilizer. Between 400 and 500 pounds of a complete fertilizer per acre is applied to the crop in two applications. The combines, which are used to harvest the soybean crop, scatter weed seeds, particularly cocklebur seeds. The following spring weeds are a serious problem in the corn. In many areas it is too wet to get heavy machinery into the fields until after the weeds are out of control. Some farmers effectively control the weeds by using pre-emergence sprays. These soils range from strongly acid to extremely acid. They require from 3 to 5 tons of lime per acre during the rotation to maintain the proper pH.

Many of these soils are well suited to pasture. The Portsmouth and Othello soils, the principal ones used for pasture, are well suited to Ladino clover and orchardgrass and other pasture mixtures. Good pastures have been established on these soils by applying from 2 to 4 tons of lime and about 1,000 pounds of a complete fertilizer per acre at seeding time. An annual topdressing of between 400 and 500 pounds of a complete fertilizer per acre should maintain a good stand of pasture under ordinary grazing conditions. To keep their pastures from becoming depleted, most farmers use a system of rotated grazing.

Capability unit VIIw–1

The soils that make up this capability unit are continuously wet. As a consequence their suitability for use as pasture or woodland is seriously limited. They occur in the Dismal Swamp and in bottom lands where water is near or on the surface most of the time. They consist largely of black, partly decomposed organic material that ranges from 1 to 10 feet in thickness. This material is underlain by gray mineral soil that contains shell marl in places. At times the thick mucky peat soils dry out, catch fire, and burn for long periods. The following mapping units make up capability unit VIIw–1:

Mixed alluvial land.
Mucky peat.
Mucky peat, shallow over loams.
Mucky peat, shallow over sands.
Wet soils.

Management requirements.—The only practical uses of these soils are as woodland or wildlife preserves. The forests consist of cypress, juniper, poplar, maple, loblolly pine, pond pine, and various species of gum. The underbrush is myrtle, smilax, bamboo briers, cane, reeds, and rushes. Deer and bear frequent the areas. Hunting clubs and timber companies own most of the land.

Capability unit VIII–1

This capability unit is made up of two miscellaneous land types—Tidal marsh and Coastal beach. These are not suited to agriculture or timber production but are suitable as habitats for wildlife and for recreational facilities. Tidal marsh occurs along the Elizabeth River. Coastal beach lies along Hampton Roads and the Chesapeake Bay.

Estimated Yields

Estimated average acre yields of principal crops are given in table 3. In columns A are yields to be expected

TABLE 3.—*Estimated average acre yields of principal crops*

[Yields in columns A are those to be expected under common management practices; yields in columns B are to be expected under good management practices. Absence of yield figure indicates crop is not commonly grown and is not suited to the soil]

Soil	Corn		Soybeans		Oats		Wheat		Lespedeza	Potatoes	Sweetpotatoes	Pasture	
	A	B	A	B	A	B	A	B	B	B	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Bu.*	*Bu.*	*Cow-acre-days*[1]	*Cow-acre-days*[1]
Bayboro silt loam	40	60	18	25	------	------	------	------	1	------	------	90	190
Bayboro mucky loam	25	45	------	------	------	------	------	------	------	------	------	80	165
Bertie very fine sandy loam	30	50	19	24	------	------	------	------	------	185	------	90	195
Bertie fine sandy loam, olive-gray subsoil variant	30	50	19	25	------	------	------	------	------	200	------	88	190
Bladen silt loam	35	55	19	24	------	------	------	------	1½	------	------	90	190
Dragston fine sandy loam	50	70	23	27	40	48	32	36	1¼	210	135	80	195
Dragston loamy fine sand	25	45	20	25	35	45	28	32	1	169	140	60	140
Elkton silt loam	30	45	17	19	------	------	------	------	1	------	------	80	180
Elkton-Othello very fine sandy loams	35	50	20	23	------	------	------	------	1	------	------	80	185
Fallsington fine sandy loam	40	60	22	26	30	38	26	38	1¼	200	------	60	130
Galestown loamy fine sand	25	50	14	16	------	------	------	------	------	208	150	------	------
Keyport very fine sandy loam	40	60	20	23	28	36	24	36	1½	------	------	80	185
Klej loamy fine sand	25	40	18	20	------	------	------	------	------	------	------	------	------
Lenoir very fine sandy loam	40	60	19	22	------	------	------	------	1¼	------	------	75	185
Matapeake fine sandy loam:													
Nearly level phase	65	90	26	30	40	55	32	40	2	200	------	97	210
Eroded undulating phase	60	90	21	26	35	50	30	34	2	175	------	93	205
Mattapex very fine sandy loam:													
Nearly level phase	50	70	23	28	33	47	27	36	1¾	200	------	100	220
Undulating phase	50	70	21	25	30	43	24	29	1¾	200	------	96	210
Othello very fine sandy loam	40	60	20	23	22	30	25	31	1	150	------	80	160
Othello loam, dark surface phase	35	55	20	23	23	29	24	26	1½	------	------	85	165
Othello-Fallsington fine sandy loams	40	60	21	24	28	39	24	28	1½	185	------	75	150
Pasquotank very fine sandy loam	40	60	20	23	32	45	28	32	1½	190	------	85	185
Pocomoke fine sandy loam	40	60	21	24	36	41	30	34	------	------	------	70	150
Portsmouth loam	45	65	21	25	36	42	30	35	1	------	------	75	160
Portsmouth mucky loam	40	60	21	24	34	39	------	------	------	------	------	70	150
Sassafras fine sandy loam:													
Nearly level phase	65	90	22	28	35	56	31	40	2	220	150	94	206
Undulating phase	65	90	21	26	26	45	25	30	2	220	150	92	200
Sassafras sandy loam, nearly level phase	65	90	22	27	38	44	30	39	1½	230	155	90	195
Sassafras loamy fine sand:													
Nearly level phase	40	60	17	20	32	41	28	33	1	240	200	84	184
Eroded undulating phase	30	56	16	20	30	39	26	30	1	200	150	80	165
Eroded rolling phase	25	45	15	18	28	33	24	26	1	185	------	80	165
Weeksville silt loam	40	60	20	24	33	40	28	32	1¾	------	------	90	190
Woodstown fine sandy loam:													
Nearly level phase	50	70	21	26	34	50	30	40	2	220	140	95	210
Undulating phase	50	70	20	25	31	47	27	35	2	220	140	90	200
Woodstown loamy fine sand:													
Nearly level phase	35	55	17	20	35	43	30	33	1¼	230	155	80	170
Undulating phase	35	55	17	20	32	40	27	31	1¼	230	155	80	180

[1] The term "cow-acre-days" is used to express the carrying capacity or grazing value of pasture. It equals the number of days of grazing that 1 acre will provide 1 animal unit in a year without injury to the sod. One animal unit is a cow, steer, or horse, or 5 sheep.

under the management now common in the county. In columns B are yields to be expected under the highest level of management now thought feasible. Lespedeza, potatoes, sweetpotatoes, and pasture are normally grown under good management practices. Therefore, estimated yields of these crops are given for only the highest level of management.

The yields given in columns A are based largely on observations made by members of the soil survey party, on information obtained by interviews with farmers and other agricultural workers who have had experience with the soils and crops of the area, and on comparisons with yield tables for nearby counties having similar soils. Data giving specific crop yields by the kind of soil are not generally available. Nevertheless, the yields given in columns A are based on a summation of local experience. They are considered fairly reliable estimates of the crop production that may be expected under the management commonly practiced.

The yields in columns B are based largely upon estimates made by men who have had experience with the soils and crops of the county. In making the estimates they considered known deficiencies of the soils and then judged how much crop yields might increase if these deficiencies were corrected within practical limits. The yields in columns B may be considered as production goals or as yields that may be obtained by using good management practices.

Good management, or the highest level of management thought feasible, requires: (1) The proper choice and rotation of crops; (2) the correct use of commercial fertilizers, lime, and manure; (3) proper tillage methods; (4) the return of organic matter to the soil; (5) adequate mechanical means for controlling water; (6) the maintenance or improvement of productivity and workability; and (7) the conservation of soil material, plant nutrients, and soil moisture.

By comparing yields in columns B with those in columns A, one gets some idea of how a soil will respond to good management. On practically all soils of the county, more intensive management will increase the yields.

Soil Formation and Classification

Soil results from the interaction of soil-forming processes on materials deposited or accumulated by geologic action. The characteristics of the soil at any given point are determined by (1) the type of parent material; (2) the climate under which the soil material has accumulated and existed since it accumulated; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Factors of Soil Formation

All of the five factors of soil formation have influenced the development of the soils of Norfolk County. Differences in parent material, however, have probably been more responsible for differences among the soils than the other factors.

Parent material

The unconsolidated sediments from which the soils of Norfolk County have developed vary widely in texture. The soils therefore have not formed in a uniform pattern. Geologically, the soils are young. The soil-forming processes have not acted on them for a long enough time for well-developed characteristics to have developed. The soils closely resemble the original sediments, particularly in texture. In most of the soils, fine-textured material overlies a sandy layer that begins at depths of 36 to 40 inches. The transition from the fine-textured material to sand is rather abrupt. Nevertheless, in most places this sandy material probably was deposited at a different time and has had little effect on the development of the overlying material.

Climate

The climate of Norfolk County is oceanic. It is tempered by breezes from the Atlantic Ocean and the Chesapeake Bay. Summers are long and temperate, and winters are short and mild. On only a few days are temperatures below freezing.

Although the elevation is fairly uniform, the climate varies somewhat within the county. In the Wallaceton area the growing season is about a month shorter than in the Norfolk area. The average annual rainfall ranges from about 51 inches at Wallaceton to about 43 inches at Norfolk. The large amount of rainfall and the high humidity cause the minerals to leach rapidly from the soil and speed chemical reaction.

Vegetation

Plants have significantly influenced the development of the soils in the county. They have influenced particularly the development of the soils of the Dismal Swamp. These poorly drained to very poorly drained soils have developed under a cover of pine, gum, red maple, cypress, and southern whitecedar.

The mineral soils that have developed under a cover of loblolly pine and mixed hardwoods generally have a light-colored surface layer that is low in organic matter. In drainage they range from poor to good. These soils make up about 35 percent of the acreage mapped in the county. The dark-colored mineral soils, mucky loams, and mucky peats, account for about 65 percent.

Relief

Norfolk County is on a level to nearly level plain that ranges from sea level to about 25 feet in elevation. In most places the slopes are less than 2 percent. Approximately 50 percent of the county is made up of very poorly drained and poorly drained soils. The rest of the soils are somewhat poorly drained to moderately well drained, except for a small acreage in which the soils are well drained. Large areas, such as the "Green Sea," have no natural drainage outlets.

The Sassafras and Matapeake series have the most mature profiles. Of all the series in the county, these two have the highest proportion of undulating and rolling soils.

Time

Most of the soils of the county are considered to be young. Of the factors of soil formation, time has had the least influence in their development. The other factors of soil formation have not acted for a long enough time for the soils to be nearly in equilibrium with their environment.

Classification of Soils

The lower categories of soil classification—phases, types, and series—are explained in the section, How a Soil Survey is Made. Briefly, a soil type consists of one or more phases and a soil series of one or more soil types. Soil types or phases are the units shown on the detailed soil map.

Soil series are classified into the next broader category, the great soil groups. Each great soil group is made up of soils that have certain internal characteristics in common. The broadest categories of soil classification are the three soil orders—zonal, intrazonal, and azonal—into which all of the great soil groups are classified. In table 4 the soil series of Norfolk County are classified by great soil groups and soil orders.

TABLE 4.—*Classification of the soil series by higher categories, and some of the factors that have contributed to differences in their formation*

Great soil group and series	Relief	Parent material	Drainage	Predominant profile color
ZONAL SOILS				
Gray-Brown Podzolic:				
Keyport	Nearly level to rolling	Fine-textured marine sediments	Moderately good	Yellowish brown.
Matapeake	Nearly level to rolling	Medium-textured marine sediments	Good	Strong brown.
Mattapex	Nearly level to rolling	Medium-textured marine sediments	Moderately good	Mottled yellow and gray.
Sassafras	Nearly level to rolling	Coarse to moderately coarse textured marine sediments.	Good	Strong brown.
Woodstown [1]	Nearly level to rolling	Same	Moderately good	Mottled yellow and gray.
INTRAZONAL SOILS				
Low-Humic Gley:				
Bertie [2]	Gently undulating	Medium-textured marine sediments	Somewhat poor	Mottled gray and yellow.
Bladen	Nearly level	Fine-textured marine sediments	Poor to very poor	Gray to very dark gray.
Dragston [2]	Nearly level to undulating.	Moderately coarse-textured marine sediments.	Somewhat poor	Mottled gray and yellow.
Elkton	Level to nearly level	Fine-textured marine sediments	Poor	Gray.
Fallsington	Nearly level	Moderately coarse-textured marine sediments.	Poor	Gray.
Lenoir [2]	Nearly level to undulating.	Fine-textured marine sediments	Somewhat poor	Yellow.
Othello	Nearly level	Medium-textured marine sediments	Poor	Gray.
Pasquotank	Nearly level	Fine- to medium-textured marine sediments.	Poor	Gray.
Humic Gley:				
Bayboro	Level; slightly depressional.	Fine-textured marine sediments	Very poor	Black.
Pocomoke	Level to nearly level	Moderately coarse-textured marine sediments.	Very poor	Black.
Portsmouth	Level; slightly depressional.	Medium-textured marine sediments	Very poor	Black.
Weeksville	Level to nearly level	Fine- to medium-textured marine sediments.	Very poor	Gray.
AZONAL SOILS				
Regosols:				
Galestown [2]	Undulating to rolling	Coarse-textured marine sediments	Good to excessive	Light brownish yellow.
Klej	Level to nearly level	Coarse-textured marine sediments	Somewhat poor to moderately good.	Gray.

[1] Soil is similar to Low-Humic Gley soils in some characteristics.
[2] Soil is similar to Gray-Brown Podzolic soils in some characteristics.

Zonal soils

Soils of the zonal order have well-developed characteristics that reflect the dominating influence of climate and vegetation. In Norfolk County about 7 percent of the acreage is made up of zonal soils. The soils have developed from permeable marine sediments. They occur on nearly level to rolling relief. In this county the zonal order is represented by one great soil group, the Gray-Brown Podzolic.

GRAY-BROWN PODZOLIC SOILS

The Gray-Brown Podzolic soils have a surface covering of leaf litter and a dark, thin, mild (only slightly acid or moderately acid) layer of humus that is mixed with some mineral soil. This material overlies a grayish-brown, leached A horizon. The B horizon is moderately heavy textured and yellowish brown, brownish yellow, or reddish brown. It becomes lighter colored with depth.

The depth of the solum varies considerably, but it is generally 4 feet or less.[1]

In Norfolk County the Gray-Brown Podzolic soils belong to the Matapeake, Sassafras, Mattapex, Woodstown, and Keyport series. The Matapeake and Sassafras soils in some characteristics are similar to the Red-Yellow Podzolic soils, and the Woodstown and Keyport soils are somewhat similar to the Low-Humic Gley soils.

MATAPEAKE AND SASSAFRAS SERIES.—Both of these series are made up of predominantly well drained soils. The Sassafras soils are coarser textured than the Matapeake, particularly in the upper horizons. A fairly good example of a mature Gray-Brown Podzolic soil is shown in the following profile of Matapeake fine sandy loam. This profile was observed in a wooded area of gently undulating relief about one-half mile west of Great Bridge.

- A_1 0 to 2 inches, dark-brown (7.5YR 3/2),[2] friable fine sandy loam mixed with partly decayed organic matter and matted with small roots; weak fine granular structure.
- A_2 2 to 9 inches, yellowish-brown (10YR 5/4), friable fine sandy loam; very weak fine subangular blocky structure but easily crushed to a fine granular mass; a few small angular particles of white quartz.
- B_1 9 to 12 inches, strong-brown (7.5YR 5/6), firm silty clay loam with a few, medium, faint mottles of light yellowish brown; moderate to weak and fine to medium blocky structure; small roots are common.
- B_{21} 12 to 20 inches, brown (7.5YR 4/4), slightly plastic and slightly sticky silty clay loam; moderate medium blocky structure; many small roots and a few small particles of white and yellowish-brown quartz.
- B_{22} 20 to 30 inches, strong-brown (7.5YR 5/6), slightly sticky silty clay loam with a few, medium, faint mottles of yellowish brown; weak medium to fine blocky structure.
- B_3 30 to 47 inches, yellowish-brown (10YR 5/6), firm fine sandy clay loam with a few, fine, faint mottles of strong brown; weak fine blocky structure.
- C 47 to 54 inches, brownish-yellow (10YR 6/6), very friable loamy fine sand with common, medium, faint mottles of yellowish brown; many hard iron concretions from ½ to 1 inch in diameter are intermixed; concretions can be crushed with moderate pressure.

KEYPORT AND WOODSTOWN SERIES.—The moderately well drained Keyport and Woodstown soils are less typical of soils of the Gray-Brown Podzolic great soil group than the Matapeake and Sassafras soils. They are somewhat mottled in the lower part of the B horizon, and most of them occur on slightly smoother relief than the Sassafras and Matapeake soils. In addition, the Keyport soils are finer textured throughout. The following is a description of a profile of Keyport very fine sandy loam observed in a wooded area of nearly level relief about 1 mile east of the town of Northwest.

- A_1 0 to 2 inches, dark grayish-brown (10YR 4/2), friable very fine sandy loam covered with a thin layer of leaf mold and organic litter mixed with small roots; weak fine granular structure.
- A_2 2 to 10 inches, brown (10YR 5/3), friable very fine sandy loam; layer faintly mottled with dark grayish brown, particularly around the root channels, because of leaching from the A_1 horizon; weak fine granular structure.
- B_1 10 to 13 inches, light yellowish-brown (10YR 6/4), firm silty clay loam with a few, fine, faint mottles of yellowish brown; moderate to weak fine blocky structure; slightly compacted.
- B_{21} 13 to 21 inches, yellowish-brown (10YR 5/4), slightly plastic and slightly sticky silty clay with moderate medium to fine blocky structure.
- B_{22} 21 to 31 inches, light yellowish-brown (10YR 6/4), slightly plastic and slightly sticky silty clay with many, coarse, prominent mottles of gray and brown; a few pockets or lenses of fine sandy loam; moderate medium subangular blocky structure.
- C 31 to 46 inches, brownish-yellow (10YR 6/6), nearly loose fine sandy loam with common, coarse, distinct mottles of gray and brown; small yellow flakes of mica can be seen when soil is rubbed between the fingers.

Intrazonal soils

Intrazonal soils have more or less well-developed characteristics that have been influenced more by some local factor of relief, parent material, or age than by the normal effects of climate and vegetation.

About 89 percent of the acreage of the soils of the county is composed of intrazonal soils. They occupy level to gently undulating relief. In Norfolk County the intrazonal order is represented by the Low-Humic Gley and the Humic Gley great soil groups.

LOW-HUMIC GLEY SOILS

The Low-Humic Gley soils are imperfectly drained to poorly drained. They have a very thin surface horizon that is moderately high in organic matter. This overlies gleyed mineral horizons that are mottled with gray and brown.

The soils of the Othello, Fallsington, Elkton, Pasquotank, Dragston, Bladen, Bertie, and Lenoir series are the Low-Humic Gley soils of Norfolk County. These soils have developed from acid marine deposits under forests of loblolly pine, pond pine, and hardwoods such as maple, poplar, beech, oak, and gum. The surface soils range in texture from silt loam to loamy fine sand. In general, the subsoil is mottled yellow, brown, and gray.

The Dragston, Bertie, and Lenoir soils are similar to the Gray-Brown Podzolic soils in some characteristics. The Bladen soil is somewhat like the Humic Gley soils.

OTHELLO, FALLSINGTON, ELKTON, AND PASQUOTANK SERIES.—The soils of these series are typical of the Low-Humic Gley soils of Norfolk County. The following is a profile of Othello very fine sandy loam, which is representative of this group of soils.

- A_1 0 to 2 inches, grayish-brown (2.5Y 5/2), friable very fine sandy loam covered with a thin layer of leaf mold and forest debris; weak very fine granular structure.
- A_2 2 to 10 inches, light brownish-gray (2.5Y 6/2), friable very fine sandy loam; weak fine granular structure; many small roots and rootholes.
- B_{1g} 10 to 15 inches, light olive-gray (5Y 6/2), plastic and sticky very fine sandy clay loam with a few, medium, distinct mottles of yellowish brown; moderate medium subangular blocky structure.
- B_{2g} 15 to 30 inches, gray (5Y 5/1), very plastic and very sticky, heavy silty clay loam with a few, medium, distinct mottles of yellowish brown; moderate coarse blocky structure; nearly massive when wet; a few pockets and lenses of very fine sandy loam.
- B_{3g} 30 to 35 inches, gray (5Y 5/1), slightly plastic and very sticky fine sandy clay loam with a few, medium, distinct mottles of yellowish brown; moderate medium to coarse blocky structure.
- C 35 to 45 inches, olive-gray (5Y 6/2), loose loamy very fine sand with many, coarse, distinct yellowish-brown mottles caused by iron oxide.

DRAGSTON SERIES.—The soils of this series are extensive in Norfolk County. They occupy nearly level to undulating relief and are somewhat poorly drained. The Dragston soils are representative of the Low-Humic Gley soils but have some characteristics of the Gray-Brown

[1] UNITED STATES DEPARTMENT OF AGRICULTURE. SOILS AND MEN. U. S. Dept. Agr. Yearbook 1938. 1,232 pp., illus. 1938.

[2] Symbols express Munsell color notations. *See* U. S. DEPT. AGR. SOIL SURVEY MANUAL. U. S. Dept. Agr. Handb. 18, 502 pp., illus. 1951.

Podzolic soils. The following is a description of a profile of Dragston fine sandy loam under a hardwood forest.

A_0 ½ to 0 inch, very dark gray (5Y 3/1) forest litter and partly decayed organic material.

A_1 0 to 4 inches, dark reddish-brown (5YR 3/2), very friable fine sandy loam containing a considerable amount of organic material; very weak fine to medium granular structure.

A_2 4 to 8 inches, dark-brown (10YR 4/3), friable fine sandy loam with a few, medium, faint mottles of dark yellowish-brown and strong brown; moderate medium subangular blocky structure; many small roots.

B_1 8 to 14 inches, light yellowish-brown (10YR 6/4), firm, light fine sandy clay loam with many, coarse, distinct mottles of dark yellowish brown and strong brown; moderate medium to fine blocky structure; small roots and root channels are common.

B_{21} 14 to 28 inches, pale-yellow (5Y 7/3), slightly plastic and slightly sticky, heavy fine sandy loam with many, coarse, prominent mottles of yellowish brown and light brownish gray; moderate medium to coarse blocky structure; slightly compacted.

B_{22} 28 to 34 inches, gray (10YR 5/1), firm, light fine sandy clay loam with a few, medium, distinct mottles of yellowish brown; moderate to weak coarse blocky structure.

C 34 to 64 inches, light brownish-gray (2.5Y 6/2), nearly loose fine sand with a few, coarse, distinct mottles of yellowish brown.

Bladen Series.—Bladen silt loam is the only soil of the Bladen series in Norfolk County. The following is a description of a profile observed near the Norfolk Southern Railway about 2 miles northeast of Hickory:

A_p 0 to 6 inches, dark-gray (10YR 4/1), friable silt loam containing some roots and stems; weak to moderate fine granular structure.

B_{21} 6 to 34 inches, light-gray (10YR 7/1), very plastic and sticky clay with many, medium, prominent mottles of yellowish brown; moderate coarse blocky structure; checked with partly decayed roots and root channels.

B_{22} 34 to 42 inches, brownish-yellow (10YR 6/6), plastic and very sticky silty clay loam with an intricate pattern of many, medium, prominent mottles of light gray and strong brown; moderate coarse blocky structure but massive when wet; a few small pockets of very plastic clay.

B_{3g} 42 to 56 inches, gray (5Y 5/1), slightly plastic and sticky very fine sandy loam mixed with very fine sandy clay loam; many, coarse, prominent mottles of yellowish brown; moderate to weak medium blocky structure.

C_g 56 to 68 inches, olive-gray (5Y 5/2), slightly plastic very fine sandy clay loam with common, coarse, distinct mottles of strong brown; weak moderate fine subangular blocky structure; small flakes of mica visible when the soil is rubbed between the fingers.

HUMIC GLEY SOILS

The Humic Gley great soil group is comprised of poorly drained or very poorly drained hydromorphic soils. These soils have moderately thick, dark-colored organic-mineral horizons, underlain by mineral gley horizons.

In Norfolk County the Humic Gley soils are the Bayboro, Portsmouth, Pocomoke, and Weeksville. These soils have developed from acid marine sediments. Their formation has been influenced by slow surface runoff and a high water table. The vegetation is loblolly pine and pond pine mixed with water-tolerant hardwoods such as water oak, sweetgum, red maple, cypress, beech, and poplar.

In general, a dark-gray to black, moderately thick surface layer overlies a subsoil that is mottled gray. The Weeksville soil contains the least amount of organic matter of any of these soils.

Bayboro Series.—Bayboro mucky loam is a typical Humic Gley soil. A description of this soil, examined about 2 miles east of Wallaceton, follows:

A_p 0 to 10 inches, black (5YR 2/1), very friable mucky loam; very porous and open; strong coarse subangular blocky structure as a result of compaction.

A_3 10 to 14 inches, dark reddish-brown (5YR 2/2), very friable mucky silt loam with few, fine, faint, black mottles caused by leaching; weak fine granular structure.

B_1 14 to 17 inches, dark grayish-brown (10YR 4/2), very plastic and sticky silty clay with a few, medium, faint mottles of gray and yellowish brown; strong coarse blocky to massive structure; roots and root channels are common.

B_2 17 to 52 inches, dark grayish-brown (10YR 4/2), very plastic and sticky silty clay with a few, medium, faint mottles of yellowish brown and gray; moderate coarse blocky to massive structure; roots and root channels common.

B_{3g} 52 to 64 inches, gray (5Y 5/1), plastic and sticky, light silty clay loam with a few, fine, distinct mottles of yellowish brown; a few lenses of very fine sandy clay loam; moderate to weak coarse blocky structure.

C 64 to 74 inches, gray (5Y 5/1), slightly plastic and slightly sticky very fine sandy clay loam with weak medium blocky structure.

Azonal soils

Soils of the azonal order do not have well-developed profiles because of their youth, resistant parent material, or steep topography. Only about 1 percent of the acreage of the soils in Norfolk County is made up of azonal soils. They occur mainly on undulating to rolling relief. The azonal order is represented by one great soil group, the Regosols, in Norfolk County.

REGOSOLS

The Regosols are an azonal group of soils consisting of deep unconsolidated rock or soft mineral deposits in which few or no clearly expressed soil characteristics have developed. They are largely confined to recent sand dunes.[3] In Norfolk County the Regosols are represented by the soils of the Galestown and Klej series.

Galestown and Klej Series.—The soils of these series were derived from loose, coarse-textured sands. The Galestown soil occurs on undulating to rolling relief; the more strongly sloping parts border rivers and creeks. This soil is well drained to somewhat excessively drained. The following is a description of a profile of Galestown loamy fine sand observed about 1 mile northwest of Deep Creek:

A_p 0 to 8 inches, very dark grayish-brown (10YR 3/2), nearly loose loamy fine sand containing many small roots and some decayed organic material.

8 to 52 inches, brownish-yellow (10YR 6/6), loose, open loamy fine sand.

52 to 62 inches, pale-yellow (2.5Y 7/4), loose fine sand with a few, medium, faint mottles of yellowish brown; structureless.

Laboratory Determinations

Chemical data for representative soils of Norfolk County are listed in table 5.

[3] Thorp, J., and Smith, Guy D. Higher categories of soil classification. Soil Sci. 67: 117–126. 1949.

TABLE 5.—*Chemical characteristics of representative soils* [1]

Soil type and horizon	Depth	pH	Available phosphorus	Organic matter	Exchangeable manganese	Exchangeable cations in M. e. per 100 gm. soil						Base saturation
						Ca	Mg	K	Na	H	Total	
	Inches		*P. p. m.*[2]	*Percent*	*P. p. m.*[2]							*Percent*
Bayboro mucky loam:												
A_p	0–10	4. 59	54. 0	38. 30	3. 98	5. 57	4. 28	0. 82	0. 03	55. 92	66. 62	16. 06
A_2	10–14	4. 04	7. 7	20. 42	1. 18	2. 05	. 80	. 41	. 03	58. 90	62. 19	5. 29
B_1	14–17	4. 22	4. 4	5. 59	(3)	1. 49	. 46	. 27	. 05	31. 86	34. 13	6. 65
B_2	17–52	4. 29	1. 1	1. 60	1. 43	1. 91	. 78	. 18	. 03	20. 54	23. 44	12. 37
B_3	52–64	4. 20	1. 1	. 48	5. 50	4. 29	5. 30	. 28	. 06	7. 46	17. 39	57. 10
C_1	64–74	4. 61	1. 8	. 54	4. 08	4. 33	4. 66	. 27	. 05	5. 94	15. 25	61. 04
Bertie fine sandy loam, olive-gray subsoil variant:												
A_p	0–8	5. 59	198. 9	1. 53	3. 63	2. 69	. 23	. 52	. 02	5. 71	9. 17	37. 73
A_3	8–14	5. 29	58. 4	1. 00	. 88	1. 03	. 07	. 27	. 02	5. 64	7. 03	19. 77
B_1	14–17	4. 83	10. 3	. 46	. 93	1. 24	. 29	. 21	. 02	5. 60	7. 36	23. 91
B_2	17–27	4. 53	17. 5	. 15	. 58	1. 49	. 37	. 36	. 01	7. 89	10. 12	22. 04
B_3	27–40	4. 52	26. 9	. 19	1. 00	1. 11	. 24	. 31	. 01	6. 68	8. 35	20. 00
C_1	40–50	4. 68	10. 3	. 06	. 58	. 39	. 09	. 05	. 01	1. 88	2. 42	22. 31
Bertie very fine sandy loam:												
A_p	0–8	4. 82	2. 4	. 88	. 93	. 44	. 28	. 06	. 02	3. 47	4. 27	18. 74
B_2	8–30	4. 89	6. 1	. 40	. 50	. 81	3. 16	. 09	. 39	7. 16	11. 61	38. 33
B_3	30–35	6. 97	5. 3	. 11	. 50	1. 01	6. 40	. 20	. 79	2. 44	10. 84	77. 49
C_1	35–45	7. 33	37. 0	. 07	1. 23	1. 13	4. 64	. 07	. 59	1. 11	7. 54	85. 28
Bladen silt loam:												
A_p	0–6	4. 95	26. 9	6. 09	8. 06	3. 97	1. 81	. 17	. 04	21. 02	27. 01	22. 18
B_{21}	6–34	4. 89	. 2	1. 27	2. 45	2. 93	2. 65	. 11	. 05	11. 34	17. 08	33. 61
B_{22}	34–42	6. 39	3. 5	. 32	1. 38	4. 72	9. 96	. 23	. 09	3. 98	18. 98	79. 03
B_3	42–56	6. 37	63. 9	. 23	1. 58	4. 24	8. 12	. 22	. 08	3. 10	15. 76	80. 33
C_1	56–68	6. 54	61. 7	. 26	1. 85	4. 08	6. 88	. 27	. 07	2. 23	13. 53	83. 52
Dragston fine sandy loam:												
A_1	0–4	4. 29	9. 2	9. 23	(3)	. 70	. 55	. 42	. 05	23. 41	25. 13	6. 84
A_2	4–8	4. 72	5. 7	5. 04	(3)	. 10	. 14	. 38	. 05	15. 76	16. 43	4. 08
B_1	8–14	4. 85	4. 4	1. 20	1. 13	. 09	. 08	. 23	. 02	7. 31	7. 73	5. 43
B_{21}	14–28	4. 91	2. 2	. 08	0	. 24	. 20	. 16	. 01	3. 02	3. 63	16. 80
B_{22}	28–34	4. 86	2. 6	. 16	0	. 34	. 68	. 16	. 03	7. 64	8. 85	13. 67
C	34–64	4. 97	1. 3	. 17	0	. 34	1. 03	. 19	. 04	4. 85	6. 45	24. 81
Dragston loamy fine sand:												
A_p	0–11	5. 62	79. 6	1. 19	1. 53	2. 08	. 13	. 16	. 02	3. 11	5. 50	43. 45
B_{21}	11–22	5. 52	1. 8	. 28	. 25	3. 10	. 31	. 13	. 02	2. 60	6. 16	57. 79
B_{22}	22–40	4. 95	3. 3	. 16	. 20	2. 45	. 14	. 09	. 03	3. 42	6. 13	44. 21
C	40–50	4. 73	. 9	. 12	0	1. 40	. 09	. 10	. 03	3. 60	5. 22	31. 03
Elkton silt loam:												
A_1	0–4	4. 92	10. 7	7. 26	12. 00	5. 60	1. 69	. 24	. 04	13. 95	21. 52	35. 18
A_2	4–11	4. 88	17. 9	2. 96	. 93	2. 28	. 80	. 16	. 04	11. 08	14. 36	22. 84
B_2	11–39	5. 50	3. 9	. 63	1. 33	8. 10	6. 60	. 23	. 11	5. 80	20. 84	72. 17
B_3	39–49	7. 82	6. 8	. 18	. 98	12. 80	2. 89	. 20	. 10	. 76	16. 75	95. 46
C_1	49–60	7. 54	27. 6	. 21	1. 05	5. 74	2. 16	. 18	. 07	1. 23	9. 38	86. 89
Fallsington fine sandy loam:												
A_1	0–4	4. 36	9. 2	4. 88	. 90	1. 15	. 31	. 39	. 02	15. 47	17. 34	10. 78
A_2	4–11	4. 62	4. 8	1. 10	. 10	. 07	. 05	. 28	. 02	7. 06	7. 48	5. 61
B_1	11–22	4. 53	. 9	. 28	. 25	. 02	. 09	. 25	. 02	6. 27	6. 65	5. 71
B_2	22–30	4. 47	7. 4	. 25	0	. 02	. 33	. 24	. 03	9. 15	9. 77	6. 35
C_1	30–50	4. 60	1. 3	. 18	. 55	. 07	. 32	. 29	. 02	4. 23	4. 93	14. 20
Galestown loamy fine sand:												
A_p	0–8	6. 28	165. 8	1. 80	3. 68	4. 70	. 33	. 10	. 01	4. 40	9. 54	53. 88
B_2	8–52	6. 97	59. 5	. 28	. 30	1. 50	. 15	. 06	. 01	1. 42	3. 14	54. 78
C_1	52–62	6. 82	22. 8	. 08	. 20	. 68	. 06	. 05	. 01	. 66	1. 46	54. 79
Keyport very fine sandy loam:												
A_1	0–2	4. 48	9. 0	5. 26	(3)	. 40	. 22	. 19	. 02	16. 58	17. 41	4. 77
A_2	2–10	4. 86	2. 6	2. 15	(3)	. 14	. 09	. 08	. 06	9. 58	9. 95	3. 72
B_1	10–13	4. 94	. 4	. 54	3. 25	. 23	. 57	. 08	. 02	6. 58	7. 48	12. 03
B_{21}	13–21	4. 92	2. 6	. 46	(3)	. 58	3. 14	. 13	. 04	9. 54	13. 43	28. 97
B_{22}	21–31	4. 85	. 7	. 30	. 50	1. 28	2. 77	. 19	. 05	11. 90	16. 19	26. 50
B_3	31–36	4. 81	5. 3	. 22	. 55	. 58	1. 71	. 15	. 02	8. 61	11. 07	22. 22
C_1	36–46	4. 91	1. 1	. 14	. 80	. 38	1. 72	. 13	. 04	6. 88	9. 15	24. 81
Klej loamy fine sand:												
A_p	0–9	6. 84	197. 3	1. 66	1. 48	2. 68	. 53	. 63	. 02	3. 04	6. 90	55. 94
B_2	9–30	6. 02	5. 3	. 14	0	. 26	. 05	. 27	. 01	1. 28	1. 87	31. 55
C_1	30–50	5. 97	2. 6	. 11	. 25	. 22	. 04	. 09	. 01	. 15	. 51	70. 59

See footnotes at end of table.

TABLE 5.—*Chemical characteristics of representative soils* [1]—Continued

Soil type and horizon	Depth	pH	Available phosphorus	Organic matter	Exchange-able man-ganese	Exchangeable cations in M. e. per 100 gm. soil						Base satura-tion
						Ca	Mg	K	Na	H	Total	
	Inches		*P. p. m.*[2]	*Percent*	*P. p. m.*[2]							*Percent*
Lenoir very fine sandy loam:												
A_1	0–2	4. 94	16. 2	9. 63	34. 41	2. 26	1. 00	0. 45	0. 04	25. 60	29. 35	12. 78
A_2	2–11	4. 96	8. 5	2. 72	1. 38	. 46	. 32	. 31	. 03	16. 19	17. 31	6. 47
B_1	11–15	4. 87	6. 1	. 57	3. 63	. 40	. 47	. 20	. 02	8. 64	9. 73	11. 20
B_2	15–36	4. 74	2. 2	. 61	23. 06	. 90	1. 46	. 30	. 03	11. 83	14. 52	18. 53
B_3	36–45	4. 82	7. 0	. 82	15. 66	1. 24	1. 71	. 31	. 04	11. 89	15. 19	21. 72
C_1	45–54	4. 85	2. 0	. 31	6. 38	1. 06	1. 71	. 22	. 04	8. 52	11. 55	26. 23
Matapeake fine sandy loam:												
A_1	0–2	4. 48	10. 5	4. 66	14. 91	1. 30	. 37	. 40	. 03	13. 30	15. 40	13. 64
A_2	2–9	4. 71	1. 8	1. 24	4. 83	. 16	. 10	. 29	. 01	7. 72	8. 28	6. 76
B_1	9–12	4. 79	3. 9	. 74	3. 45	. 19	. 33	. 23	. 02	8. 02	8. 79	8. 76
B_{21}	12–20	5. 03	2. 6	. 43	. 40	. 38	2. 40	. 32	. 04	12. 54	15. 68	20. 03
B_{22}	20–30	5. 18	10. 1	. 32	. 85	. 30	2. 39	. 23	. 03	11. 73	14. 68	20. 10
B_3	30–47	5. 33	5. 7	. 19	1. 43	. 24	2. 08	. 32	. 05	8. 62	11. 31	23. 78
C_1	47–54	5. 36	11. 9	. 11	. 88	. 07	. 61	. 28	. 03	5. 27	6. 26	15. 81
Mattapex very fine sandy loam:												
A_p	0–8	5. 03	81. 6	3. 13	10. 41	2. 14	. 26	. 59	. 02	14. 48	17. 49	17. 21
B_1	8–18	4. 83	5. 7	. 70	1. 58	. 67	. 08	. 23	. 02	7. 22	8. 22	12. 17
B_{21}	18–32	4. 93	9. 2	. 28	1. 33	3. 19	. 35	. 20	. 02	8. 18	11. 94	31. 49
B_{22}	32–56	5. 13	8. 6	. 25	5. 58	2. 97	. 96	. 21	. 02	7. 45	11. 61	35. 83
C_1	56–66	5. 09	3. 7	. 26	1. 85	1. 67	. 78	. 17	. 02	5. 06	7. 70	34. 29
Othello very fine sandy loam:												
A_1	0–2	4. 19	5. 9	3. 75	[3]	. 71	. 37	. 12	. 03	12. 17	13. 40	9. 18
A_2	2–10	4. 59	3. 5	1. 18	. 58	. 59	. 28	. 06	. 02	7. 11	8. 06	11. 79
B_1	10–15	4. 72	2. 8	. 32	. 25	. 91	. 31	. 06	. 04	6. 51	7. 83	16. 86
B_2	15–30	4. 90	2. 8	. 29	. 25	5. 93	2. 05	. 16	. 36	7. 29	15. 79	53. 83
B_3	30–35	6. 83	2. 8	. 20	. 55	6. 95	2. 16	. 14	. 36	1. 56	11. 17	86. 03
C_1	35–45	7. 23	4. 4	. 06	. 50	2. 95	. 76	. 09	. 16	. 58	4. 54	87. 22
Othello loam, dark surface phase:												
A_p	0–6	5. 83	29. 2	8. 09	1. 83	5. 91	2. 56	. 31	. 01	14. 07	22. 86	38. 45
B_1	6–10	4. 82	2. 7	. 66	. 70	1. 23	. 57	. 07	. 01	5. 97	7. 85	23. 95
B_2	10–30	4. 83	2. 6	. 32	. 50	6. 19	2. 33	. 15	. 02	6. 13	14. 82	58. 64
B_3	30–35	5. 10	1. 8	. 22	. 20	4. 83	2. 10	. 16	. 02	2. 86	9. 97	71. 31
C_1	35–45	5. 47	3. 3	. 15	. 40	1. 47	. 40	. 07	. 01	. 91	2. 86	68. 18
Pasquotank very fine sandy loam:												
A_p	0–8	4. 97	25. 6	3. 90	5. 13	1. 63	. 51	. 21	. 02	11. 48	13. 85	17. 11
B_{21}	8–30	5. 08	2. 8	. 57	1. 03	1. 91	. 33	. 07	. 03	5. 20	7. 54	31. 03
B_{22}	30–52	5. 17	1. 5	. 30	. 40	1. 83	2. 47	. 13	. 04	4. 38	8. 85	50. 51
C_1	52–62	5. 53	19. 5	. 19	1. 78	2. 05	2. 83	. 14	. 03	2. 84	7. 89	64. 01
Portsmouth loam:												
A_p	0–12	5. 12	17. 7	8. 00	. 50	1. 97	1. 84	. 13	. 01	18. 50	22. 45	17. 59
B_1	12–15	4. 67	2. 8	. 60	. 30	. 19	. 15	. 11	. 01	4. 98	5. 44	8. 46
B_2	15–23	4. 51	2. 4	. 63	0	. 23	. 17	. 11	. 01	6. 24	6. 76	7. 69
B_3	23–27	4. 71	2. 6	. 57	. 20	. 35	. 16	. 10	. 01	5. 30	5. 92	10. 47
C_1	27–45	4. 98	2. 4	. 47	. 20	. 11	. 03	. 05	. 01	3. 82	4. 02	4. 98
Portsmouth mucky loam:												
A_1	0–8	4. 28	2. 6	22. 43	. 50	1. 57	. 32	. 13	. 03	58. 74	60. 79	3. 37
A_2	8–13	4. 38	3. 3	7. 73	0	. 49	. 12	. 10	. 02	34. 43	35. 16	2. 08
B_{21}	13–22	4. 58	2. 8	1. 47	1. 13	1. 97	. 60	. 13	. 01	9. 12	11. 83	22. 91
B_{22}	22–30	5. 01	1. 5	1. 39	. 93	1. 71	. 62	. 09	. 01	3. 61	6. 04	40. 23
C	30–40	5. 17	2. 0	. 50	. 10	. 88	. 10	. 01	. 02	1. 40	2. 41	41. 91
Sassafras fine sandy loam:												
A_1	0–4	4. 60	8. 1	3. 80	21. 47	2. 10	. 32	. 16	. 04	12. 08	14. 70	17. 82
A_2	4–10	4. 83	6. 3	1. 56	4. 08	. 82	. 13	. 17	. 02	8. 19	9. 33	12. 22
B_1	10–14	4. 78	3. 7	. 72	4. 53	. 97	. 32	. 16	. 03	8. 37	9. 85	15. 03
B_2	14–26	5. 17	9. 0	. 46	1. 63	2. 44	. 75	. 13	. 04	7. 32	10. 68	31. 46
B_3	26–38	5. 52	12. 0	. 22	. 88	2. 34	. 55	. 06	. 04	4. 49	7. 48	39. 97
C	38–50	5. 62	11. 8	. 16	. 73	1. 38	. 40	. 10	. 03	3. 02	4. 93	38. 74
Sassafras loamy fine sand:												
A_1	0–2	4. 15	5. 0	3. 46	1. 58	. 58	. 13	. 25	. 02	8. 34	9. 32	10. 52
A_2	2–17	4. 91	2. 8	. 77	. 58	. 12	. 05	. 28	. 01	3. 35	3. 81	12. 07
B_1	17–20	4. 89	2. 8	. 28	. 58	. 52	. 09	. 37	. 02	4. 10	5. 10	19. 61
B_2	20–28	4. 88	2. 4	. 16	. 50	. 30	1. 19	. 26	. 04	9. 12	10. 91	16. 41
B_3	28–34	4. 83	2. 8	. 16	. 10	. 28	1. 01	. 28	. 04	8. 09	9. 70	16. 60
C_1	34–50	4. 93	2. 0	. 10	. 50	. 30	. 79	. 34	. 03	4. 53	5. 99	24. 37

See footnotes at end of table.

TABLE 5.—*Chemical characteristics of representative soils* [1]—Continued

Soil type and horizon	Depth	pH	Available phosphorus	Organic matter	Exchangeable manganese	Exchangeable cations in M. e. per 100 gm. soil						Base saturation
						Ca	Mg	K	Na	H	Total	
Weeksville silt loam:	*Inches*		*P. p. m.*[2]	*Percent*	*P. p. m.*[2]							*Percent*
A_{p2}	0–15	5. 89	11. 4	4. 14	1. 70	4. 16	1. 21	0. 11	0. 04	10. 77	16. 29	33. 89
B_{21}	15–26	4. 94	1. 3	. 95	. 25	1. 56	. 43	. 05	. 05	8. 23	10. 32	20. 25
B_{22}	26–42	5. 03	. 7	. 37	. 10	2. 18	2. 81	. 11	. 09	5. 63	10. 82	47. 97
B_3	42–54	6. 17	14. 9	. 26	0	2. 54	3. 15	. 17	. 19	2. 46	8. 51	71. 09
C	54–64	6. 33	36. 3	. 17	. 88	2. 18	2. 45	. 13	. 08	7. 12	11. 96	40. 47
Woodstown fine sandy loam:												
A_p	0–6	4. 60	9. 5	7. 74	1. 08	. 12	. 16	. 39	. 02	19. 67	20. 36	3. 39
A_2	6–11	5. 02	7. 0	2. 35	(3)	. 08	. 04	. 34	. 02	9. 78	10. 26	4. 68
A_3	11–14	4. 98	4. 5	. 44	. 10	. 08	. 11	. 23	. 02	4. 65	5. 09	8. 64
B_1	14–22	4. 97	3. 7	. 22	. 30	. 08	. 15	. 14	. 02	4. 59	4. 98	7. 83
B_2	22–36	4. 89	4. 2	. 24	. 30	. 08	. 17	. 22	. 02	5. 62	6. 11	8. 02
C_1	36–60	5. 16	15. 5	. 15	. 10	. 04	. 08	. 34	. 01	9. 52	9. 99	4. 70
Woodstown loamy fine sand:												
A_p	0–9	6. 10	114. 4	1. 70	2. 05	3. 38	. 08	. 06	. 02	3. 55	7. 09	49. 93
AB	9–16	6. 20	34. 6	. 50	. 65	1. 62	. 07	. 08	. 01	1. 81	3. 59	49. 58
AB	16–26	5. 51	2. 6	. 26	. 93	1. 36	. 08	. 07	. 02	2. 09	3. 62	42. 27
B_2	26–40	5. 59	4. 6	. 20	. 58	2. 70	. 07	. 08	. 02	2. 79	5. 66	50. 71
B_3	40–45	5. 16	3. 7	. 17	. 50	3. 38	. 12	. 10	. 02	3. 49	7. 11	50. 91
C_1	45–55	4. 83	10. 5	. 12	. 58	1. 52	. 07	. 09	. 02	3. 75	5. 45	31. 19

[1] Analyses made from 1952–54 by Helen Rose and H. E. Dailey at the Soil Laboratory of Virginia Polytechnic Institute.

[2] Parts per million.

[3] Amount not determined.

Forests [4]

Forests throughout Norfolk County have diminished considerably or have been greatly altered since the county was first settled. This has been caused by the clearing of land for farming and by drainage projects, logging operations, and forest fires. Practically all of the better drained soils have been cleared for agriculture. Forests still occupy a large part of the county. Of the total land in farms, about 23 percent is in woodland; this compares with the State average of 45 percent.

The forests of Norfolk County can be grouped according to the three major sites in which they are located: (1) The Dismal Swamp, (2) river swamps and other poorly drained areas, and (3) better drained areas. Although these groups classify the type of forest, in many areas on one site the forest may be, in some respects, similar to the forest on the other sites.

Dismal Swamp.—The peat soils of the Dismal Swamp support many kinds of forest species varying from loblolly pine to cypress and tupelo-gum. During the early settlement of Norfolk County, dense stands of southern whitecedar, cypress, and various kinds of gum trees covered this area. These species occurred in pure and in mixed stands. The forests of the Dismal Swamp were commonly considered as consisting of three general types—the juniper-glade forest, the gum-swamp forest, and the mixed forest. Southern whitecedar, cypress, and tupelo-gum generally occupied the wetter sites; sweetgum, blackgum, yellow poplar, loblolly pine, and pond pine made up the mixed forest; and swamp oaks occupied areas where water did not stand for long periods.

Extensive cutting, destructive fires, and the building of artificial drainage systems have caused large areas that were once covered by dense forests to be occupied by shrubs and herbaceous growth. Only a limited acreage has reseeded to cypress and southern whitecedar, possibly because of the exacting requirements of these species to reproduce through natural seeding.

Although the peat soils normally have a high water table, the upper soil layers are likely to dry out during droughts. As a result many areas have been burned to a considerable depth. The burning left depressions that are often filled with water. When areas of peat soils are drained, the risk of fire is increased. The fires are difficult to control. When draining these soils, it is usually best to establish a system of dams along the drainageways so that the water table can be kept high.

River swamps and other poorly drained areas.—Red maple, tupelo-gum, and cypress occupy the more poorly drained sites. These species grow where water stands on the surface throughout much of the year. In places that are not so wet, such as on Othello, Elkton, and Lenoir soils, a hardwood forest with varying mixtures of loblolly and pond pine predominates. Sweetgum, swamp blackgum, water oak, willow oak, red oak, swamp white oak, yellow poplar, green ash, beech, and hickory grow on most of these sites. After cutting and fires, some kinds of maple and gum, which sprout vigorously, have increased greatly.

Better drained areas.—Pines, principally loblolly pines, grow on a large part of the better drained areas. Many abandoned fields become stocked with pure stands of pine. As the stands grow older, and particularly after they are cut, hardwoods, which bear light seeds, invade the forest if it is protected from fire. Maples and sweetgums are the first to invade. Oaks, beeches, and hickories, which have heavier seeds, become established later.

[4] Prepared by C. Edward Gill, Associate Extension Forester, Virginia Polytechnic Institute Extension Service.

Loblolly pines, sweetgums, oaks, beeches, and hickories are now predominant on these sites.

Dense stands of shrubs, some of which approach the size of trees, are in many of the woodlands throughout the county. The typical plants vary from those for which wet sites are most suitable to those that generally grow on somewhat dry areas. The plants are bay, fetter bush, gallberry, smilax or greenbrier, waxmyrtle, blackberry, switch cane or reed, sweetbay, prickly ash, sourwood, and dogwood.

Pond pine, the most moisture tolerant of the common yellow pines, is prevalent throughout the county. The ability of this tree to withstand fire and to reproduce after a fire is apparently the main reason that it grows on sites that vary widely in characteristics. Where loblolly pine will grow, however, it is usually preferred because of its better growth characteristics.

The best stand of trees observed consisted of loblolly pines growing on the Galestown soil. No great difference in the rate or quality of growth was observed on the different soils, however, provided the content of moisture was similar. Apparently the kind of seed available and what happens to the seedlings after they start to grow have a greater influence on the species that occur on a site.

Forest Use

The favorable soil and climate, the presence of desirable native trees, and the many markets for timber make Norfolk County highly suitable for growing timber. The market is good for both standing timber and rough forest products such as saw logs, veneer logs, poles, piling, and pulpwood.

Loblolly pine is best suited to timber production because it grows rapidly and because of the many uses that can be made of the wood. There is a wide, steady market for loblolly pine. All of the better drained soils, especially the Galestown, Sassafras, and Woodstown, will support a good stand of loblolly pine (fig. 8).

Figure 8.—**A young stand of well-managed pines and mixed hardwoods near the town of Butts.**

Forest Management

Most of the woodlands of Norfolk County are seriously depleted. The rate of stocking of desirable trees is low and irregular. In a few places extensive fires have followed the cutting of trees, and underbrush and weeds have replaced almost all of the better formed trees. Such areas are known locally as "lights." In other places loblolly pine, when given an opportunity, has reproduced unusually well through natural seeding.

The woodlands could be greatly improved by using better methods of cutting and planting, by controlling the growing of inferior hardwoods, and by preventing fires. The greatest menace to stands of timber, except for fire, is the invasion of a dense stand of inferior hardwoods. In many places it is necessary to use artificial means such as poisoning, girdling, disking, or bulldozing to control this growth. On some of the poorly drained peat soils, woodland owners must regulate the height of the water table to grow superior species such as loblolly pine.

Engineering Applications[5]

This soil survey report for Norfolk County, Va., contains information that can be used by engineers to—

(1) Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
(2) Assist in designing drainage and irrigation structures and planning dams and other structures for water and soil conservation.
(3) Make reconnaissance surveys of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed soil surveys for the intended locations.
(4) Locate sand and gravel for use in structures.
(5) Correlate pavement performance with types of soil and thus develop information that will be useful in designing and maintaining the pavements.
(6) Determine the suitability of soil units for cross-county movements of vehicles and construction equipment.
(7) Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making soil maps and reports that can be readily used by engineers.

The mapping and the descriptive report are somewhat generalized, however, and should be used only in planning more detailed field surveys to determine the in-place condition of the soil at the site of the proposed engineering construction.

Soil Science Terminology

Some of the terms used by the agricultural soil scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, sand, aggregate, and granular—may have special meanings in soil science. These

[5] This section was prepared by the Division of Physical Research, Bureau of Public Roads, with the assistance of personnel from the Soil Conservation Service and Virginia Department of Highways. Test data in table 6 were obtained in the Soils Laboratory, Bureau of Public Roads.

and other special terms that are used in the soil survey report are defined in the glossary in the back part of the report.

Soil Test Data and Engineering Soil Classifications

To be able to make the best use of the soil maps and the soil survey reports, the engineer should know the physical properties of the soil materials and the in-place condition of the soil. After testing soil materials and observing the behavior of soils when used in engineering structures and foundations, the engineer can develop design recommendations for the soil units delineated on the maps.

Soil test data

Soil samples from the principal soil type of each of 11 extensive soil series were tested in accordance with standard procedure [6] to help evaluate the soils for engineering purposes. The test data are given in table 6.

The engineering soil classifications in table 6 are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. Mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming soil textural classes.

The liquid-limit and plastic-limit tests measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from the plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 6 also gives compaction (moisture-density) data for the tested soils. If a soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material will increase until the "optimum moisture content" is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for as a rule optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Engineering classification systems

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials. In this system, soil materials are classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol, in the next to last column of table 6. The principal characteristics according to which soils are classified in this system are shown in table 7.

Some engineers prefer to use the Unified soil classification system.[7] In this system, soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. The principal characteristics of the 15 classes of soil are given in table 8. The classification of the tested soils according to the Unified system is given in the last column of table 6.

Soil Engineering Data and Recommendations

Some of the engineering information can be obtained from the soil map. It will often be necessary, however, to refer to other sections of the report, particularly to the sections entitled General Nature of the Area, Descriptions of the Soils, General Management Requirements, and Soil Formation and Classification.

A summary of the primary features of the soils that affect engineering is given in table 9.

A more detailed estimate of the physical properties of the soils, by layers, is given in table 10. The depths given for the layers of soil are based on the typical profile descriptions in the section, Descriptions of the Soils. The estimates represent the normal range in the physical properties of the layers of soil.

Permeability, or the rate of movement of water through each layer of soil, is important in planning farm drainage. The rate of permeability depends on the texture and structure of the soil.

Ratings given in table 10 show the suitability of the soils of Norfolk County as sources of topsoil to be used to promote the growth of vegetation on embankments, on cut slopes, in ditches, and on the shoulders of highways. Sandy loams or loamy sands are preferred on shoulders that are to support limited traffic.

Soil materials that change greatly in volume when the content of moisture changes under the normal climatic conditions are not generally suitable for use in the upper part of dams or road embankments, and their use may be restricted in other parts of such structures. Fortunately, most of the soils of Norfolk County have low or moderate shrink-swell potential.

The soil features affecting engineering work, listed in table 11, are based on information in the rest of the report and on experience gained by persons working with the same kinds of soils in other counties.

The primary soil problems in highway work are due to the nature of the soil material and drainage conditions. These soils of the Coastal Plains consist predominantly of silty clay, silt, and fine sand. Bedrock is at great depths.

[6] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 7, 2 v., illus. 1955.

[7] WATERWAYS EXPERIMENT STATION. UNIFIED SOIL CLASSIFICATION SYSTEM, 3 v., Corps of Engin. U. S. Army Tech. Memo. 3–357. Prepared for Off., Chief of Engin., Vicksburg, Miss. 1953.

TABLE 6.—*Engineering test data* [1] *for*

Soil and location	Bureau of Public Roads report No.	Depth	Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis [2] — Percentage passing sieve: 1½-in.	1-in.	¾-in.	⅜-in.
		Inches		*Lb. per cu. ft.*	*Percent*				
Bayboro mucky loam: 2 miles E. of Wallaceton on Highway 740.	90514	0 to 10	A_p	57	50	----	----	----	----
	90515	17 to 52	B_2	106	18	----	----	----	----
	90516	64 to 74	D	112	14	----	----	----	----
Bertie very fine sandy loam: 2 miles N. of Northwest, on State Highway 170.	90535	0 to 8	A_p	102	15	----	----	----	----
	90536	8 to 30	B_2	117	13	----	----	----	----
	90537	35 to 45	C	109	14	----	----	----	----
Dragston fine sandy loam: 0.25 mile N. of Gertie, on Highway 740.	90505	4 to 8	A_2	104	17	----	----	----	----
	90506	14 to 28	B_{21}	125	9	----	----	----	----
	90507	34 to 64	C	114	14	----	----	----	----
Elkton silt loam: 5 miles N. of Fentress, on Highway 604.	90523	4 to 11	A_2	107	16	----	----	----	----
	90524	11 to 39	B_{2g}	112	15	----	----	----	----
	90525	49 to 60	C_g	116	13	----	----	----	----
Fallsington fine sandy loam: 0.5 mile S. of Churchland, on Highway 659.	90511	4 to 11	A_2	120	12	----	----	----	----
	90512	22 to 30	B_{2g}	120	12	----	----	----	----
	90513	30 to 50	C	112	12	----	----	----	----
Keyport very fine sandy loam: 0.5 mile E. of Northwest	90532	2 to 10	A_2	112	13	----	----	----	----
	90533	13 to 21	B_{21}	111	16	----	----	----	----
	90534	36 to 46	C	123	10	100	96	96	95
Matapeake fine sandy loam: 0.5 mile W. of Great Bridge, on Highway 634.	90517	2 to 9	A_2	114	14	----	----	----	----
	90518	12 to 20	B_{21}	106	20	----	----	----	----
	90519	47 to 54	C	117	12	----	----	----	----
Othello very fine sandy loam: 1 mile E. of Benefit, on Highway 614	90520	2 to 10	A_2	120	11	----	----	----	----
	90521	12 to 30	B_{2g}	113	15	----	----	----	----
	90522	35 to 40	C	112	13	----	----	----	----
Portsmouth loam: 1 mile E. of southernmost intersection of U. S. Highway 13 and State Highway 170.	90529	0 to 12	A_p	94	20	----	----	----	----
	90530	15 to 23	B_{2g}	126	10	----	----	----	----
	90531	27 to 45	D	104	13	----	----	----	----
Sassafras fine sandy loam: 0.5 mile NE. of Oak Grove	90526	4 to 10	A_2	122	10	----	----	----	----
	90527	14 to 26	B_2	117	14	----	----	----	----
	90528	38 to 50	C	111	12	----	----	----	----
Woodstown fine sandy loam: 1.5 miles W. of St. Brides, on Highway 614.	90508	6 to 11	A_2	117	12	----	----	----	----
	90509	22 to 36	B_2	125	10	----	----	----	----
	90510	36 to 60	C	121	10	----	----	----	----

[1] Tests performed by Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (A. A. S. H. O.).

[2] Mechanical analyses are based on the soil samples as received by the Bureau of Public Roads Laboratory and tested according to the A. A. S. H. O. Designation: T 88–58. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the A. A. S. H. O. procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material in the soil sample, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the

soil samples taken from 11 soil profiles

Mechanical analysis [2]—Continued									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued					Percentage smaller than—							
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			A. A. S. H. O.[3]	Unified [4]
--------	100	91	86	78	68	43	20	14	72	6	A-5(12)	OH.
--------	--------	--------	100	94	84	57	38	30	33	13	A-6(9)	CL.
--------	--------	--------	100	80	72	51	32	24	32	15	A-6(10)	CL.
--------	--------	100	99	93	72	25	8	6	NP [5]	NP [5]	A-4(8)	ML.
--------	--------	--------	100	96	83	47	27	21	29	13	A-6(9)	CL.
--------	--------	100	99	88	73	16	12	11	22	3	A-4(8)	ML.
--------	--------	100	96	50	46	34	19	11	26	5	A-4(3)	SM-SC.
--------	--------	100	97	45	42	32	15	9	14	3	A-4(2)	SM.
--------	--------	100	97	21	19	15	14	13	19	3	A-2-4(0)	SM.
--------	--------	100	99	91	83	54	27	19	30	8	A-4(8)	ML-CL.
--------	--------	100	99	92	84	62	36	29	34	17	A-6(11)	CL.
--------	--------	100	99	81	62	24	17	15	23	6	A-4(8)	ML-CL.
--------	100	99	94	40	38	31	20	15	19	5	A-4(1)	SM-SC.
--------	100	99	96	46	44	37	26	21	26	11	A-6(2)	SC.
--------	--------	100	94	25	22	16	15	11	NP [5]	NP [5]	A-2-4(0)	SM.
--------	100	89	83	75	68	49	20	12	25	5	A-4(8)	ML-CL.
--------	100	95	91	86	80	61	39	31	36	16	A-6(10)	CL.
92	83	62	52	37	32	23	19	17	34	16	A-6(2)	SC.
--------	100	99	94	73	69	54	23	16	21	5	A-4(8)	ML-CL.
--------	100	99	96	84	81	70	47	39	39	14	A-6(10)	ML-CL.
--------	100	99	95	33	28	19	15	12	NP [5]	NP [5]	A-2-4(0)	SM.
--------	100	99	88	62	57	39	19	12	18	4	A-4(5)	ML-CL.
--------	100	99	91	71	68	57	38	31	35	21	A-6(12)	CL.
--------	--------	100	98	38	28	14	10	9	NP [5]	NP [5]	A-4(1)	SM.
--------	100	97	80	35	33	26	12	9	NP [5]	NP [5]	A-2-4(0)	SM.
--------	100	97	82	35	34	28	16	12	16	4	A-2-4(0)	SM-SC.
--------	100	99	83	7	6	5	2	2	NP [5]	NP [5]	A-3(0)	SP-SM.
--------	100	97	85	41	38	27	15	9	15	2	A-4(1)	SM.
--------	100	97	86	46	45	37	27	24	27	10	A-4(2)	SC.
--------	100	97	85	13	13	13	11	10	NP [5]	NP [5]	A-2-4(0)	SM.
--------	100	90	70	36	35	29	15	12	20	5	A-4(0)	SM-SC.
--------	100	89	69	38	38	32	19	14	20	6	A-4(1)	SM-SC.
--------	100	86	60	20	19	16	11	9	NP [5]	NP [5]	A-2-4(0)	SM.

material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1, ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, A. A. S. H. O. Designation: M 145-49.

[4] Based on the Unified Soil Classification System, Tech. Memo. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

[5] NP=nonplastic.

TABLE 7.—*Classification of soils by American*

General classification	Granular materials (35 percent or less passing No. 200 sieve)				
Group classification	A-1		A-3	A-2	
	A-1-a	A-1-b		A-2-4	A-2-5
Sieve analysis:					
Percent passing—					
No. 10	50 maximum				
No. 40	30 maximum	50 maximum	51 minimum		
No. 200	15 maximum	25 maximum	10 maximum	35 maximum	35 maximum
Characteristics of fraction passing No. 40 sieve:					
Liquid limit			NP [2]	40 maximum	41 minimum
Plasticity index	6 maximum	6 maximum	NP [2]	10 maximum	10 maximum
Group index	0	0	0	0	0
Usual types of significant constituent materials.	Stone fragments, gravel, and sand.	Stone fragments, gravel, and sand.	Fine sand	Silty gravel and sand.	Silty gravel and sand.
General rating as subgrade.	Excellent to good.				

[1] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt.1; ed.7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, A. A. S. H. O. Designation: M 145-49.

[2] NP=nonplastic.

Association of State Highway Officials [1]

Granular materials (35 percent or less passing No. 200 sieve)—Con.		Silt-clay materials (More than 35 percent passing No. 200 sieve)				
A-2		A-4	A-5	A-6	A-7	
A-2-6	A-2-7				A-7-5	A-7-6
35 maximum	35 maximum	36 minimum	36 minimum	36 minimum	36 minimum	36 minimum.
40 maximum	41 minimum	40 maximum	41 minimum	40 maximum	41 minimum	41 minimum.
11 minimum	11 minimum	10 maximum	10 maximum	11 minimum	11 minimum [3]	11 minimum.[3]
4 maximum	4 maximum	8 maximum	12 maximum	16 maximum	20 maximum	20 maximum.
Clayey gravel and sand.	Clayey gravel and sand.	Nonplastic to moderately plastic silty soils.	Highly elastic silts.	Medium plastic clays.	Highly plastic clays.	Highly plastic clays.
Fair to poor.						

[3] Plasticity index of A-7-5 subgroup is equal to, or less than, LL minus 30. Plasticity index of A-7-6 subgroup is greater than L minus 30.

455251—59——4

TABLE 8.—*Characteristics of soil groups*

Major divisions	Group symbol	Soil description	Value as foundation material [2]	Value as base course directly under bituminous pavement
Coarse-grained soils (*50 percent or less passing No. 200 sieve*):				
	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	Excellent	Good
	GP	Poorly graded gravels and gravel-sand mixtures; little or no fines.	Good to excellent	Poor to fair
Gravels and gravelly soils (*more than half of coarse fraction retained on No. 4 sieve*).	GM	Silty gravels and gravel-sand-silt mixtures.	Good	Poor to good
	GC	Clayey gravels and gravel-sand-clay mixtures.	Good	Poor
	SW	Well-graded sands and gravelly sands; little or no fines.	Good	Poor
	SP	Poorly graded sands and gravelly sands; little or no fines.	Fair to good	Poor to not suitable.
Sands and sandy soils (*more than half of coarse fraction passing No. 4 sieve*).	SM	Silty sands and sand-silt mixtures	Fair to good	Same
	SC	Clayey sands and sand-clay mixtures.	Fair to good	Not suitable
Fine-grained soils (*more than 50 percent passing No. 200 sieve*):				
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, and clayey silts of slight plasticity.	Fair to poor	Not suitable
Silts and clays (*liquid limit of 50 or less*)	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays.	Fair to poor	Not suitable
	OL	Organic silts and organic clays having low plasticity.	Poor	Not suitable
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, and elastic silts.	Poor	Not suitable
Silts and clays (*liquid limit greater than 50*)	CH	Inorganic clays having high plasticity and fat clays.	Poor to very poor	Not suitable
	OH	Organic clays having medium to high plasticity and organic silts.	Same	Not suitable
Highly organic soils	Pt	Peat and other highly organic soils	Not suitable	Not suitable

[1] Based on information in The Unified Soil Classification System, Tech. Memo. No. 3-357, v. 1, 2, and 3, Waterways Experiment Station, Corps of Engineers, 1953. Ratings and ranges in test values are for guidance only. Design should be based on field survey and test of samples from construction site.

in unified soil classification system [1]

Value for embankments	Compaction: Characteristics and recommended equipment	Approximate range in A.A.S.H.O. maximum dry density [3]	Field (in-place) CBR	Subgrade modulus k	Drainage characteristics	Comparable groups in A. A. S. H. O. classification
		Lb./cu. ft.		*Lb./sq. in./in.*		
Very stable; use in pervious shells of dikes and dams.	Good; use crawler-type tractor, pneumatic-tire roller, or steel-wheel roller.	125–135	60–80	300+	Excellent	A–1.
Reasonably stable; use in pervious shells of dikes and dams.	Same	115–125	25–60	300+	Excellent	A—1.
Reasonably stable; not particularly suited to shells, but may be used for impervious cores or blankets.	Good, but needs close control of moisture; use pneumatic-tire or sheepsfoot roller.	120–135	20–80	200–300+	Fair to practically impervious.	A–1 or A–2.
Fairly stable; may be used for impervious core.	Fair, use pneumatic-tire or sheepsfoot roller.	115–130	20–40	200–300	Poor to practically impervious.	A–2.
Very stable; may be used in pervious sections; slope protection required.	Good; use crawler-type tractor or pneumatic-tire roller.	110–130	20–40	200–300	Excellent	A–1.
Reasonably stable; may be used in dike section having flat slopes.	Same	100–120	10–25	200–300	Excellent	A–1 or A–3.
Fairly stable; not particularly suited to shells, but may be used for impervious cores or dikes.	Good, but needs close control of moisture; use pneumatic-tire or sheepsfoot roller.	110–125	10–40	200–300	Fair to practically impervious.	A–1, A–2, or A–4.
Fairly stable; use as impervious core for flood-control structures.	Fair; use pneumatic-tire roller or sheepsfoot roller.	105–125	10–20	200–300	Poor to practically impervious.	A–2, A–4, or A–6.
Poor stability; may be used for embankments if properly controlled.	Good to poor; close control of moisture is essential; use pneumatic-tire or sheepsfoot roller.	95–120	5–15	100–200	Fair to poor	A–4, A–5, or A–6.
Stable; use in impervious cores and blankets.	Fair to good; use pneumatic-tire or sheepsfoot roller.	95–120	5–15	100–200	Practically impervious.	A–4, A–6, or A–7.
Not suitable for embankments	Fair to poor; use sheepsfoot roller.[4]	80–100	4–8	100–200	Poor	A–4, A–5, A–6, or A–7.
Poor stability; use in core of hydraulic fill dam; not desirable in rolled fill construction.	Poor to very poor; use sheepsfoot roller.[4]	70–95	4–8	100–200	Fair to poor	A–5 or A–7.
Fair stability on flat slopes; use in thin cores, blankets, and dike sections of dams.	Fair to poor; use sheepsfoot roller.[4]	75–105	3–5	50–100	Practically impervious.	A—7.
Not suitable for embankments	Poor to very poor; use sheepsfoot roller.[4]	65–100	3–5	50–100	Same	A–5 or A–7.
Not used in embankments, dams, or subgrades for pavements					Fair to poor	None.

[2] Ratings are for subgrade and subbases for flexible pavement.
[3] Determined in accordance with test designation: T 99–49, A. A. S. H. O.
[4] Pneumatic-tire rollers may be advisable, particularly when moisture content is higher than optimum.

TABLE 9.—*List of soil mapping units and some characteristics significant to engineering*

Soil	Depth to seasonally high water table	Selected characteristics significant to engineering
	Feet	
Bayboro mucky loam	0	½ to 1 foot of very poorly drained, highly organic material (OL or Pt) over moderately plastic silty clay or sandy clay (primarily ML or CL; A–4 or A–6); occurs in flat, slightly depressed areas.
Bayboro silt loam	0	½ to 2 feet of very poorly drained, friable, organic loamy soil material (ML or OL; A–4 or A–5) over moderately plastic silty clay loam to clay (primarily CL; A–4 or A–6); sandier material (primarily SC or A–4) below depths of about 5 feet; occurs in flat, slightly depressed areas.
Bertie very fine sandy loam	½–1	Somewhat poorly drained, stratified material ranging from slightly plastic loamy sand to moderately plastic silty clay (primarily SM or SC to ML or CL; A–2, A–4, or A–6); occurs on gently undulating topography.
Bertie fine sandy loam, olive-gray subsoil variant.		
Bladen silt loam	0	Poorly drained to very poorly drained stratified material ranging from sandy loam to moderately or highly plastic silty clay (SC to CH; A–4 to A–7); occurs on nearly level topography.
Coastal beach	0	Very narrow strips of loose sand (SP; A–3); parts of which may be covered with water during high tide.
Dragston fine sandy loam	1–2	2 to 3½ feet of somewhat poorly drained material ranging from slightly plastic loamy sand or sandy loam (SM or SC; A–2 or A–4) to moderately plastic clay (SC or CL; A–4 or A–6) over loamy sand or sand (SM or SP; A–2 or A–3); occurs on level to nearly level topography.
Dragston loamy fine sand		
Elkton silt loam	0	Poorly drained layers of material ranging from slightly plastic loamy sand to moderately plastic clay (SM to CL; A–2 to A–6); occurs on flat to nearly level topography.
Elkton-Othello very fine sandy loams	0	Areas of Elkton and Othello soils; the Othello consists of coarser grained material.
Fallsington fine sandy loam	0	2 to 3 feet of poorly drained slightly plastic loamy sand to moderately plastic sandy clay (SM or SC to CL; A–2 or A–4 to A–6) overlying loamy sand or sand (SM or SP; A–2 or A–3); occurs on nearly level areas.
Galestown loamy fine sand	3½–4	3 to 5 feet of well drained to somewhat excessively drained loamy sand (SM; A–2) over loamy sand or sand (SM or SP; A–2 or A–3); pockets of sandy clay loam (SC; A–4 or A–6) at depths of 2 to 3½ feet in places; occupies undulating to rolling areas.
Keyport very fine sandy loam	1½–2	Moderately well drained material ranging from loamy sand or sand (SM or SP; A–2 or A–3) to moderately plastic clay or sandy clay (primarily CL; A–6); occurs on nearly level to rolling areas.
Klej loamy fine sand	1½–1	2 to 3 feet of moderately well drained to somewhat poorly drained loamy sand (SM; A–2) over sand (primarily SP; A–3); occurs on nearly level areas.
Lenoir very fine sandy loam	1–2	½ to 1 foot of somewhat poorly drained sandy loam (SM or SC; A–2 or A–4) over stratified material ranging from loamy sand to moderately to highly plastic clay (SM or SC to CH; A–2 to A–7).
Matapeake fine sandy loam:		
Nearly level phase	2–2½	Well-drained stratified material ranging from loamy sand to moderately plastic silty clay (SM to CL; A–2 to A–7); occurs on nearly level to undulating areas.
Eroded undulating phase		
Mattapex very fine sandy loam:		
Nearly level phase	1½–2	Moderately well drained stratified material ranging from loamy sand to moderately plastic silty clay (SM to CL; A–2 to A–6).
Undulating phase		
Mixed alluvial land	0	Poorly drained stratified material ranging from loamy sand to moderately plastic silty clay (SM to CL; A–2 to A–6); occurs on flood plains along streams.
Mucky peat	0	4 to 15 feet of very poorly drained peat or muck (Pt) overlying stratified material ranging from sand to clay; occurs in depressions.
Mucky peat, shallow over loams	0	1½ to 4 feet of very poorly drained mucky peat (Pt) overlying stratified material ranging from loam to moderately plastic silty clay (ML to CH; A–4 to A–7); occurs in depressions or at margins of Mucky peat.
Mucky peat, shallow over sands	0	1½ to 4 feet of very poorly drained mucky peat (Pt) overlying stratified material ranging from sand to moderately plastic sandy clay loam (SM to CL; A–2 to A–6); occurs in depressions.
Othello loam, dark surface phase	0	2½ to 4 feet of poorly drained, moderately plastic material ranging from sandy loam to moderately plastic silty clay loam (ML to CL; A–4 to A–6) over loamy sand (SM; A–2 or A–4); occurs on nearly level areas.
Othello very fine sandy loam		
Othello-Fallsington fine sandy loams	0	Areas of Othello and Fallsington soils.
Pasquotank very fine sandy loam	0	Poorly drained stratified material ranging from loamy sand to moderately plastic sandy clay (SM to CL; A–2 to A–6); occurs on nearly level areas.

TABLE 9.—*List of soil mapping units and some characteristics significant to engineering*—Continued

Soil	Depth to seasonally high water table	Selected characteristics significant to engineering
	Feet	
Pocomoke fine sandy loam	0	1 to 2 feet of very poorly drained loamy sand or organic silt (SM, ML, or OL; A–2 or A–4) underlain by ½ to 1½ feet of loamy sand or moderately plastic sandy clay (SC or CL; A–4 or A–6) over fine sand (SM or SP; A–2 or A–3); occurs on flat or nearly level areas.
Portsmouth loam Portsmouth mucky loam	0	½ to 1½ feet of very poorly drained silt loam or sandy loam having a high content of organic matter (SM, ML, or OL; A–2, A–4, or A–5) over ½ to 1½ feet of sandy clay loam (primarily SC or CL; A–4 or A–6); underlain by fine sand (SM or SP; A–2 or A–3); occurs in slightly depressed areas.
Sassafras fine sandy loam: Nearly level phase Undulating phase Sassafras loamy fine sand: Nearly level phase Eroded undulating phase Eroded rolling phase Sassafras sandy loam, nearly level phase	2–3	½ to 1½ feet of loamy sand or sandy loam (SM or SC; A–2 or A–4) over 1½ to 2½ feet of sandy loam or moderately plastic sandy clay loam (SC or CL; A–4 or A–6); underlain by loamy sand or sand (SM or SP; A–2 or A–3).
Tidal marsh	0	Soil materials are mixed sand, silt, and clay that contain some organic matter; areas are normally covered by water at high tide; vegetation of marshgrass.
Weeksville silt loam	0	3 to 5 feet of poorly drained silty materials (ML or CL; A–4 or A–6) on loamy sand or sand (SM or SP; A–2 or A–3); topography is nearly level.
Wet soils	0	Wooded areas that were not mapped in detail; consist of Bayboro, Bladen, Elkton, Othello, Portsmouth, and other soils of the "Green Sea."
Woodstown fine sandy loam: Nearly level phase Undulating phase Woodstown loamy fine sand: Nearly level phase Undulating phase	1–2	½ to 1½ feet of moderately well drained loamy sand or sandy loam (SM or SC; A–2 or A–4) over 1½ to 2½ feet of sandy loam or moderately plastic sandy clay loam (primarily SC or CL; A–4 or A–6); underlain by loamy sand or sand (SM or SP; A–2 or A–3).

TABLE 10.—*Estimated physical properties of the soils*

Soils	Depth from surface (typical profile)	Classification		Perme-ability	Structure	Suitability as source of topsoil [1]	Shrink-swell potential
		Unified	A. A. S. H. O.				
	Inches			*Inches per hour*			
Bayboro mucky loam	0 to 14	Pt, OL, OH, or MI	A-4 or A-5		Blocky to granular	Not suitable	Moderate to high.
	14 to 64	ML, CL, or MH	A-4, A-6, or A-7.	0. 05-0. 2	Blocky to massive		Moderate to high.
	64 to 74+	SM, SC, ML, or CL	A-2, A-4, or A-6.	. 2-2. 5	Blocky		Low to moderate.
Bayboro silt loam	0 to 10	ML or OL	A-4 or A-5		Granular	Poor	Moderate.
	10 to 30	ML or CL	A-4 or A-6	. 05-. 2	Blocky to massive		Moderate.
	30 to 50	SM, SC, ML, or CL	A-2 or A-4	. 8-2. 5	Blocky		Low to moderate.
Bertie very fine sandy loam Bertie fine sandy loam, olive-gray subsoil variant.	0 to 8	SM, SC, or ML	A-2 or A-4		Granular	Fair	Low.
	8 to 35	ML or CL	A-4 or A-6	. 8-5	Blocky		Moderate.
	35 to 45+	SM, SC, or ML	A-2 or A-4	2. 5-10	Granular to single grain.		Low.
Bladen silt loam	0 to 6	ML or CL	A-4 or A-6		Granular	Poor	Low.
	6 to 56	CL, MH, or CH	A-6 or A-7	([2])	Blocky		High.
	56 to 68	SC, ML, or CL	A-4 or A-6	. 2-5	Blocky		Moderate.
Coastal beach	0 to 60+	SP	A-3	10+	Single grain	Not suitable	None.
Dragston fine sandy loam	0 to 8	SM or SC	A-2 or A-4		Granular	Good	Low.
	8 to 34	SM, SC, ML, or CL	A-4 or A-6	2-5-5	Blocky		Low to moderate.
	34 to 64	SM or SP	A-2 or A-3	10+	Single grain		Low.
Dragston loamy fine sand	0 to 11	SM or SC	A-2 or A-4		Granular	Good	Low.
	11 to 40	SC, ML, or CL	A-4 or A-6	2. 5-5	Blocky		Low to moderate.
	40 to 50	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Elkton silt loam	0 to 11	ML or CL	A-4 or A-6		Granular	Poor	Low to moderate.
	11 to 49	SC or CL	A-4 or A-6	([2])	Blocky		Moderate.
	49 to 60	SM, SC, or ML	A-2 or A-4	8-5	Granular		Low.
Fallsington fine sandy loam	0 to 11	SM, SC, or ML	A-2 or A-4		Granular	Good	Low.
	11 to 30	SC or CL	A-4 or A-6	. 8-5	Blocky		Moderate.
	30 to 50	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Galestown loamy fine sand	0 to 8	SM	A-2		Single grain	Fair	Low.
	8 to 52	SM	A-2	10+	Single grain		Low.
	52 to 62	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Keyport very fine sandy loam	0 to 10	SM, SC, ML, or CL	A-2, A-4, or A-6.		Granular	Fair	Low to moderate.
	10 to 31	CL, MH, or CH	A-6 or A-7	. 2-. 8	Blocky		High.
	31 to 46	SP, SM, SC, or CL	A-2, A-3, A-4, or A-6.	. 8-5	Granular		Low to moderate.
Klej loamy fine sand	0 to 9	SM or SC	A-2		Single grain	Good	Low.
	9 to 30	SM or SC	A-2	5-10	Single grain		Low.
	30 to 50	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Lenoir very fine sandy loam	0 to 11	SM or SC	A-2 or A-4		Granular	Poor to fair	Low.
	11 to 45	CL or CH	A-6 or A-7	([2])	Blocky		High.
	45 to 54	SM or SP	A-2 or A-3	10+	Single grain		Low.
	54+	SM to CH	A-2 to A-7				Low to high.

Matapeake fine sandy loam: Nearly level phase; Eroded undulating phase	0 to 9	SM, ML, or CL	A-2, A-4, or A-6.		Granular	Good	Low to moderate.
	9 to 47	SC or CL	A-4, A-6, or A-7.	.8-5	Blocky		Moderate to high.
	47 to 54	SM or SC	A-2 or A-4	10+	Single grain		Low.
Mattapex very fine sandy loam: Nearly level phase; Undulating phase	0 to 8	SM, SC, ML, or CL	A-2, A-4, or A-6.		Granular	Fair	Low to moderate.
	8 to 56	SC or CL	A-4 or A-6	.8-2.5	Blocky		Moderate.
	56 to 66	SM or SC	A-2 or A-4	2.5-5	Blocky		Low.
Mixed alluvial land		SM, SC, ML, or CL	A-2, A-4, or A-6.	.05-.8		Not suitable	Low to moderate.
Mucky peat	0 to 40+	Pt		5-10		Not suitable	Moderate to high.
Mucky peat, shallow over loams	0 to 20	Pt		5-10		Not suitable	Moderate to high.
	20 to 40+	ML, OL, CL, MH, or CH.	A-4, A-5, A-6, or A-7.	.8-2.5	Blocky to massive		Moderate to high.
Mucky peat, shallow over sands	0 to 20	Pt		5-10		Not suitable	Moderate to high.
	20 to 40+	SM, SC, ML, OL, or CL.	A-2, A-4, or A-6.	2.5-5	Single grain to blocky.		Low to moderate.
Othello very fine sandy loam; Othello loam, dark surface phase	0 to 10	ML or CL	A-4 or A-6		Granular	Poor	Low to moderate.
	10 to 35	SC or CL	A-4 or A-6	.05-2.5	Blocky		Moderate.
	35 to 45	SM	A-2	2.5-10	Single grain		Low.
Pasquotank very fine sandy loam	0 to 8	SM, SC, or ML	A-2 or A-4		Granular	Fair	Low.
	8 to 52	SM, SC, ML, or CL	A-2, A-4, or A-6.	.8-2.5	Blocky		Low to moderate.
	52 to 62	SM, SC, or ML	A-2 or A-4	5-10	Blocky		Low.
Pocomoke fine sandy loam	0 to 15	SM, ML, or OL	A-2, A-4, or A-5.		Granular	Good	Low to moderate.
	15 to 28	SC or CL	A-4 or A-6	.8-5	Blocky		Moderate.
	28 to 45+	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Portsmouth loam	0 to 15	SM, ML, or OL	A-2, A-4, or A-5.		Granular	Fair	Low to moderate.
	15 to 27	SM, SC, ML, or CL	A-2, A-4, or A-6.	.8-5	Blocky		Low to moderate.
	27 to 45	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Portsmouth mucky loam	0 to 13	ML or OL	A-4 or A-5		Granular	Poor	Moderate.
	13 to 30	SC or CL	A-4 or A-6	.8-5	Blocky		Moderate.
	30 to 40	SM or SP	A-2 or A-3	10+	Single grain		Low to none.
Sassafras fine sandy loam: Nearly level phase; Undulating phase. Sassafras sandy loam, nearly level phase. Sassafras loamy fine sand: Nearly level phase; Eroded undulating phase; Eroded rolling phase	0 to 10	SM or SC	A-2 or A-4		Granular	Good	Low.
	10 to 38	SC or CL	A-4 or A-6	2.5-5	Blocky		Moderate.
	38 to 50	SM or SP	A-2 or A-3	10+	Single grain		Low to none.

See footnotes at end of table.

TABLE 10.—*Estimated physical properties of the soils*—Continued

Soils	Depth from surface (typical profile)	Classification		Permeability	Structure	Suitability as source of topsoil [1]	Shrink-swell potential
		Unified	A. A. S. H. O.				
	Inches			*Inches per hour*			
Tidal marsh		SM to CL	A–2 to A–6	(3)	Massive	Not suitable	Low to moderate.
Weeksville silt loam	0 to 15	ML or CL	A–4 or A–6		Granular	Poor	Moderate.
	15 to 42	ML or CL	A–4 or A–6	0. 8–5	Blocky		Moderate.
	42 to 54	SC or CL	A–4 or A–6	. 8–5	Blocky		Moderate.
	54 to 64	SM or SP	A–2 or A–3	10+	Single grain		Low to none.
Wet soils	This mapping unit includes Bayboro, Bladen, Elkton, Othello, and Portsmouth soils.						
Woodstown fine sandy loam:							
Nearly level phase Undulating phase	0 to 14	SM	A–2 or A–4		Granular	Good	Low.
	14 to 36	SC or CL	A–4 or S–6	2. 5–5	Blocky		Low.
	36 to 60	SM or SP	A–2 or A–3	10+	Single grain		Low to none.
Woodstown loamy fine sand:							
Nearly level phase Undulating phase	0 to 16	SM or SC	A–2 or A–4		Granular	Good	Low.
	16 to 45	SM, SC, ML, or CL	A–2, A–4, or A–6.	2. 5–5	Blocky		Low to moderate.
	45 to 55+	SM or SP	A–2 or A–3	10+	Single grain		Low to none.

[1] Rating is for material in the surface layer, or A-horizon, for use on shoulders of highways, embankments, and cut slopes, and in ditches to promote the growth of vegetation.

[2] Less than 0.2.

[3] Less than 2.5.

TABLE 11.—*Soil features affecting engineering work*

Soil series	Highways: Features affecting—				Soil and water conservation: Features affecting—			Suitable type of farm pond
	Adaptability to earthwork during prolonged wet periods	Desired location of grade line	Removal of topsoil in shallow grading sections	Suitability as source of subbase material	Adaptability to irrigation	Drainage system: Open ditch	Drainage system: Tile	
						Hazard	*Hazard*	
Bayboro:								
Bayboro mucky loam.	Not adapted	5 feet minimum above upper surface of inorganic soil material.[1]	Yes	Not suitable	Not adapted			Excavated.
Bayboro silt loam	Not adapted	5 feet minimum above ground surface.	Yes	Not suitable	Not adapted			Excavated.
Bertie	Not adapted	4 feet minimum above water table.	No	Not suitable	Fair	Caving; flowing sand.	Sand substrata.	Excavated.
Bladen	Not adapted	5 feet minimum above ground surface.	No	Not suitable	Not adapted			Excavated.
Coastal beach	Good	1 foot minimum above high tide.[2]	No	Poor	Not adapted			
Dragston	Poor	4 feet minimum above water table.	No	Not suitable	Fair	Caving; flowing sand.	Sand substrata.	
Elkton	Not adapted	4 feet minimum above water table.	Yes	Not suitable	Not adapted			Excavated or impounded.
Elkton-Othello	Not adapted	4 feet minimum above water table.	Yes	Not suitable	Not adapted			Excavated or impounded.
Fallsington	Poor	4 feet minimum above water table.	No	Not suitable	Fair	Caving; flowing sand.	Sand substrata.	Excavated or impounded.

Galestown	Fair to good	Anywhere, if adequate surface drainage is provided.	No	Poor	Good			
Keyport	Poor to fair	4 feet minimum above water table.	No	Not suitable	Not adapted			
Klej	Fair to good	4 feet minimum above water table.	No	Not suitable	Fair			
Lenoir	Not adapted	4 feet minimum above water table.	No	Not suitable	Not adapted			Excavated or impounded.
Matapeake	Not adapted	4 feet minimum above water table.	No	Not suitable	Good			Impounded.
Mattapex	Not adapted	4 feet minimum above water table.	No	Not suitable	Fair			Impounded.
Mixed alluvial land	Not adapted	2 to 3 feet minimum above high water.	No	Not suitable	Not adapted			Excavated and impounded.
Mucky peat	Not suitable	Field investigation required	Yes	Not suitable	Not adapted			
Mucky peat, shallow	Not suitable	Field investigation required	Yes	Not suitable	Not adapted			
Othello	Not adapted	4 feet minimum above water table.	No	Not suitable	Not adapted	Caving; flowing sand.		Excavated or impounded.
Othello-Fallsington	Not adapted	4 feet minimum above water table.	No	Not suitable	Not adapted	Caving; flowing sand.		Excavated or impounded.
Pasquotank	Not adapted	4 feet minimum above water table.	No	Not suitable	Fair			Excavated.
Pocomoke	Poor to not adapted.	4 feet minimum above water table.	Yes	Not suitable	Fair	Caving; flowing sand.		Excavated.
Portsmouth	Poor to fair	3 to 4 feet minimum above water level.	Yes	Not suitable	Fair	Caving; flowing sand.	Sand substrata.	Escavated.
Sassafras	Fair to good	Anywhere, if adequate surface drainage is provided.	No	Poor to fair	Good			Impounded.
Tidal marsh	Not suitable	3 to 4 feet minimum above water level.	Yes	Not suitable	Not adapted			
Weeksville	Not suitable	4 feet minimum above water table.	No	Not suitable	Fair			Excavated.
Wet soils	Not suitable	4 feet minimum above water table.	Yes	Not suitable	Not adapted	Caving; flowing sand.		Excavated.
Woodstown	Fair	4 feet minimum above water table.	No	Poor to fair	Good		Sand substrata.	Impounded.

[1] Highly organic material must be removed before embankment construction is started.

[2] Road embankment must be protected from erosion by waves.

The drainage characteristics of the soils are reflected in table 11 in the columns on adaptability to earthwork during prolonged wet periods and the desired location of gradeline. The ratings given the soils for adaptability to earthwork during prolonged wet periods are based on internal drainage and on the workability of the soil materials at a high moisture content. Many of the soils have a high water table and may be made more suitable as sources of borrow material for use in embankments, as well as for roadway excavation, if drainage ditches are constructed before earthwork is started. Underdrains may be required in places where a high water table might make the soil unstable. County zoning regulations may restrict earth borrow to certain soils and may not permit borrow excavation in built-up (densely populated) areas.

Because of the level to nearly level topography and the low elevation of Norfolk County, most of the roads should be built on embankments; the minimum elevations of the pavement surface above the water table should be 3 feet for a rigid pavement and 4 feet for a flexible pavement. The lower parts of the bottom lands may be flooded each year, and a roadway in these lowlands should be constructed on a continuous embankment that is at least 3 feet above the high water level.

Some of the fine sands that occur where the water table is deep are susceptible to wind erosion when they are exposed in roadway cuts. When a road embankment is built on Coastal beach, it must be protected from erosion by the action of waves. Stabilizing the sand by mixing it with other materials may be effective where the wave action is slight; riprap can be used on the slopes of embankments where the action of the waves is greater.

Earthwork can generally be done during the winter in the excessively drained, well drained, and moderately well drained sandy soils at elevations of more than 10 feet, provided the required standards of construction concerning compaction of soils are maintained.

Extensive areas of poorly drained and very poorly drained soils occur at low elevations in Norfolk County. Highly organic material has developed in many of these areas. The thickness of the highly organic layer of Mucky peat in places is as much as 15 feet, and that of the associated Bayboro, Pocomoke, and Portsmouth soils, Mixed alluvial land, Wet soils, and Tidal marsh is not greater than 2 feet in most places. This highly organic material should be removed from the roadway section and placed where it will not be detrimental to road construction. Roads should be built on embankments in these low places so that the surface of the pavement is at least 4 feet above the water table. In constructing roads, the removal of the topsoil through shallow grading sections is required where the topsoil contains a considerable amount of organic material.

Because the soils lack gravel, none of them are suitable as sources of material for use in base courses of flexible pavements. Some of them serve as limited sources of subbase materials, even though the maximum particle size is about 2 mm. (passing a No. 10 sieve); these soils are rated "poor" to "fair" in the column on suitability as source of subbase material in table 11.

It is generally considered that repeated movements of heavy-axle trucks on a rigid pavement constructed on a subgrade composed of soil material more than 35 percent of which passes through the No. 200 sieve will cause the forceful ejection of the subgrade soil and water. Consequently, a base course will be needed for rigid pavements that are to have a great volume of truck traffic.

Some of the most important characteristics of soils with respect to their adaptability to irrigation are as follows: (1) The topography must be suitable for irrigation or the lay of the land must be such that it can be leveled without exposing the subsoil; (2) the soil profile should be permeable enough so that drainage will not be impeded; (3) the soil should have good water-holding capacity, yet permit aeration and unrestricted growth of roots; (4) the soil should be largely free of salts; and (5) the structure and other physical properties of the soil should enable it to resist erosion. Consequently, the ratings given the soils in table 11 on adaptability to irrigation are based on the texture and structure of the various horizons and their relative water-holding capacity, permeability, and adaptability to drainage.

In planning and developing drainage systems, the permeability of the soil must be considered. A tile-drainage system may not be practical if the permeability of the soil layers is slow or very slow or if the water table is high. Open ditches may be used to remove the excess surface water and to lower the water table in permeable soils. Some information on open-ditch drainage is described in the section, General Management Requirements.

The hazards of caving and flowing sand, listed under open-ditch drainage system in table 11, are additional to the normal drainage problems. Flowing water may cause the caving of sand from the walls of an open ditch. The erosion and deposition of the fine sand may choke the drainage ditch. If a soil has a sand substratum, tile drains may become clogged.

The type of farm pond construction, excavation or impounding (earth dam) suitable for specific soils is also shown on table 11. A farm pond must be constructed carefully so that the impounded water does not escape through a layer of permeable sandy material.

At many construction sites, major variations in the soil may occur within the depth of the proposed excavation, and several soil units may occur within a short distance. The soil map and profile descriptions, as well as the engineering data and recommendations given in this section, should be used in planning detailed surveys of soils at construction sites. By using the information in the soil survey reports, the soils engineer can concentrate on the most important soil units. Then, a minimum number of soil samples will be obtained for laboratory testing, and an adequate soil investigation can be made at minimum cost.

Glossary

Aeration, soil. The replacement of air in the soil with air from the atmosphere. In a well-aerated soil the composition of the air in the soil is similar to that in the atmosphere. In a poorly aerated soil the air in the soil is considerably higher in carbon dioxide and lower in oxygen than that in the atmosphere.

Aggregate. A cluster of primary soil particles held together by internal forces to form a clod or fragment.

Base-exchange capacity (of soil). A measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents per 100 grams of soil that is neutral in reaction (pH 7.0) or at some other stated pH value. (Commonly called cation-exchange capacity.)

Clay. A soil separate or size group of mineral particles less than 0.002 mm. in diameter. As a textural class, clay consists of material containing 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Concretions. Local concentrations of certain chemical compounds, such as calcium carbonate or compounds of iron that form hard grains or nodules. The composition of some concretions is unlike that of the surrounding soil. The sizes, shapes, and colors vary.

Consistence, soil. The attributes of soil material that are expressed by the degree and kind of cohesion and adhesion or by the resistance to deformation or rupture. Terms commonly used to describe consistence are *loose*, *friable*, *firm*, *sticky*, and *plastic*.

Contour tillage. Furrows plowed at right angles to the direction of slope, at the same level throughout, and ordinarily at comparatively close intervals. This practice helps conserve soil and water on sloping soils.

Cover crop. A close-growing crop, such as a small grain, grass, or clover, used to protect and improve the soil between the periods when the regular crops are being grown.

Drainage, artificial. The removal of excess water in or on the soil by means of surface or subsurface drains.

Ditch, drainage. An open ditch used to remove excess surface water.
Lateral. A shallow, open, field ditch.
Lead. A deep, open ditch that receives drainage water from a number of laterals.

Erosion, soil. The wearing away of the land surface by moving water, wind, or by other geological agents.
Accelerated. The wearing away of the soil over and above normal erosion. This is brought about by changes in the natural cover or ground condition, especially changes caused directly or indirectly by human interference.
Sheet. Removal of a more or less uniform layer of soil material by accelerated erosion. In sheet erosion the eroding surface consists mainly of a number of very small rills.

Fertility, soil. That quality of a soil that enables it to provide the proper compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, temperature, and the physical condition of the soil are favorable.

Fluvial deposits. Soil materials deposited by streams.

Genesis, soil. The mode of origin of the soil with special reference to the processes responsible for the development of the solum, or true soil, from the unconsolidated parent material.

Gleization. A process of soil formation in which the soil has been saturated with water for long periods. The waterlogging and lack of oxygen have caused the color to be a neutral gray.

Green-manure crop. Any crop grown and plowed under for the purpose of improving the soil.

Granular structure. Soil structure in which the individual grains are grouped into spherical aggregates with indistinct sides. Highly porous granules are commonly called crumbs.

Horizon, soil. A layer of soil approximately parallel to the surface, with characteristics produced by soil-forming processes.

Hummock. A rounded or conical knoll or hillock.

Hydromorphic soil. Any intrazonal soil that occupies nearly level or depressed lowlands. These areas have very slow runoff all or part of the time and no natural erosion. Such soils retain all, or nearly all, of the water that falls as rain and, in addition, often receive a considerable amount of runoff from adjacent uplands.

Infiltration. The downward movement of water into a soil.

Leaching. The removal of materials in solution by percolating water.

Leaf mold. Partly decomposed organic forest litter.

Marine deposits. Soil materials deposited by the sea.

Morphology, soil. The physical constitution of the soil including the texture, structure, consistence, color, and other physical and chemical properties of the various soil horizons that make up the soil profile.

Mottled (soil). Soil horizons irregularly marked with spots of color. A common cause of mottling in soils is imperfect or impeded drainage, although there are other causes, such as the soil having developed from an unevenly weathered rock. Mottling is described in terms of (1) Abundance—*few*, *common*, and *many*; (2) Size—*fine*, *medium*, and *coarse*; (3) Contrast—*faint*, *distinct*, and *prominent*.

Muck. Highly decomposed organic soil material developed from peat. Generally, muck has a higher mineral or ash content than peat and is decomposed to the point that the original plant parts cannot be identified.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in elaboration of its food and tissue.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as peat soils, muck soils, and peaty soil layers.

Organic litter. An accumulation of leaves, needles, twigs, and bark that has not decomposed.

Organic-mineral horizon. A soil layer that contains both organic and mineral matter but with the mineral matter predominating.

Oxide. A compound of any element with oxygen alone.

Peat. Unconsolidated soil material that consists largely of undecomposed or only slightly decomposed organic matter accumulated under conditions of excessive moisture.

Percolation. The downward movement of water through soil.

Permeability, soil. That quality of a soil horizon that enables it to transmit water or air. The permeability of a soil may be limited by the presence of only one nearly impermeable horizon, even though the others are permeable.

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

Pore space. The total space within soils not occupied by solid particles.

Porosity, soil. The degree to which the soil mass is permeated with pores or cavities.

Productivity (of soil). The capability of a soil for producing a specified plant or sequence of plants under a defined set of management practices. Productivity is measured in terms of the outputs or harvest in relation to the inputs of production factors for a specific kind of soil under a physically defined system of management.

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

	pH		*pH*
Extremely acid	below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher.
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of the land surface, considered collectively.

Sand. A soil separate ranging in diameter from 2.0 mm. to 0.05 mm. As a textural class, sand consists of soil material that contains 85 percent or more sand and not more than 10 percent clay.

Sandy soils. A broad term for sands or loamy sands. The sands are loose and single grained. The sandy loams contain much sand but have enough silt and clay to make them somewhat coherent.

Silt. A soil separate having diameters ranging from 0.05 mm. to 0.002 mm. As a textural class, silt consists of soil material that contains 80 percent or more silt and less than 12 percent clay.

Slope, soil. The incline of the surface of a soil area. It is usually expressed in percent slope, which equals the vertical distance divided by the horizontal distance times 100, or the number of feet of fall per 100 feet of horizontal distance.

Soil. The natural medium for the growth of land plants on the surface of the earth. It is composed of organic and mineral materials.

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

Structure, soil. The arrangement of the individual grains and aggregates that make up the soil mass. Structure can be described by the following terms: (1) Grade—*structureless* (*massive* or *single grain*), *weak*, *moderate*, *strong*; (2) Size—*very fine*, *fine*, *medium*, *coarse*, and *very coarse*; (3) Type—*platy*, *prismatic*, *columnar*, *blocky*, *angular blocky*, *subangular blocky*, *granular*, and *crumb*.

Subsoil. The B horizons of soils that have distinct profiles. In soils that have weak profile development, the subsoil is the

SUMMARY OF IMPORTANT

Soil	Surface soil			Subsoil
	Color [1]	Consistence [2]	Thickness	Color [1]
			Inches	
Bayboro silt loam	Black	Friable	10	Dark grayish brown; mottled
Bayboro mucky loam	Black	Friable	12	Dark grayish brown; mottled
Bertie very fine sandy loam	Dark grayish brown	Very friable	8	Mottled brownish yellow and light gray; olive gray.
Bertie fine sandy loam, olive-gray subsoil variant.	Dark grayish brown	Very friable	8	Pale olive to olive; mottled
Bladen silt loam	Dark gray	Friable	6	Light gray, brownish yellow, and gray; mottled.
Dragston fine sandy loam	Dark grayish brown; mottled	Very friable to friable.	8	Light yellowish brown, pale yellow, and gray; mottled.
Dragston loamy fine sand	Grayish brown	Very friable	11	Yellowish brown to light brownish gray; mottled.
Elkton silt loam	Dark gray; mottled	Friable	11	Gray to light olive gray; mottled
Elkton-Othello very fine sandy loams.	(Elkton) light olive gray to light gray; mottled; (Othello) olive gray to light gray; mottled.	(Elkton) friable; (Othello) friable to firm.	(Elkton) 12; (Othello) 10.	(Elkton) gray; mottled; (Othello) light gray, gray and pale olive; mottled.
Fallsington fine sandy loam	Dark grayish brown to light brownish gray; mottled.	Friable	11	Gray; mottled
Galestown loamy fine sand	Very dark grayish brown	Nearly loose	8	Brownish yellow
Keyport very fine sandy loam	Dark grayish brown to brown	Friable	10	Light yellowish brown, yellowish brown and light yellowish brown; mottled.
Klej loamy fine sand	Dark grayish brown	Nearly loose to very friable.	9	Pale yellow; mottled
Lenoir very fine sandy loam	Very dark brown to brown	Friable	11	Light yellowish brown, pale yellow, and brownish yellow; mottled.
Matapeake fine sandy loam:				
Nearly level phase	Dark brown to yellowish brown.	Friable	9	Brown, strong brown, and yellowish brown; mottled.
Eroded undulating phase	Dark grayish brown	Friable	8	Same
Mattapex very fine sandy loam:				
Nearly level phase	Brown	Friable	8	Light yellowish brown to yellowish brown; mottled.
Undulating phase	Yellowish brown	Friable	7	Same
Othello very fine sandy loam	Grayish brown to light olive gray.	Friable to plastic and sticky.	10	Light olive gray to gray; mottled
Othello loam, dark surface phase.	Very dark brown	Friable	6	Light brownish gray to gray; mottled.
Othello-Fallsington fine sandy loams.	(Othello) dark gray; (Fallsington) dark gray.	(Othello) friable; (Fallsington) friable.	(Othello) 6; (Fallsington) 9.	(Othello) grayish brown to gray; mottled; (Fallsington) dark grayish brown, gray, light olive gray.
Pasquotank very fine sandy loam.	Dark grayish brown	Friable	8	Light brownish gray; mottled
Pocomoke fine sandy loam	Black	Friable	15	Dark grayish brown; mottled
Portsmouth loam	Black	Very friable	15	Light olive gray to light brownish gray; mottled.
Portsmouth mucky loam	Very dark brown to dark grayish brown.	Very friable	13	Grayish brown to gray and light brownish gray; mottled.
Sassafras fine sandy loam:				
Nearly level phase	Dark reddish brown and brown to dark brown.	Very friable	10	Reddish brown, yellowish red, and strong brown; mottled.
Undulating phase	Same	Very friable	8	Same
Sassafras sandy loam, nearly level phase.	Dark grayish brown	Very friable	10	Strong brown

See footnotes at end of table.

soil below the plow layer, or its equivalent of surface soil, in which roots normally grow.

Surface soil. That part of the soil commonly stirred by tillage, or the A layer if thicker than the layer tilled.

Texture, soil. Size of the individual particles that make up the soil mass. The various soil separates, such as sand, silt, and clay, determine texture. A coarse-textured soil is one high in content of sand; a fine-textured soil contains a large proportion of clay.

Topsoil. Presumably fertile soil material used to topdress road-banks, gardens, and lawns.

Water-holding capacity. The ability of the soil to retain moisture.

Watershed. This term refers to the total area above a given point on a stream that contributes water to the flow at that point. Synonyms are drainage basin and catchment basin.

Water table. The upper limit of the part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

CHARACTERISTICS OF THE SOILS

Subsoil—Continued		Drainage	Need for artificial drainage	Estimated suitability for irrigation
Consistence [2]	Thickness			
	Inches			
Very plastic and sticky	20	Very poor	Great	Unsuited.
Plastic and sticky	24	Very poor	Great	Unsuited.
Slightly plastic and slightly sticky	27	Somewhat poor	Moderate	Moderately good.
Same	32	Somewhat poor	Moderate	Moderately good.
Plastic and very sticky	50	Poor to very poor	Very great	Unsuited.
Slightly plastic and slightly sticky	26	Somewhat poor	Moderate	Moderately good.
Slightly plastic and sticky	29	Somewhat poor	Moderate	Moderately good.
Very plastic and sticky	38	Poor	Very great	Unsuited.
(Elkton) very plastic and sticky; (Othello) plastic and slightly sticky.	(Elkton) 18; (Othello) 30.	Poor	Great to very great	Poor.
Slightly sticky	19	Poor	Great	Poor.
Loose	44	Good to somewhat excessive	None	Very good.
Slightly plastic and slightly sticky	21	Moderately good	Moderate	Moderately good.
Nearly loose	21	Moderately good to somewhat poor.	None or slight	Very good.
Plastic and sticky	34	Somewhat poor	Great	Poor.
Slightly plastic and slightly sticky	38	Good	None	Moderately good.
Same	38	Good	None	Moderately good.
Same	48	Moderately good	None or slight	Moderately good.
Same	42	Moderately good	None or slight	Moderately good.
Very plastic and very sticky	25	Poor	Great	Poor.
Very plastic and very sticky	29	Poor	Great	Poor.
(Othello) plastic and sticky; (Fallsington) slightly sticky.	(Othello) 32; (Fallsington) 27.	Poor	Great	Poor.
Plastic and slightly sticky	44	Poor	Great	Poor.
Slightly plastic and sticky	13	Very poor	Great	Moderately good.
Slightly plastic and slightly sticky	12	Very poor	Great	Moderately good.
Plastic	17	Very poor	Great	Moderately good.
Slightly sticky	28	Good	None	Very good.
Slightly sticky	26	Good	None	Very good.
Friable	28	Good	None	Very good.

SUMMARY OF IMPORTANT CHARACTERISTICS

Soil	Surface soil			Subsoil
	Color [1]	Consistence [2]	Thickness	Color [1]
			Inches	
Sassafras loamy fine sand:				
Nearly level phase	Grayish brown to pale yellow	Very friable to friable.	16	Yellowish brown; mottled
Eroded undulating phase	Pale yellow	Very friable	17	Yellowish brown; mottled
Eroded rolling phase	Pale yellow	Very friable	15	Yellowish brown; mottled
Weeksville silt loam	Dark grayish brown	Very friable	15	Dark gray to light gray; mottled
Woodstown fine sandy loam:				
Nearly level phase	Very dark brown, yellowish brown, and yellow to brownish yellow.	Very friable	14	Yellow; mottled
Undulating phase	Same	Very friable	13	Yellow; mottled
Woodstown loamy fine sand:				
Nearly level phase	Dark grayish brown, pale yellow, and yellowish brown; mottled.	Very friable	20	Strong brown; mottled
Undulating phase	Very dark grayish brown	Very friable	15	Grayish brown to light olive brown.

[1] Colors are listed in sequence, from top to bottom, for the various layers.

OF THE SOILS—Continued

Subsoil—Continued		Drainage	Need for artificial drainage	Estimated suitability for irrigation
Consistence [2]	Thickness			
	Inches			
Slightly sticky	29	Good	None	Very good.
Slightly plastic and slightly sticky	17	Good	None	Very good.
Same	14	Good	None	Very good.
Same	39	Poor	Very great	Poor.
Same	22	Moderately good	None or slight	Very good.
Same	23	Moderately good	None or slight	Very good.
Slightly sticky	14	Moderately good	None or slight	Very good.
Slightly sticky	28	Moderately good	None or slight	Very good.

[2] Predominant consistence; the terms *friable*, *firm*, and *loose* refer to soil that is moist, and *plastic* and *sticky* refer to soil that is wet.

U. S. GOVERNMENT PRINTING OFFICE: 1959

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).