United States Department of Agriculture

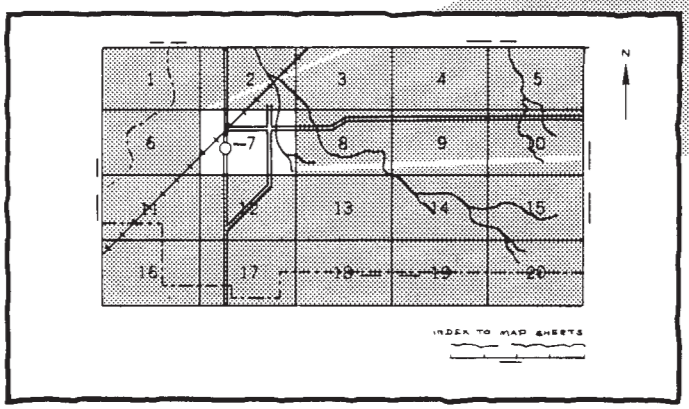
Soil Conservation Service

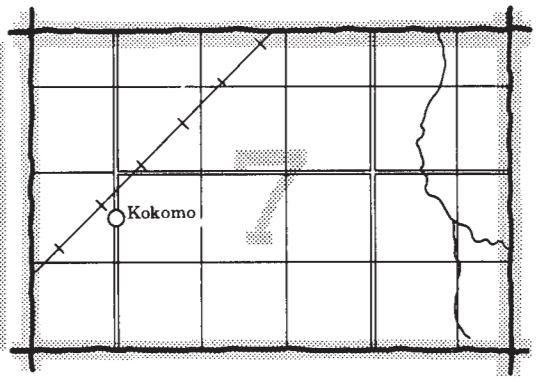
In cooperation with Virginia Polytechnic Institute and State University

Soil Survey of Essex County Virginia

HOW TO USE

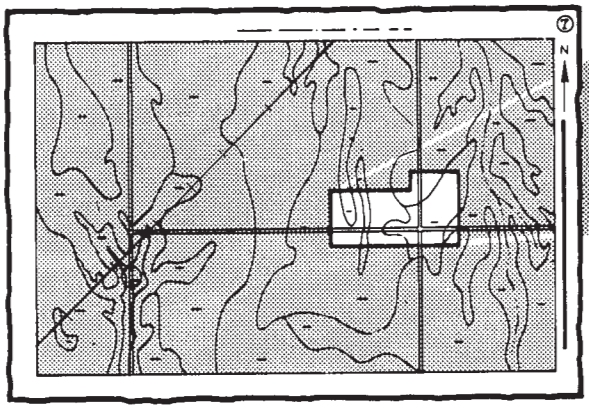
1. Locate your area of interest on the "Index to Map Sheets"

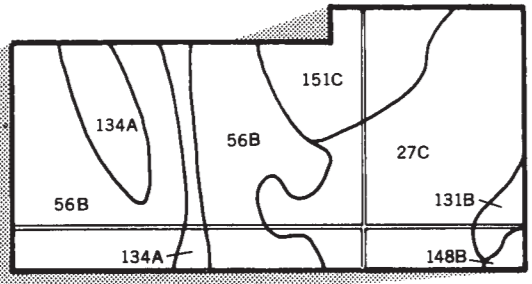




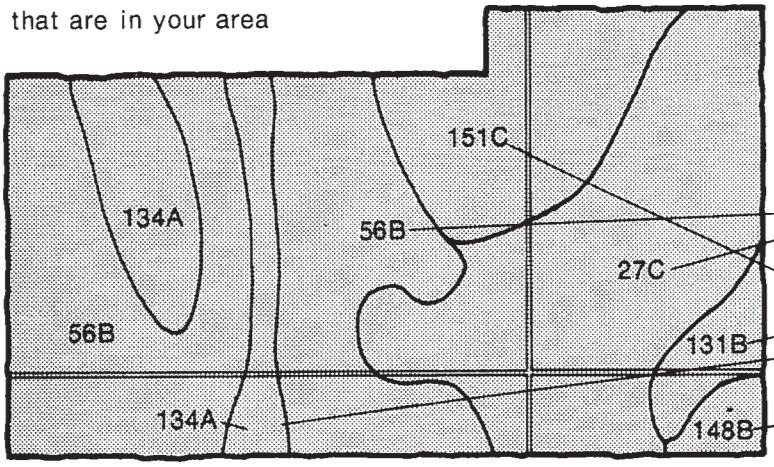
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area

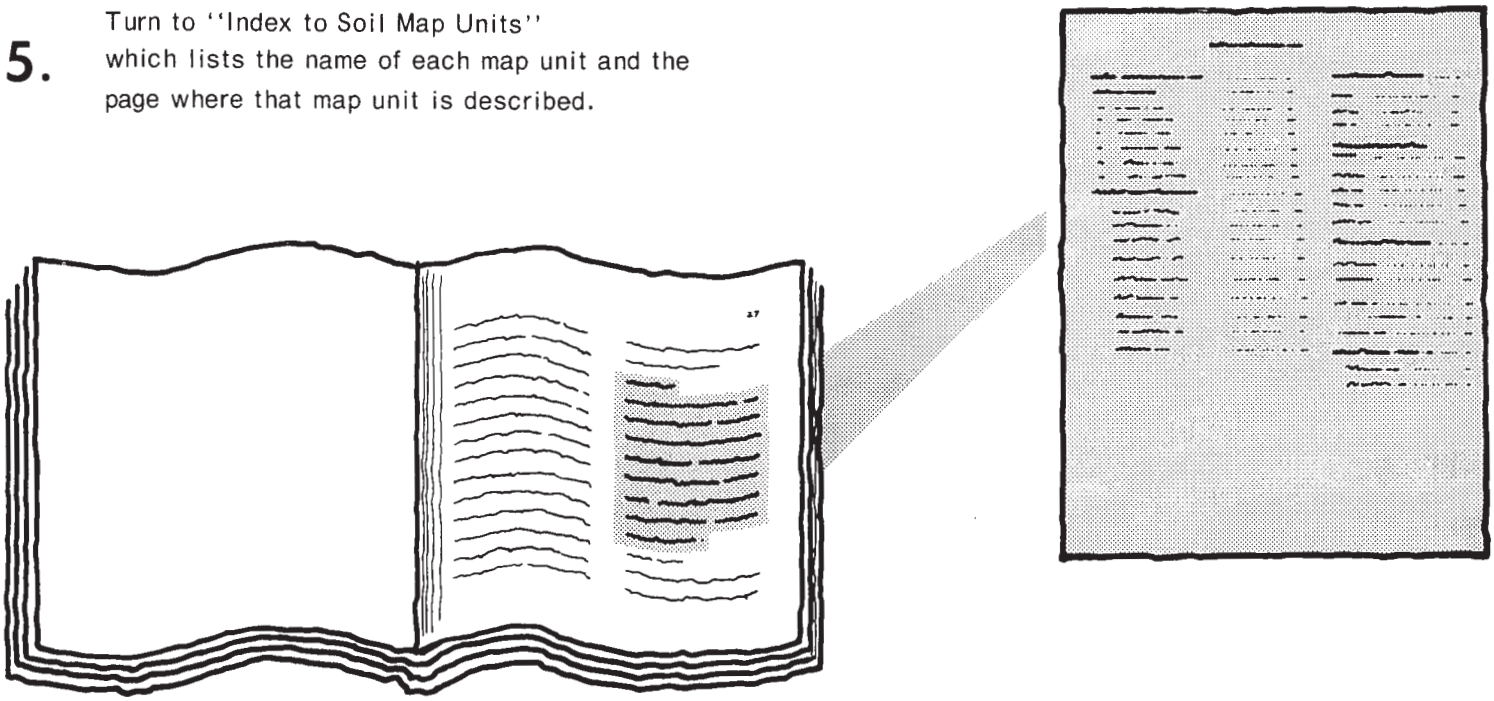


Symbols

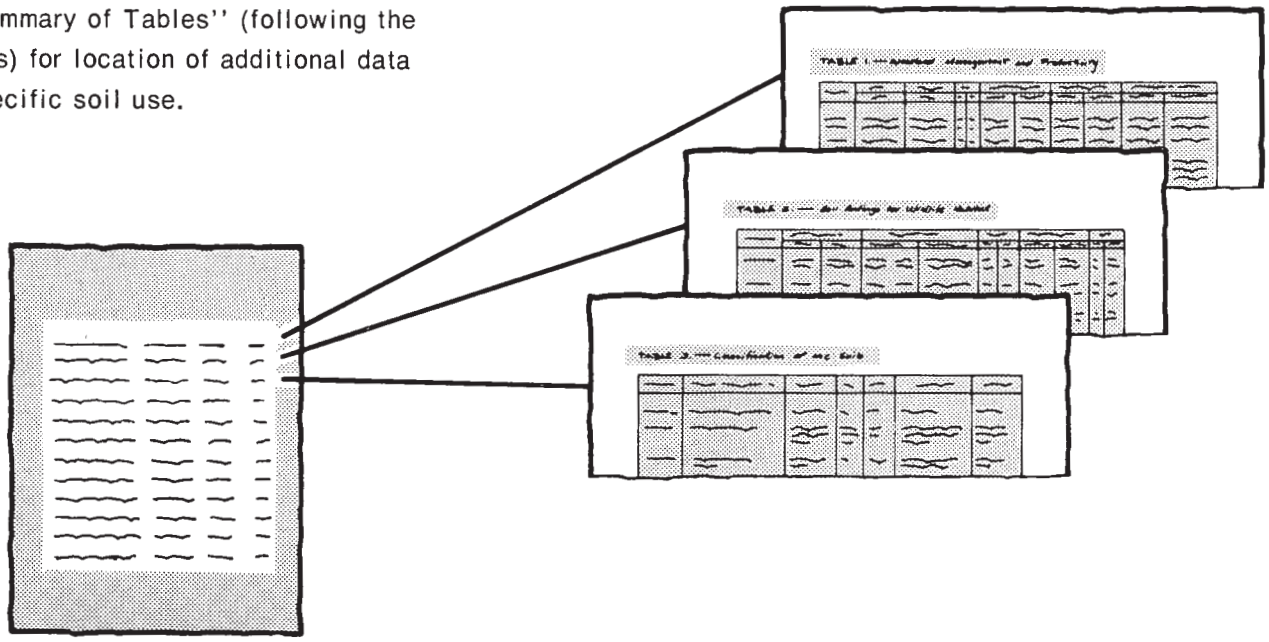
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service and the Virginia Polytechnic Institute and State University. The survey is part of the technical assistance furnished to the Three River Soil and Water Conservation District. This survey was financed in part by the Essex County Board of Supervisors.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Soybeans that were planted using no-till on Kempsville sandy loam, 2 to 6 percent slopes. This is a prime farmland soil.

Contents

Soil Series

Issued April 1989

Index to Map Units

Summary of Tables

Foreword

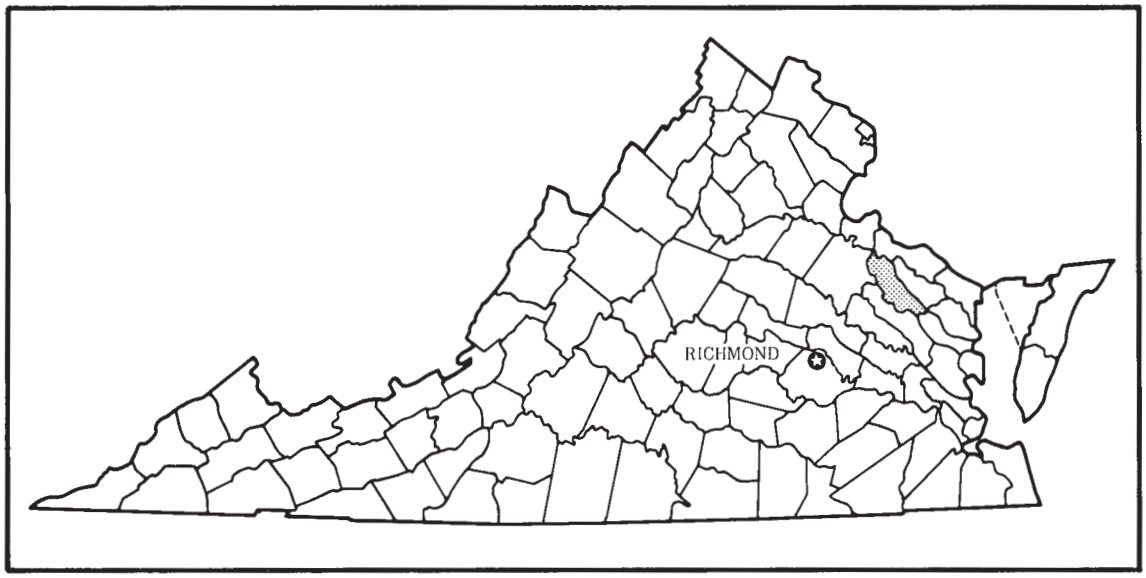
This soil survey contains information that can be used in land-planning programs in Essex County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Norris
State Conservationist
Soil Conservation Service



Location of Essex County in Virginia.

Soil Survey of Essex County, Virginia

By Diane A. S. Hoppe, Soil Conservation Service

Fieldwork by Diane A. S. Hoppe and David L. Jones
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Virginia Polytechnic Institute and State University

ESSEX COUNTY is located in the upper end of the Middle Peninsula of Virginia. It covers 183,680 acres, of which 16,680 acres is water. The county is narrow and elongated in shape. It is bordered on the west by Caroline County, on the southwest by King and Queen County, on the south by Middlesex County, and on the northeast by the Rappahannock River. The Chesapeake Bay is about 25 miles from the southern border of the county. Tappahannock is the county seat. The population of the county in 1980 was 8,864.

The county is primarily an agricultural area. Most farms produce cash-grain crops. Woodland covers about 60 percent of the acreage, and farmland covers 40 percent.

General Nature of the County

This section provides information on the history, climate, physiography, relief, and drainage, transportation, agriculture and industry, and water supply of Essex County.

History

In 1692, Essex County, named after the county of Essex in England, was formed by the Assembly at Jamestown from part of Rappahannock County, Virginia.

During the expedition of Capt. John Smith in 1608, the Rappahannock Indians inhabited this area. Amos Todkill, who was on that expedition, became the first European to stand on land that is now Essex County. By the 1640's, settlements were well established in the area. Conflicts between the Indians and the settlers were common during the next century.

In 1680, the county seat was founded at what was then known as Hobb's Hole or Hobb's Hold and renamed New Plymouth. In 1705, it was renamed Tappahannock, which is an Indian name.

The population of the county was associated mainly with several large plantations. A few of the oldest are Blandfield, deeded in 1680; Brooke's Bank, deeded in 1730; and Elmwood, deeded in 1770. Tobacco was the chief export and principal currency. In 1730, public warehouses for the inspection of tobacco were established in the county at Tappahannock, Bowler's Wharf, and Layton's.

Vauter's Church, on U.S. 17 about 18 miles north of Tappahannock, was the upper church of St. Anne's Parish, formed in 1693. The north half of the structure was built about 1719, and the south half, in 1731. The church has a communion service set presented by Queen Anne of England.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Warsaw, Virginia, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 38.5 degrees F, and the average daily minimum temperature is 28.5 degrees. The lowest temperature on record, which occurred at Warsaw on January 28, 1961, is -4.0 degrees. In summer the average temperature is 76.8 degrees, and the average daily maximum temperature is

87 degrees. The highest recorded temperature, which occurred at Warsaw on June 30, 1959, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 42.69 inches. Of this, 23.54 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 29.04 inches. The heaviest 1-day rainfall during the period of record was 6.41 inches at Warsaw on August 20, 1969. Thunderstorms occur on about 27 days each year, and most occur in summer.

The average seasonal snowfall is 18.8 inches. The greatest snow depth at any one time during the period of record was 21.0 inches. On the average, 5 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 9 miles per hour, in spring.

Physiography, Relief, and Drainage

Essex County is entirely within the southern Coastal Plain. Most of the county is on the Sunderland Terrace, which is in the central part and extends the length of the county. Other parts of the county are on the Wicomico, Chowan, Dismal Swamp, and Princess Anne Terraces. The Sunderland Terrace is about 100 to 200 feet above sea level, and the Wicomico Terrace is about 60 to 90 feet. The Chowan Terrace (30 to 45 feet), Dismal Swamp Terrace (10 to 25 feet), and Princess Anne Terrace (0 to 15 feet) are on low flats bordering the Rappahannock River.

The dividing line between the Sunderland Terrace and the other terraces is a distinct slope or scarp at about 50 feet in elevation that rises to about 100 feet. The uplands are a gently rolling plateau dissected by numerous small and several large drainageways. The plateau is highest at Jacks Fork, which is at an elevation of 201 feet. The other terraces along the Rappahannock River are not distinct except for the Princess Anne Terrace, which comprises soils subject to daily tidal flooding.

The county is drained by the Rappahannock River and tributaries of the Piankatank River. It forms a part of the Chesapeake Bay Watershed. The drainage pattern is dendritic but rather irregularly branched.

Transportation

The principal highways in Essex County are U.S. Route 17, which extends north-south, and U.S. Route 360, which runs east-west. They intersect at Bray's Fork, near Tappahannock.

Passenger or freight rail service is not available in the county. The nearest rail service is about 45 miles west, in Richmond, or 55 miles north, in Fredericksburg.

A small municipal airport is at Tappahannock. Passenger air service is not available in the county. Byrd International Airport is in Richmond, and National Airport is about 90 miles north, in Washington, DC.

Agriculture and Industry

The main crops in the county are corn, soybeans, wheat, and barley. Permanent pastures are few.

Livestock enterprises consist mainly of hogs and a few beef cattle herds. In most of the hog operations, hogs are kept in confinement with automated feeding and water.

The major nonfarm enterprises consist mainly of small sawmills, logging operations, and construction companies. A few production oriented industries are in the town of Tappahannock.

In recent years the rate of clearing woodland has increased. The practices of woodland clearing and drainage have been used to increase the acreage of cropland. In reforestation, woodland is cleared and generally planted to loblolly pine.

Water Supply

Ground water is obtained from several water-bearing strata that are generally between depths of 50 and 140 feet. Wells drilled between these depths are generally for individual residential use. In most areas ground water is high in mineral content, and the best water is from the deeper wells.

The municipal system of Tappahannock is supplied from deep wells located in the town. The well for Tidewater Memorial Hospital, in Tappahannock, is about 570 feet deep.

In other areas of the county livestock is watered from wells or small dugout or embankment ponds.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed

the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material has few or no roots or other living organisms and has been changed very little by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps

because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area (fig. 1). Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Emporia-Slagle-Atlee

Well drained and moderately well drained, nearly level to steep, loamy soils on Coastal Plain uplands

This map unit consists of broad, nearly level plateaus, narrow to broad, gently sloping ridgetops, and strongly sloping and steep side slopes of intervening drainageways that dissect the uplands (fig. 2). It is mainly in that part of the county drained by the Dragon Swamp and its tributaries. Elevation ranges from 50 feet above sea level in the drainageways to 180 feet above sea level. Slope ranges from 0 to 50 percent, and is more than 6 percent on about 20 percent of the acreage.

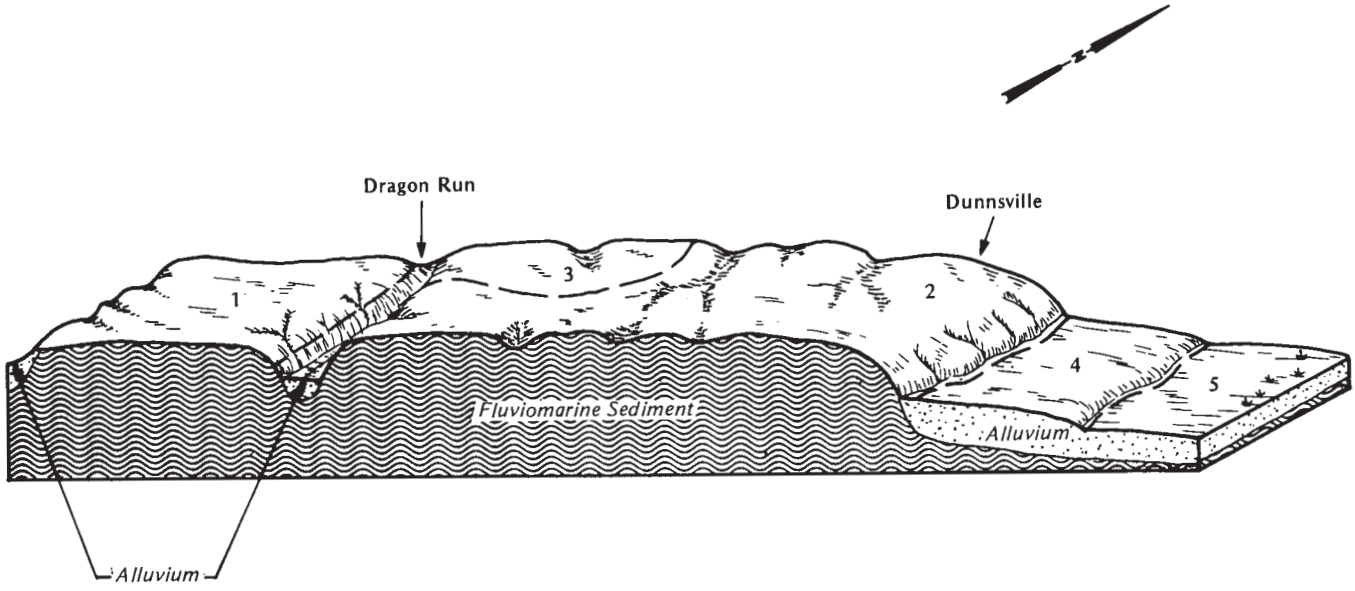


Figure 1.—Cross section of the typical soil patterns of the general soil map. The landmarks shown are Dragon Run and the town of Dunnsville.

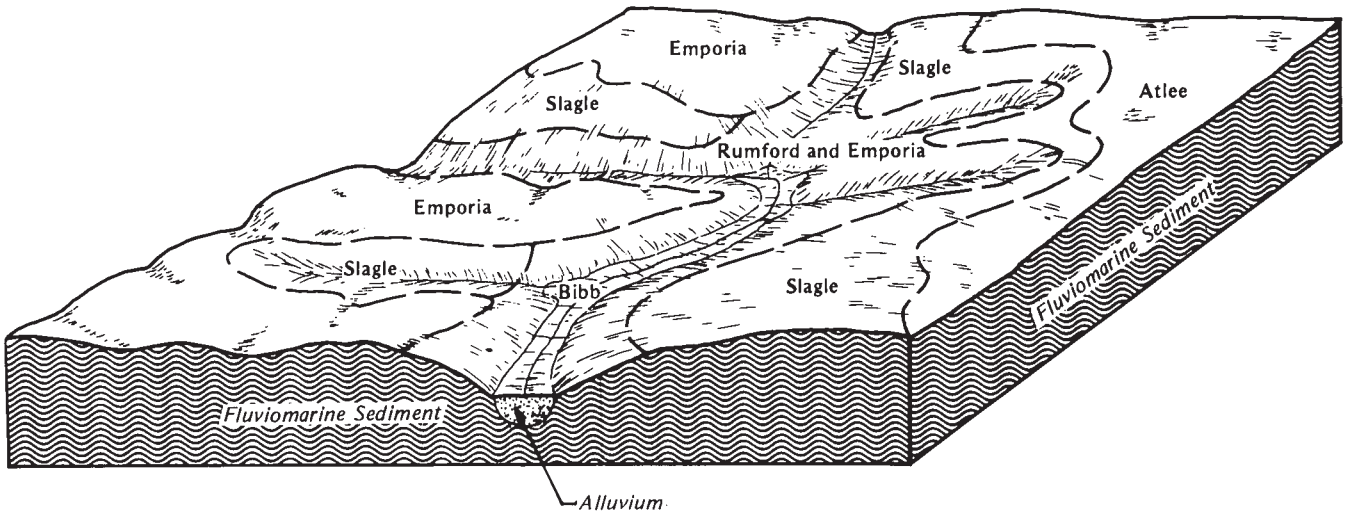


Figure 2.—Typical landscape pattern of the soils and the underlying material in the Emporia-Slagle-Atlee general soil map unit.

This map unit makes up about 16 percent of the county. About 23 percent of the unit is Emporia soils, 22 percent is Slagle soils, 12 percent is Atlee soils, and 43 percent is soils of minor extent.

Emporia soils are on nearly level to gently sloping ridgetops and steep side slopes around drainageways. The soils are well drained. Permeability is moderately slow or slow in the lower part of the subsoil. The surface layer is sandy loam. The subsoil is sandy clay loam and clay loam.

Slagle soils are on gently sloping and strongly sloping, slightly convex ridgetops and in concave areas near the heads of drainageways. The soils are moderately well drained. Permeability is moderately slow to slow in the lower part of the subsoil. The surface layer is fine sandy loam. The subsoil is loam and clay loam.

Atlee soils are on nearly level plateaus, generally between 120 and 170 feet in elevation. The soils are moderately well drained in the subsoil. Permeability is moderately slow in the subsoil. The surface layer is silt loam. The subsoil is loam and clay loam, and has a brittle, compact layer at a depth of about 24 inches.

The common soils of minor extent are poorly drained Bibb soils on flood plains along drainageways, well drained Kempsville soils on nearly level or gently sloping, slightly convex ridgetops, and somewhat excessively drained Rumford soils on strongly sloping and steep slopes along drainageways.

About 20 percent of the acreage in this map unit is farmland. The rest is mostly suited to and is used for trees. The main limitations to urban development in many areas are the seasonal high water table and slope.

2. Rumford-Suffolk-Emporia

Somewhat excessively drained and well drained, nearly level to steep, loamy and sandy soils on Coastal Plain uplands

This map unit consists of nearly level to strongly sloping, broad to narrow ridgetops and strongly sloping and steep side slopes of drainageways that dissect the uplands (fig. 3). Elevation ranges from less than 50 feet above sea level in the drainageways to 180 feet on the higher knolls of ridges. Slope ranges from 0 to 50 percent, and is more than 6 percent on about 55 percent of the acreage.

This map unit makes up about 45 percent of the county. About 28 percent of the map unit is Rumford soils, 18 percent is Suffolk soils, 16 percent is Emporia soils, and 38 percent is soils of minor extent.

Rumford soils are on steep side slopes along drainageways and, to some extent, on gently sloping ridgetops. The soils are somewhat excessively drained. Permeability is moderately rapid in the subsoil. The surface layer is loamy sand. The subsoil is sandy loam and loamy sand.

Suffolk soils are on nearly level and gently sloping, broad to narrow, slightly convex ridgetops. The soils are well drained. Permeability is moderate. The surface layer is sandy loam. The subsoil is sandy loam and sandy clay loam underlain by loamy sand and sand.

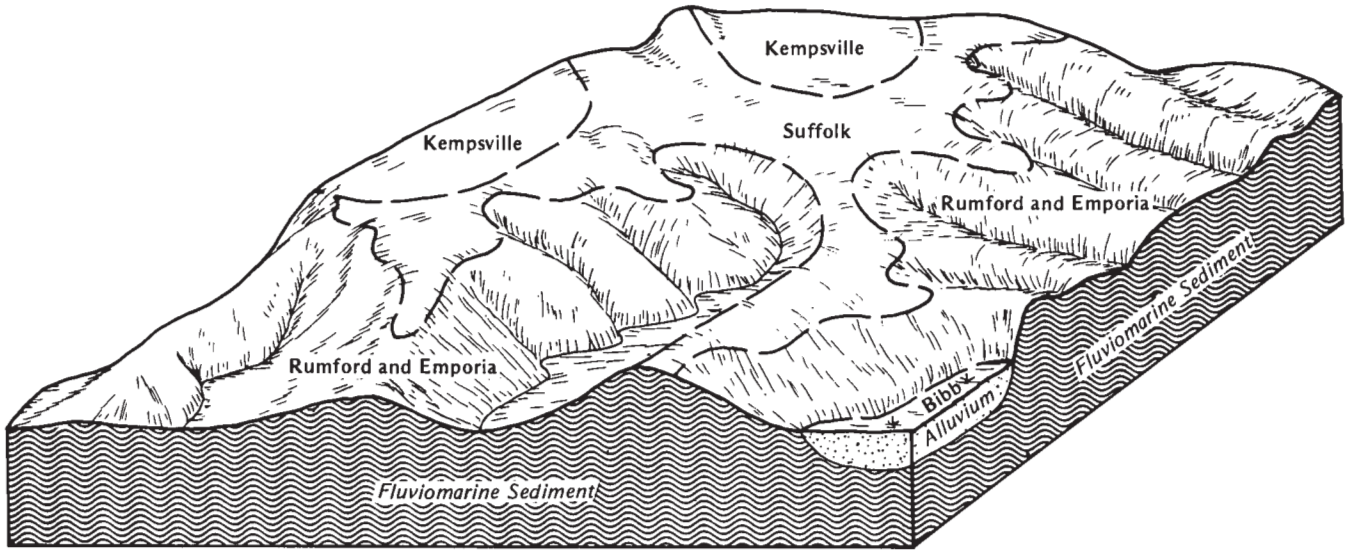


Figure 3.—Typical landscape pattern of the soils and the underlying material in the Rumford-Suffolk-Emporia general soil map unit.

Emporia soils are on steep side slopes along drainageways and on nearly level to strongly sloping, slightly convex ridgetops. The soils are well drained. Permeability is slow in the lower part of the subsoil. The surface layer is sandy loam. The subsoil is clay loam or sandy clay loam.

The common soils of minor extent are well drained Kempsville soils on gently sloping, slightly convex ridgetops and moderately well drained Slagle soils on gently sloping knolls on ridgetops and on steep side slopes of drainageways and poorly drained Bibb soils on flood plains along drainageways.

About 35 percent of the acreage in this map unit, mostly in nearly level and gently sloping areas, is farmland. The rest is mostly suited to and is used for trees. The main limitations to urban development are slope and the seasonal high water table.

3. Emporia-Rumford-Slagle

Well drained, somewhat excessively drained, and moderately well drained, gently sloping to steep, loamy and sandy soils on Coastal Plain uplands

This map unit consists of nearly level to strongly sloping, narrow to broad ridgetops and strongly sloping and steep side slopes of drainageways that dissect the uplands. Elevation ranges from less than 50 feet above sea level in the drainageways to 200 feet on the higher ridges in the northwestern part of the county. Slope ranges from 0 to 50 percent, and is more than 6 percent on about 42 percent of the acreage.

This map unit makes up about 13 percent of the county. About 26 percent of the map unit is Emporia soils, 12 percent is Rumford soils, 10 percent is Slagle soils, and 52 percent is soils of minor extent.

Emporia soils are on intricately sloping, highly dissected, generally narrow ridges and on steep side slopes of drainageways. The soils are well drained. Permeability is moderately slow to slow in the lower part of subsoil. The surface layer is sandy loam. The subsoil is sandy clay loam and clay loam.

Rumford soils are mainly on strongly sloping and steep side slopes of drainageways. The soils are somewhat excessively drained. Permeability is moderately rapid in the subsoil. The surface layer is loamy sand. The subsoil is sandy loam and loamy sand.

Slagle soils are on gently sloping and strongly sloping, slightly convex ridgetops, and in concave areas around the heads of drainageways. The soils are moderately well drained. Permeability in the lower part of the subsoil is moderately slow or slow. The surface layer is fine sandy loam. The subsoil is loam and clay loam.

The common soils of minor extent are well drained Suffolk and Kempsville soils on nearly level and gently sloping ridgetops and poorly drained Bibb soils on flood plains along drainageways.

About 20 percent of the acreage in this soil map unit is farmed, mostly in nearly level and gently sloping areas. The rest of the map unit is suited to and is used for trees. The main limitations to most kinds of urban

development are slope and the seasonal high water table.

4. Tetotum-Tomotley-State

Moderately well drained, poorly drained, and well drained, nearly level and gently sloping, loamy soils on the middle terrace

This map unit is mainly on a broad, flat terrace that lies to the east of U.S. Highway 17, and runs the length of the county (fig. 4). Elevation ranges from about 10 feet above sea level to about 50 feet. The seasonal high water table is in about three-fourths of the acreage of this map unit. Slope ranges from 0 to 6 percent.

This map unit makes up about 18 percent of the county. About 30 percent of the unit is Tetotum soils, 16 percent is Tomotley soils, 12 percent is State soils, and 42 percent is soils of minor extent.

Tetotum soils are on nearly level, broad flats and in gently sloping areas around drainageways. They are moderately well drained. Permeability is moderate. The surface layer is loam. The subsoil is mottled, sandy clay loam to fine sandy loam.

Tomotley soils are on nearly level, broad flats and in depressional areas. They are poorly drained. Permeability is moderate. The surface layer is fine sandy loam. The subsoil is clay loam and sandy clay loam.

State soils are on nearly level to gently sloping, broad flats. They are well drained. Permeability is moderate. The surface layer is fine sandy loam. The subsoil is sandy clay loam or loam that is underlain by loamy sand.

The common soils of minor extent are moderately well drained Munden soils on broad flats, somewhat poorly drained Augusta soils in depressions and ill-defined drainageways, and poorly drained, clayey Chickahominy soils on flats near the base of the escarpment on the uplands.

Most of the acreage in this map unit is used for cultivated crops. A small percentage is wooded. The main limitation to urban development is the seasonal high water table.

5. Rappahannock-Molena-Pamunkey

Very poorly drained, somewhat excessively drained, and well drained, nearly level and gently sloping, mucky, sandy, and loamy soils on the low, fluvial terrace

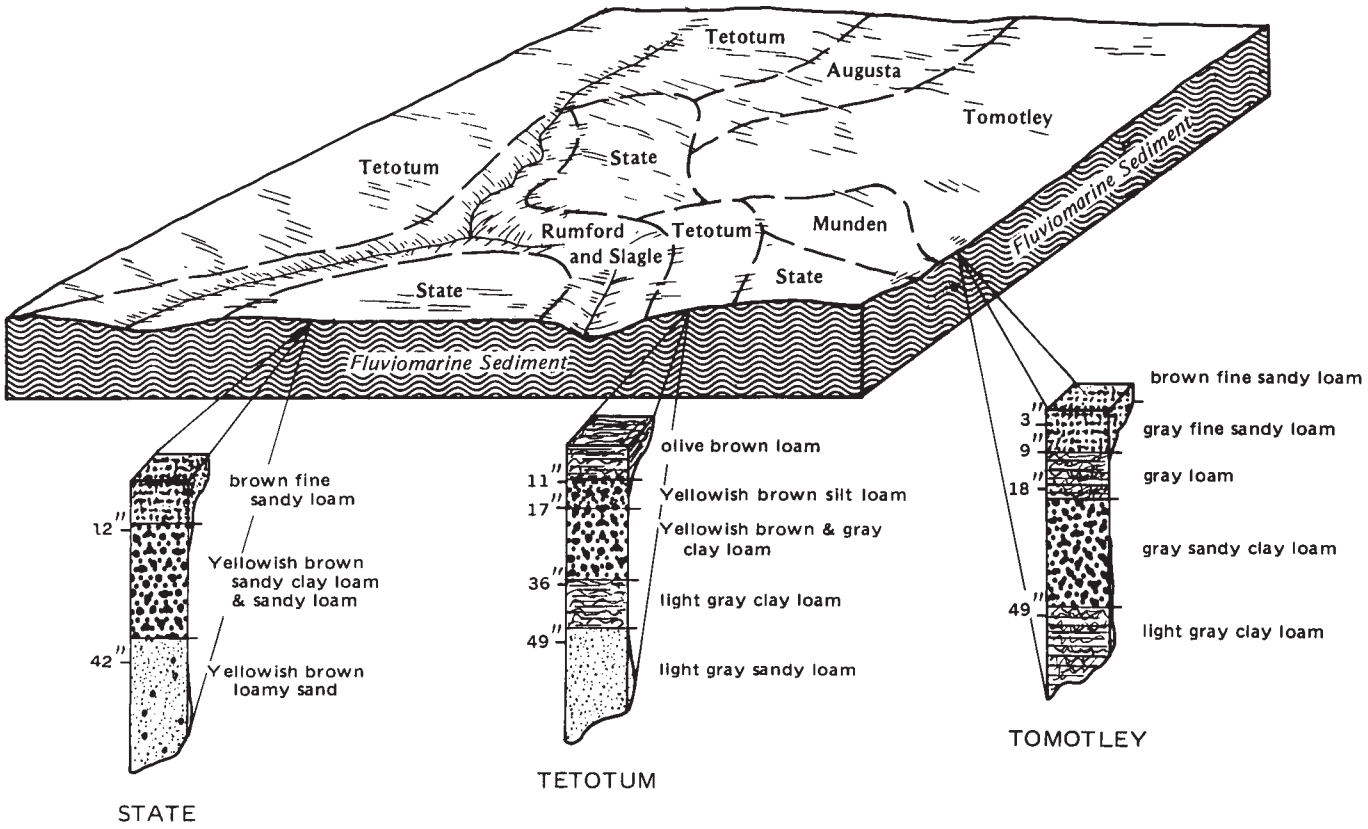


Figure 4.—Typical landscape pattern of the soils, abstraction of the underlying material, and projections of soil profiles in the Tetotum-Tomotely-State general soil map unit.

This map unit consists of broad, low-lying flats along the Rappahannock River and major creeks. Elevation ranges from sea level to about 15 feet above sea level. Slope ranges from 0 to 6 percent.

This map unit makes up about 8 percent of the county. About 32 percent of the unit is Rappahannock soils, 15 percent is Molena soils, 12 percent is Pamunkey soils, and 41 percent is soils of minor extent.

Rappahannock soils are in tidal marshes along the Rappahannock River and major creeks. They are nearly level and very poorly drained, and consist of organic material (muck) to a depth of about 40 inches.

Molena soils are on broad flats mainly at the north end of the county. They are nearly level and gently sloping, and somewhat excessively drained. Permeability is rapid. The surface layer is loamy sand. The subsoil is loamy sand or sandy loam that is underlain by sand.

Pamunkey soils are on narrow flats along the Rappahannock River. They are nearly level and well drained. Permeability in the upper subsoil is moderate. The seasonal high water table is at a depth of 4 to 6 feet. The surface layer is loam. The subsoil is loam, fine sandy loam, and clay loam.

The common soils of minor extent are very poorly drained Levy soils on freshwater marshes at the north end of the county and moderately well drained Bolling and Munden soils in depressional areas and ill-defined drainageways.

About half of the acreage in this map unit is farmland. The rest is in tidal or freshwater marshes. Some areas are used for waterfront development. The main limitations to urban development in some areas are the seasonal high water table and flooding.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kempsville sandy loam, 0 to 2 percent slopes, is one of several phases in the Kempsville series.

Some map units are made up of two or more major soils. These map units are called undifferentiated groups.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Rumford and Slagle soils, 6 to 15 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

1A—Atlee silt loam, 0 to 2 percent slopes. This is a very deep, nearly level, moderately well drained soil on broad, dissected ridgetops on Coastal Plain uplands. Areas of the soil are elongated and rectangular or oval. They range from about 3 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 2 inches, dark grayish brown silt loam

Subsurface layer:
2 to 10 inches, pale brown silt loam

Subsoil:
10 to 14 inches, yellowish brown silt loam
14 to 26 inches, yellowish brown loam
26 to 52 inches, somewhat brittle and compact yellowish brown clay loam that has light brownish gray and pale brown mottles
52 to 60 inches, multicolored yellowish brown, red, and gray clay loam

Substratum:
60 to 72 inches, gray clay loam that has red and yellowish brown mottles

Included with this soil in mapping are small areas, generally less than 3 acres in size, of well drained

Emporia and Kempsville soils. These soils are in slightly higher landscape positions than the Atlee soil or are intricately mixed with the Atlee soil. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer and in the upper part of the subsoil, moderately slow in the middle part of the subsoil, and moderately slow or moderate in the lower part of the subsoil and in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to moderately acid in the surface layer and the subsurface layer and extremely acid to strongly acid below.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is easily tilled when moist. In some areas it becomes firm and difficult to till if plowed when too wet.
Water table: The seasonal high water table is at a depth of 1 1/2 to 2 1/2 feet in winter and early spring.
Root zone: Somewhat restricted by a brittle, compact layer at a depth of 26 inches.
Shrink-swell potential: Moderate in the lower part of the subsoil.

Most areas of this soil are woodland (fig. 5). A few areas are farmed. They are used for row crops and small grains, or for pasture. This is a prime farmland soil.

This soil is moderately well suited to cultivated crops and hay. The major management concern is surface wetness, which results in poor soil tilth if the soil is cultivated when too wet. Suitable management practices are increasing organic matter content, use of lime and fertilizer to offset acidity and to increase fertility, and surface drainage. If the soil is used for cultivated crops, conservation tillage, cover crops, and grasses and legumes included in the cropping system help to increase organic matter content and to maintain soil tilth. Crop residue kept on or near the surface helps to control erosion. Chisel plowing to a depth of 12 to 18 inches every 3 to 5 years improves soil aeration and root development.

This soil is moderately well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing the pasture decreases some desirable grasses and legumes and reduces yields. Grazing during the seasons when the soil is wet commonly cuts up or compacts the surface soil and thus reduces yields and soil aeration. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 100 cubic feet. The soil is managed for both pine and hardwoods. The windthrow hazard is slight. The seasonal high water table limits the use of timber equipment. Use of timber equipment during wet seasons compacts the surface layer and makes deep tracks and depressions that pond water.

The main limitations to use of this soil for urban development are the seasonal high water table and slow permeability. These soil properties limit use of the soils as sites for buildings, sanitary landfills, and septic tank absorption fields and most types of recreation. Low strength and moderate shrinking and swelling make the soil a poor subgrade material for local roads and streets.

The capability subclass is IIw.

2A—Augusta fine sandy loam, 0 to 2 percent slopes. This is a very deep, somewhat poorly drained, nearly level soil on the middle terrace along the Rappahannock River. Areas of the soil are irregular in shape to oval. They range from 3 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 7 inches, grayish brown fine sandy loam that has strong brown mottles

Subsoil:
7 to 18 inches, light olive brown clay loam that has light brownish gray and yellowish brown mottles
18 to 28 inches, light brownish gray clay loam that has yellowish brown mottles
28 to 50 inches, light gray sandy loam that has strong brown mottles

Substratum:
50 to 72 inches, light gray clay loam that has strong brown mottles

Included with this soil in mapping are small intermingled areas, generally less than 3 acres in size, of moderately well drained Munden and Tetotum soils in slightly higher landscape positions and poorly drained Tomotley soils in slightly depressional areas. Included soils make up 5 to 10 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer and moderate in the subsoil and the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid, if the soil has not been limed.

Figure 5.—Pine plantation with understory vegetation on Atlee silt loam, 0 to 2 percent slopes. This is a prime farmland soil.

Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is easily tilled when moist. In some areas it becomes firm and difficult to till if plowed when too wet.

Water table: The seasonal high water table is at a depth of 1 to 2 feet in winter and early spring or during periods of prolonged wetness.
Root zone: Somewhat restricted by the seasonal high water table.
Shrink-swell potential: Low.

Most areas of this soil are woodland (fig. 6). A few areas are farmed. They are used for cultivated crops and, to a limited extent, pasture and hay.

This soil is moderately well suited to cultivated crops and hay. This is a prime farmland soil, where drained. If a subsurface tile drainage system is installed, it is well suited to cultivated crops. The major management concerns are the seasonal high water table and maintenance of drainage systems. Suitable management practices are increasing organic matter content and use of lime and fertilizer to offset acidity and to increase fertility. If the soil is used for cultivated crops, minimizing dead furrows and slight depressions helps to prevent temporary ponding. Conservation tillage, cover crops, and grasses and legumes included in the cropping system help to increase organic matter content and to maintain soil tilth. Crop residue kept on or near the surface helps to control erosion. Chisel plowing to a depth of 10 to 16 inches every 3 to 5 years improves soil aeration and root development.

This soil is well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility. Artificial drainage is needed. Overgrazing decreases some desirable grasses and legumes and reduces yields. Grazing during the seasons when the soil is wet commonly cuts up or compacts the surface, and thus reduces yields.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. The soil is managed mostly for pine and partly for hardwoods. Seedling mortality is moderate. The seasonal high water table limits the use of timber equipment. If used during wet seasons timber equipment compacts the surface layer, and cuts up and leaves deep traces and depressions that pond water.

Figure 6.—Clearcutting on Augusta fine sandy loam, 0 to 2 percent slopes. This is a prime farmland soil, where drained.

The main limitation to urban and most types of recreation development is the seasonal high water table. This soil property limits use of the soil as sites for buildings, sanitary landfills, and septic tank absorption fields. It also makes the soil a poor subgrade material for local roads and streets.

The capability unit is IIIw.

3A—Bibb sandy loam, 0 to 2 percent slopes, frequently flooded. This is a very deep, nearly level, poorly drained soil on flood plains along streams at the base of steep slopes. It is subject to frequent flooding in late winter and early spring. Areas of this soil are long and winding, and range from 10 to 100 acres. Slope is dominantly less than 1 percent, but ranges from 0 to 2 percent.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 4 inches, dark brown sandy loam

Substratum:
4 to 22 inches, grayish brown loam that has yellowish brown mottles
22 to 36 inches, gray loamy sand
36 to 48 inches, gray sandy loam
48 to 72 inches, light gray, stratified coarse sand and sandy loam

Included with this soil in mapping are areas of very poorly drained Levy soils in depressional areas and somewhat excessively drained Catpoint soils on gently sloping benches in slightly higher landscape positions. Also included are very poorly drained Rappahannock soils adjacent to tidal areas and small bodies of open water. Included soils make up more than 15 percent of the map unit.

Soil properties:

Permeability: Moderate.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid.
Surface runoff: Very slow.
Erosion hazard: Slight.
Water table: The seasonal high water table ranges from near the surface to a depth of 1 1/2 feet in winter and early spring.
Root zone: Restricted by the high water table near the surface.
Shrink-swell potential: Low.
Flooding: Frequently flooded in winter and early spring.

Nearly all areas of this soil are woodland. A few areas are used as pasture.

This soil is not suited to cultivated crops, but is moderately well suited to pasture. The major management concerns are flooding and the seasonal high water table. Grazing during wet seasons cuts up and compacts the surface and increases ponding. Deferred grazing, rotation grazing, lime and fertilizer, harvesting at the proper stage of plant growth, and weed and brush control help to increase the quantity and quality of feed and forage.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. The seasonal high water table and flooding cause high seedling mortality and limit the use of timber equipment to dry periods.

The main limitations to most kinds of urban development are the seasonal high water table and flooding. The soil is suited to developing a habitat for wetland wildlife.

The capability subclass is Vw.

4A—Bojac loamy sand, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on low, stream terraces along the Rappahannock River. Areas of this soil commonly are broad and irregular in shape. They range from about 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 2 inches, dark grayish brown loamy sand
2 to 7 inches, yellowish brown loamy sand

Subsoil:
7 to 25 inches, yellowish brown sandy loam
25 to 40 inches, strong brown sandy clay loam

Substratum:
40 to 72 inches, brownish yellow loamy sand that has light gray and very pale brown mottles

Included with this soil in mapping are small areas of well drained State soils and moderately well drained Munden soils. State soils are in slightly higher areas throughout the map unit, and Munden soils are in swales and around poorly defined drainageways. Also included are soils that have slope of 3 to 6 percent. Included soils make up about 15 percent of the map unit.

Soil properties:

Permeability: Rapid in the surface layer, moderately rapid in the subsoil, and rapid in the substratum.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.

Soil reaction: In unlimed areas extremely acid to slightly acid in the surface layer and the subsoil and very strongly acid to moderately acid in the substratum.
Surface runoff: Slow.
Erosion hazard: Wind erosion is a moderate hazard, and water erosion is a slight hazard.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The seasonal high water table is at a depth of 4 to 6 feet during wet seasons.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

About half of the acreage of this soil is farmed. The rest is woodland.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer, but available water capacity in some areas limits growth and reduces yields. Soil blowing in spring commonly damages or covers up small plants. Conservation tillage, cover crops, grasses and legumes included in the cropping system, stubble mulching, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to control erosion, to reduce crop damage, and to improve the moisture holding capacity of the soil.

This soil is well suited to pasture. Overgrazing causes surface compaction and damages the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. Droughtiness causes high seedling mortality.

The main limitations to urban development are the seasonal high water table, moderately rapid permeability in the subsoil, and coarse texture of the soil. The seasonal high water table and moderately rapid permeability in the subsoil limit use of the soil as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. Coarse texture of the soil causes sloughing of excavations. Droughtiness limits use of the soil for lawns and landscaping.

The capability subclass is IIs.

5A—Bolling silt loam, 0 to 2 percent slopes. This is a very deep, nearly level, moderately well drained soil in slight depressions and poorly defined drainageways on low stream terraces along the Rappahannock River. Areas of this soil commonly are elongated or oval. They range from about 3 to 150 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, dark yellowish brown silt loam

Subsoil:
8 to 17 inches, yellowish brown clay loam
17 to 22 inches, yellowish brown clay loam that has light brownish gray mottles
22 to 32 inches, yellowish brown loam that has light brownish gray and strong brown mottles
32 to 40 inches, light yellowish brown sandy clay loam that has strong brown mottles

Substratum:
40 to 72 inches, yellowish brown stratified loamy sand and sand

Included with this soil in mapping are small areas of well drained Pamunkey soils and somewhat excessively drained Molena soils. Pamunkey soils are in slightly higher areas throughout the map unit, and Molena soils are on slightly higher, subdued ridges. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Moderate or moderately rapid in the surface layer and moderate in the subsoil and the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Moderate.
Soil reaction: Very strongly acid to neutral in the surface layer and in the upper part of the subsoil and moderately acid to neutral in the lower part.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is easily tilled when moist. It becomes firm and cannot be easily tilled if plowed when too wet.
Water table: The seasonal high water table is at a depth of 1 1/2 to 2 1/2 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of this soil are farmed. A few areas are pasture or woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and wetness commonly interferes with tillage and crop harvest. An adequate surface drainage system generally helps to remove surface water, if suitable outlets are available. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to maintain organic matter content and soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and damages the stand of grasses and

legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soil is soft when wet, and thus limits the use of heavy timber equipment.

The main limitations of this soil for urban development are the seasonal high water table and low strength of the subsoil. The seasonal high water table severely limits the use of the soil as sites for sanitary facilities, small commercial buildings, and roads and streets and for most types of recreation. Low strength makes the soil a poor subgrade material for local roads and streets.

The capability subclass is IIw.

6B—Catpoint loamy sand, 0 to 6 percent slopes. This is a very deep, nearly level to gently sloping, somewhat excessively drained soil on low-lying terraces along major drainageways. Areas of the soil commonly are elongated and parallel to large streams and drainageways. They range from about 5 to 10 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 7 inches, dark yellowish brown loamy sand

Subsurface layer and subsoil:
7 to 20 inches, brownish yellow loamy sand
20 to 35 inches, very pale brown sand that has brownish yellow mottles
35 to 72 inches, very pale brown sand that has a few horizontal layers of yellowish brown sandy loam

Included with this soil in mapping are small areas of moderately well drained Munden and Tetotum soils in slight depressions adjacent to smaller or poorly defined drainageways. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Rapid or very rapid.
Available water capacity: Very low.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to slightly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Moderate.
Tilth: The surface is friable and can be easily tilled.
Water table: The seasonal high water table ranges from 4 to 6 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are woodland. A few areas are farmed.

This soil is moderately well suited to cultivated crops and hay. It is droughty during the growing season. Very low available water capacity limits crop response to lime and fertilizer. The major management concern, especially during the early growing season, is the moderate erosion hazard. Soil blowing commonly damages or covers up small plants. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and stubble mulching help to increase organic matter content, to maintain soil tilth, to control erosion, to reduce crop damage, and to improve the moisture holding capacity of the soil.

This soil is moderately well suited to pasture. Overgrazing cuts up the soft surface and damages the stands of grasses and legumes, and thus reduces yields and increases the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, and to control erosion.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. Low available water capacity during the growing season limits seed and seedling survival.

The main limitations to use of this soil for urban development are sandy texture and rapid permeability in the subsoil. Seepage caused by rapid permeability and the seasonal high water table limit use of the soil as sites for sewage lagoons, septic tank absorption fields, and sanitary landfills. If the soil is used as sites for septic tank absorption fields, pollution of ground water and nearby streams is a hazard because the soil readily absorbs but does not adequately filter the effluent. Sandy texture limits use of the soil for shallow excavations, daily cover for landfills, and some types of recreation. The soil is a fair subgrade material for local roads and streets.

The capabiltiy subclass is IIIs.

7A—Chickahominy silt loam, 0 to 2 percent slopes. This is a very deep, nearly level, and poorly drained soil on broad, low-lying flats below 50 feet in elevation, generally near the escarpment to the uplands. Areas of this soil are irregular in shape or oval. They range from about 3 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, light brownish gray silt loam

Subsoil:
8 to 12 inches, grayish brown silty clay
12 to 39 inches, dark gray clay that has yellowish red and grayish brown mottles
39 to 46 inches, grayish brown clay that has yellowish red mottles
46 to 72 inches, light gray clay that has yellowish brown mottles

Included with this soil in mapping are small areas of moderately well drained Tetotum soils in slightly higher areas and poorly drained Tomotley soils on landscapes similar to those of the Chickahominy soil. Also included are soils where water is ponded on the surface in winter and early spring and during periods of prolonged rainfall. Included soils make up about 15 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer, moderately slow in the subsoil, and very slow in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to very strongly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is difficult to till because of wetness.
Water table: The seasonal high water table is at or near the surface in winter and spring.
Root zone: Somewhat restricted by the seasonal high water table.
Shrink-swell potential: High.

Most areas of this soil are woodland. A few areas are used for cultivated crops.

This soil is poorly suited to cultivated crops and moderately suited to hay. Crops respond well to lime and fertilizer. The soil, however, is wet and cold in spring and wetness commonly interferes with tillage and damages crops. Surface drainage systems help to remove surface water if suitable outlets are available. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to improve organic matter content, to maintain soil tilth, to reduce clodding, and to increase water infiltration.

This soil is moderately suited to pasture. Overgrazing and grazing when the soil is wet compacts the surface layer and damages the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. Seedling mortality is severe. The soil is soft when wet, and thus limits the use of heavy timber equipment.

The main limitations of this soil for urban development are the seasonal high water table, very slow permeability, and high shrinking and swelling in the subsoil. These soil properties severely limit use of the soil as sites for buildings, sanitary landfills, and septic tank absorption fields and for most types of recreation.

The capability subclass for undrained soil is IVw.

8A—Dogue loam, 0 to 2 percent slopes. This is a very deep, nearly level, moderately well drained soil on broad, middle terraces along the Rappahannock River. Areas of this soil mostly are oval or rectangular. They range from about 3 to 50 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 2 inches, dark brown loam

Subsurface layer:
2 to 8 inches, light yellowish brown loam

Subsoil:
8 to 17 iches, yellowish brown clay loam
17 to 24 inches, light olive brown clay that has strong brown mottles
24 to 35 inches, pale brown clay that has yellowish brown and light brownish gray mottles
35 to 53 inches, gray clay that has yellowish brown mottles

Substratum:
53 to 72 inches, light gray, stratified clay loam and sand.

Included with this soil in mapping are small areas of well drained State soils, moderately well drained Tetotum soils, somewhat poorly drained Newflat soils, and poorly drained Chickahominy soils. State and Tetotum soils are in slightly higher landscape positions. Newflat and Chickahominy soils are in depressional areas and poorly defined drainageways. Also included are soils that have slope of 3 to 6 percent. Included soils make up about 15 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer, moderately slow in the subsoil, and moderate or moderately rapid in the substratum.
Available water capacity: Moderate.

Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is friable and can be easily tilled throughout a wide range of moisture content.
Water table: The seasonal high water table is at a depth of 1 1/2 to 3 feet in winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of this soil are wooded. Some areas are farmed, and a few areas are pasture. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. The soil is wet and cold in the early spring, and wetness commonly interferes with early tillage. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to improve organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing and grazing when the soil is wet cause surface compaction and damage the stands of grasses and legumes. Overgrazing also increases runoff and the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. Seeds and seedlings survive and grow well. The soil is soft when wet, and consequently limits the use of heavy timber equipment.

The main limitations to use of this soil for urban development are the seasonal high water table, moderately slow permeability, and shrinking and swelling in the subsoil. The seasonal high water table and moderately slow permeability limit use of the soil as sites for buildings, sanitary landfills, and septic tank absorption fields. Shrinking and swelling in the subsoil limits use of the soil as subgrade material for roads and streets and as building foundations.

The capability subclass is IIw.

9A—Emporia sandy loam, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on narrow upland ridges. Areas of this soil commonly are long and narrow, or oval. They range from about 5 to 50 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 3 inches, grayish brown sandy loam

Subsurface layer:
3 to 9 inches, yellowish brown loam

Subsoil:
9 to 13 inches, yellowish brown and clay loam
13 to 24 inches, strong brown clay loam that has yellowish red and yellowish brown mottles
24 to 42 inches, brownish yellow sandy clay loam that has strong brown and yellowish red mottles
42 to 72 inches, yellowish brown sandy clay loam and clay loam that has gray, brown, and red mottles

Included with this soil in mapping are small areas of well drained Kempsville soils and moderately well drained Slagle soils. Kempsville soils are on small knolls, and Slagle soils are in shallow depressions or around drainageways. Included soils make up about 10 percent of the map unit. In some map units in the Miller's Tavern-Dunbrooke area, the surface layer and the substratum are sandier than typical of the Emporia soil.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderately slow or moderate in the upper part of the subsoil, moderately slow or slow in the middle part, and slow to moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The perched seasonal high water table is at a depth of 3 to 4 1/2 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of this soil are farmed. Some small areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing causes surface compaction and reduces the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 100 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

The main limitations of this soil for urban development are low strength, moderate shrinking and swelling, the seasonal high water table, and slow permeability in the subsoil. Low strength and moderate shrinking and swelling limit use of the soil as building sites. The perched seasonal high water table limits excavations. Slow permeability and the seasonal high water table limit use of the soils as sites for septic tank absorption fields.

The capability class is I.

9B—Emporia sandy loam, 2 to 6 percent slopes. This is a very deep, gently sloping, well drained soil on narrow upland ridges adjacent to drainageways. Areas of the soil commonly are long and winding. They range from about 5 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 3 inches, grayish brown sandy loam

Surface layer:
3 to 9 inches, yellowish brown loam

Subsoil:
9 to 13 inches, yellowish brown clay loam
13 to 24 inches, strong brown clay loam that has yellowish red and yellowish brown mottles
24 to 42 inches, brownish yellow sandy clay loam that has strong brown and yellowish red mottles
42 to 72 inches, yellowish brown sandy clay loam and clay loam that has gray, brown, and red mottles

Included with this soil in mapping are small areas of well drained Kempsville soils and moderately well drained Slagle soils. Kempsville soils are on small knolls, and Slagle soils are in shallow depressions or around drainageways. Included soils make up about 10 percent of the map unit. In some map units in the Miller's Tavern-Dunbrooke area, the surface layer and the substratum are sandier than typical of soils in the Emporia series. In some map units in the area between Loretto and Chance, the subsoil has more clay and a higher percentage of rock fragments than typical of the Emporia soil.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderately slow or moderate in the upper part of the subsoil, moderately slow or slow in the middle part and slow to moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid, if the soil has not been limed.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The perched seasonal high water table is at a depth of 3 to 4 1/2 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of this soil are farmed. Some areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and to hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to control erosion, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing causes surface compaction and increases runoff and the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, to reduce runoff, and to control erosion.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 100 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

The main limitations of this soil for urban development are low strength, moderate shrinking and swelling, the seasonal high water table, and slow permeability in the subsoil. Low strength and moderate shrinking and swelling limit use of the soil as building sites. The perched seasonal high water table limits excavations. Slow permeability and the seasonal high water table limit use of the soil as sites for septic tank absorption fields.

The capability subclass is IIe.

9C—Emporia sandy loam, 6 to 10 percent slopes. This is a very deep, strongly sloping, well drained soil on side slopes adjacent to drainageways. Slopes are smooth and commonly concave. Areas of this soil commonly are long and winding. They range from about 5 to 30 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 3 inches, grayish brown sandy loam

Subsurface layer:

3 to 6 inches, yellowish brown loam

Subsoil:
6 to 13 inches, yellowish brown clay loam
13 to 24 inches, strong brown clay loam that has yellowish red and yellowish brown mottles
24 to 42 inches, brownish yellow sandy clay loam that has strong brown and yellowish red mottles
42 to 72 inches, yellowish brown sandy clay loam and clay loam that has gray, brown, and red mottles

Included with this soil in mapping are small areas of well drained Kempsville soils and moderately well drained Slagle soils. Kempsville soils are higher on the slopes, and Slagle soils are on similar side slopes throughout the map unit. Also included are areas that have seeps at the base of toe slopes and colluvial, nearly level areas. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderately slow or moderate in the upper part of the subsoil, moderately slow or slow in the middle part and slow to moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid, if the soil has not been limed.
Surface runoff: Rapid.
Erosion hazard: Severe.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The perched seasonal high water table ranges from 3 to 4 1/2 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of this soil are woodland. A small acreage is cultivated or used for pasture.

This soil is moderately well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Erosion is a severe hazard and a major management concern. Conservation tillage, cover crops, grasses and legumes included in the cropping system, stubble mulching, contour tillage, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to control erosion, to reduce crusting, and to increase water infiltration. Grassed waterways and diversions help to reduce surface runoff and to control erosion.

The soil is moderately well suited to pasture. Overgrazing and grazing when the soil is too wet cause surface compaction, reduce plant growth, and also increase runoff and erosion. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of adapted grasses and legumes, to increase the carrying capacity of pasture, to reduce runoff, and to control erosion.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 100 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

The main limitations to use of this soil for urban development are low strength, moderate shrinking and swelling, the seasonal high water table, moderately slow permeability in the subsoil, and slope. Slope, the seasonal high water table, and shrinking and swelling limit use of the soil as building sites. Low strength of the clay loam subsoil when wet limits vehicular traffic in unpaved areas. Slope, the seasonal high water table, and moderately slow permeability in the subsoil limit use of the soil as sites for septic tank absorption fields and sanitary landfills, and some types of recreation.

The capability subclass is IIIe.

10A—Kempsville sandy loam, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on broad, dissected uplands. Areas of the soil commonly are elongated, rectangular, or oval. They range from about 3 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, brown sandy loam

Subsoil:
8 to 12 inches, light yellowish brown loam
12 to 22 inches, yellowish brown sandy clay loam
22 to 49 inches, strong brown sandy clay loam that has brownish yellow, brittle pockets
49 to 72 inches, yellowish brown sandy loam that has red mottles

Included with this soil in mapping are small areas of well drained Emporia and Suffolk soils and moderately well drained Slagle soils. Emporia soils are in slightly lower areas, Suffolk soils are at the ends of narrow ridges, and Slagle soils are adjacent to drainageways and in depressions. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer and the upper part of the subsoil and moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.

Soil reaction: Very strongly acid or strongly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: Below a depth of 6 feet.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed. Some small areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing and grazing when the soil is wet cause surface compaction and damage the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. The soil is managed for both pine and hardwoods. Seeds and seedlings survive and grow well if competing vegetation is controlled.

This soil is suited to most kinds of urban development. Moderate permeability limits use of the soil as sites for septic tank absorption fields and sewage lagoons.

The capability class is I.

10B—Kempsville sandy loam, 2 to 6 percent slopes. This is a very deep, gently sloping, well drained soil on broad, dissected uplands. Areas of this soil are elongated, rectangular, or oval. They range from about 3 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, brown sandy loam

Subsoil:
8 to 12 inches, light yellowish brown loam
12 to 22 inches, yellowish brown sandy clay loam
22 to 49 inches, strong brown sandy clay loam that has brownish yellow, brittle pockets
49 to 72 inches, yellowish brown sandy loam that has red mottles

Included with this soil in mapping are small areas of well drained Emporia and Suffolk soils and moderately well drained Slagle soils. Emporia soils are in slightly lower areas, Suffolk soils are at the ends of narrow ridges, and Slagle soils are adjacent to drainageways and in depressions. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer and the upper part of the subsoil and moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid, if the soil has not been limed.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: Below a depth of 6 feet.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed (fig. 7). Some areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops (fig. 8) and hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to reduce runoff, to control erosion, to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing and grazing when the soil is too wet cause surface compaction, damage the stands of grasses and legumes, reduce yields, and increase runoff and the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, to reduce runoff, and to control erosion.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. The soil is managed for both pine and hardwoods. Seeds and seedlings survive and grow well if competing vegetation is controlled.

This soil is suited to most kinds of urban development. Moderate permeability in the subsoil limits use of the soil as sites for septic tank absorption fields and sewage lagoons.

The capability subclass is IIe.

10C—Kempsville sandy loam, 6 to 10 percent slopes. This is a very deep, strongly sloping, well drained soil on the sides of narrow, convex ridgetops

Figure 7.—Soybeans and corn on Kempsville sandy loam, 2 to 6 percent slopes.

and around the heads of natural drainageways. Slopes are generally smooth. Areas of this soil follow the ridges and drainageways, and are commonly narrow and winding. They range from 5 to 20 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 6 inches, brown sandy loam

Subsoil:
6 to 10 inches, light yellowish brown loam
10 to 22 inches, yellowish brown sandy clay loam
22 to 49 inches, strong brown sandy clay loam that has brownish yellow, brittle pockets
49 to 72 inches, yellowish brown sandy loam that has red mottles

Included with this soil in mapping are small intermingled areas, generally less than 2 acres in size, of moderately slowly permeable Emporia soils. These soils are along the edge of the map unit or on ridgetops. Included Emporia soils make up about 10 percent of the map unit. Also included, on crests of ridges, are small severely eroded spots where the surface layer is yellowish brown sandy clay loam. These spots make up about 5 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer and the upper part of the subsoil and moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid, if the soil is not limed.
Surface runoff: Medium.
Erosion hazard: Severe.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: Below a depth of 6 feet.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Figure 8.—Soybeans that were planted using no-till on Kempsville sandy loam, 2 to 6 percent slopes. This is a prime farmland soil.

Most areas of this soil are woodland. Some areas are used for pasture or hay.

This soil is moderately well suited to cultivated crops and hay. Water erosion is a severe hazard, and consequently intensive management is needed if the soil is cultivated. Conservation tillage, sod planting, cover crops, grassed waterways, contour farming, stripcropping, and grasses and legumes included in the cropping system help to reduce runoff and to control erosion. Other suitable management practices are keeping crop residue on or near the surface to increase organic matter content and use of lime and fertilizer to offset acidity and increase fertility.

This soil is well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing increases runoff and erosion. The pasture, if eroded, is difficult to re-establish. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime helps to offset acidity, and fertilizer helps to increase fertility.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. The soil is managed for both pine and hardwoods.

This soil is suited to most kinds of urban development. Moderate permeability and slope are moderate limitations to use of the soil as sites for septic tank absorption fields and sewage lagoons. Slope is a moderate limitation to use of the soil as sites for buildings and sanitary landfills, and for local roads and streets.

The capability subclass is IIIe.

11A—Levy silty clay loam, 0 to 2 percent slopes, frequently flooded. This is a very deep, nearly level, very poorly drained soil. It is subject to frequent flooding. It is near sea level along the Rappahannock River, mainly in two large marshes at the north end of the county. It is also near or adjacent to tidal marshes in other parts of the county where it is subject to almost continuous floodings. The areas are long and oval, and

range from 5 to 500 acres. Slope is generally less than 1 percent.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 12 inches, dark grayish brown silty clay loam that has dark brown mottles

Substratum:
12 to 48 inches, gray and dark gray silty clay
48 to 72 inches, very dark gray muck (sapric material)

Included with this soil in mapping are small areas of poorly drained and moderately well drained soils on slightly higher elevations. Also included, closer to the water's edge than the Levy soil, are small areas of Rappahannock soils, which support only grasses and sedges. Included soils make up about 5 percent of the map unit.

Soil properties:

Permeability: Slow.
Available water capacity: High.
Organic matter content: Moderate or high.
Natural fertility: Moderate.
Soil reaction: Extremely acid to strongly acid.
Water table: Generally flooded with 2 to 10 inches of water, but in several months each year it is flooded with about 12 to 24 inches of water.
Root zone: Restricted by water.
Shrink-swell potential: High.
Flooding: Frequent or continuous flooding.

In almost all areas this soil is woodland. It is not suited to cultivated crops or pasture because of the seasonal high water table and frequent flooding.

Potential productivity for sweetgum on this soil is high. Estimated average annual production of wood per acre is 120 cubic feet. The seasonal high water table and flooding cause very high seedling mortality. The seasonal high water table and low strength severely limit use of equipment.

The main limitations of this soil for most types of urban development are the seasonal high water table and flooding. The soil is well suited to use as habitat for wetland wildlife.

The capability subclass is VIIw.

12A—Molena loamy sand, 0 to 2 percent slopes. This is a very deep, nearly level, somewhat excessively drained soil on the broad, low-lying terrace along the Rappahannock River. Areas of this soil commonly are elongated and generally follow the course of the river. They range from 5 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, dark brown loamy sand

Subsurface layer:
8 to 12 inches, dark yellowish brown loamy sand

Subsoil:
12 to 23 inches, brown loamy sand

Substratum:
23 to 54 inches, strong brown sand and gravelly sand
54 to 72 inches, brownish yellow sand

Included with this soil in mapping are small areas of well drained Pamunkey soils and moderately well drained Munden soils. Pamunkey soils are on similar to slightly lower landscapes, and Munden soils are in shallow depressions. The included soils make up 10 to 15 percent of the map unit.

Soil properties:

Permeability: Rapid.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to slightly acid in the surface layer and very strongly acid to moderately acid below.
Surface runoff: Slow.
Erosion hazard: Wind erosion is a severe hazard, and water erosion is a slight hazard.
Tilth: The surface layer is friable and can be easily tilled.
Water table: Below a depth of 6 feet
Root zone: Commonly extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are cropland. A few areas are woodland.

This soil is moderately well suited to cultivated crops and hay. It is droughty during the growing season. Water erosion is a slight hazard and wind erosion is a severe hazard. Some management concerns are the need to increase organic matter content and use of lime and fertilizer to offset acidity and to increase fertility. In cultivated areas conservation tillage, crop residue kept on or near the surface, cover crops, and grasses and legumes included in the cropping system help to increase organic matter, to maintain soil tilth, and to control wind erosion.

This soil is well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing

overgrazing. Overgrazing decreases some desirable grasses and legumes and reduces yields. Proper stocking rates, rotation grazing and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soft, loose soil limits use of timber equipment.

The main limitations of this soil for urban development are seepage and sandy texture. Seepage is a limitation to use as sites for sewage lagoons, septic tank absorption fields, and sanitary landfills. The sandy texture is a limitation to use for shallow excavations, daily cover for landfills, and construction material. The soil is a good subgrade material for local roads and streets.

The capability subclass is IIIs.

12B—Molena loamy sand, 2 to 6 percent slopes. This is a very deep, gently sloping, somewhat excessively drained soil on the broad, low-lying terrace along the Rappahannock River. Areas of this soil commonly are elongated or oval, and generally follow the course of the river. They range from 5 to 100 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, dark brown loamy sand

Subsurface layer:
8 to 12 inches, dark yellowish brown loamy sand

Subsoil:
12 to 23 inches, brown loamy sand

Substratum:
23 to 54 inches, strong brown sand and gravelly sand
54 to 72 inches, brownish yellow sand

Included with this soil in mapping are small areas of well drained Pamunkey soils and moderately well drained Munden soils. Pamunkey soils are on similar to slightly lower landscapes, and Munden soils are in shallow depressions. Included soils make up about 10 to 15 percent of the map unit.

Soil properties:

Permeability: Rapid.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: In unlimed areas very strongly acid to slightly acid in the surface layer and very strongly acid to moderately acid below.
Surface runoff: Medium.
Erosion hazard: Wind erosion is a severe hazard, and water erosion is a moderate hazard.
Tilth: The surface layer is friable and can be easily tilled.
Water table: Below a depth of 6 feet.
Root zone: Commonly extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are used as cropland. A few areas are woodland.

This soil is moderately well suited to cultivated crops and hay. It is droughty during the growing season. Water erosion is a moderate hazard, and wind erosion is a severe hazard. Some management concerns are the need to increase organic matter content and to use lime and fertilizer to offset acidity and to increase fertility. If the soil is used for cultivated crops, conservation tillage, crop residue kept on or near the surface, cover crops, and grasses and legumes included in the cropping system help to increase organic matter, to maintain soil tilth, and to control wind erosion.

This soil is well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing decreases some desirable grasses and legumes and reduces yields. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime helps to offset acidity and fertilizer helps to increase fertility.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soft, loose soil limits the use of timber equipment.

The main limitations of this soil for urban development are seepage and sandy textures. Seepage is a limitation for sewage lagoons, septic tank absorption fields, and sanitary landfills. Sandy textures are limitations for shallow excavations, daily cover for landfill, and construction material. The soil is a good subgrade material for local roads and streets.

The capability subclass is IIIs.

13A—Munden fine sandy loam, 0 to 2 percent slopes. This is a very deep, nearly level, moderately well drained soil on broad to very broad flats below 50 feet in elevation. Areas of this soil are irregular in shape, and range from 5 to 200 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:

Surface to 11 inches, brown fine sandy loam

Subsoil:
11 to 23 inches, light olive brown sandy loam
23 to 30 inches, light yellowish brown sandy loam that has yellowish brown, strong brown, and white mottles

Substratum:
30 to 39 inches, light gray loamy sand that has yellowish brown mottles
39 to 47 inches, stratified, pale brown, yellowish brown, and light brownish gray loamy sand and sandy loam
47 to 72 inches, light brownish gray silty clay loam that has yellowish brown mottles

Included with this soil in mapping are small areas, generally less than 2 acres in size, of moderately well drained Tetotum soils in the same landscape positions as the Munden soil and well drained State and Bojac soils in slightly higher landscape positions. Also included are a few areas that have a dark surface layer and a clayey substratum. Also included are soils that have slope of 3 to 6 percent. Included soils make up more than 20 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer, moderate or moderately rapid in the subsoil and moderately rapid or rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The seasonal high water table is at a depth of 1.5 to 2.5 feet in winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are used for cultivated crops. A few areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. The major management concern is the seasonal high water table during wet periods. Some other management concerns are the need to increase organic matter content and use of lime and fertilizer to offset acidity and to increase fertility. Winter cover crops and all crop residue kept on the surface help to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is also well suited to pasture. Major management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Grazing during periods of seasonal wetness often cuts up and compacts the surface and reduces yields. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to improve fertility.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. Seasonal wetness limits the use of timber equipment.

The main limitation of this soil for urban development is the seasonal high water table. This soil property limits use of the soil as sites for septic tank absorption fields, shallow excavations, and dwellings with basements. It makes the soil a fair subgrade material for local roads and streets.

The capability subclass is IIw.

14A—Newflat silt loam, 0 to 2 percent slopes. This is a very deep, nearly level, somewhat poorly drained soil on broad flats of the middle terrace along the Rappahannock River. Areas of the soil are irregularly elongated. They range from 5 to 80 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 8 inches, grayish brown silt loam

Subsoil:
8 to 13 inches, light olive brown silty clay loam that has strong brown mottles
13 to 29 inches, gray clay loam that has yellowish brown mottles
29 to 42 inches, grayish brown clay loam that has yellowish red mottles
42 to 72 inches, light gray silty clay that has yellowish brown mottles

Included with this soil in mapping are small areas of moderately well drained Tetotum soils and poorly drained Chickahominy soils. Tetotum soils are in slightly higher areas, and Chickahominy soils are in slight depressions and near drainageways. Included soils make up about 15 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer, moderately slow in the upper and middle parts of the subsoil, and very slow in the lower parts.
Available water capacity: High.
Organic matter content: Low.
Natural fertility: Low.

Soil reaction: Extremely acid to strongly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer generally becomes firm and difficult to till when under conventional cultivation or if plowed when too wet.
Water table: The seasonal high water table ranges from 0.5 to 1.5 feet in winter and early spring.
Root zone: Somewhat restricted by the seasonal high water table.
Shrink-swell potential: High.

Most areas of this soil are woodland. A few areas are used for pasture.

This soil is moderately well suited to cultivated crops and well suited to hay. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and wetness often interferes with tillage and crop harvest. A surface drainage system can be used to remove surface water if suitable outlets are available. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing and grazing when the soil is too wet cause surface compaction and damage the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 130 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soil is soft when wet, and thus limits the use of heavy timber equipment during wet periods.

The main limitations of this soil for urban development are the seasonal high water table, slow permeability, and high shrinking and swelling. These soil properties limit use of the soil as sites for buildings, sanitary landfills, and septic tank absorption fields and for most types of recreation. Low strength limits use of the soil subgrade material for local roads and streets.

The capability subclass is IIIw.

15A—Pamunkey loam, wet substratum, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on broad, low stream terraces along the Rappahannock River. Areas of this soil commonly are elongated and follow the course of the river. They range from about 5 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 12 inches, brown loam

Subsoil:
12 to 29 inches, yellowish red clay loam
29 to 38 inches, yellowish red loam
38 to 51 inches, yellowish red fine sandy loam

Substratum:
51 to 72 inches, strong brown loamy fine sand

Included with this soil in mapping are small areas of somewhat excessively drained Molena soils and moderately well drained Bolling soils. Molena soils normally are in slightly higher areas than the Pamunkey soil, and Bolling soils are in swales and poorly defined drainageways. Also included are soils that have slope of 3 to 6 percent. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Moderate in the surface layer and the subsoil and moderately rapid or rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Moderate.
Soil reaction: Moderately acid to neutral in the surface layer and the subsoil and strongly acid to neutral in the substratum.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is very friable and can be easily tilled.
Water table: The seasonal high water table is at a depth of 4 to 6 feet in winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed. A few areas are used as woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to reduce crusting, to increase water infiltration, and to control erosion.

This soil is well suited to pasture. Overgrazing damages the stands of desirable grasses and legumes, and thus increases runoff and the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, to reduce runoff, and to control erosion.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood

per acre is 130 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

The main limitations of this soil for urban development are the seasonal water table and sandy texture in the substratum. The seasonal high water table moderately limits use of the soil as sites for septic tank absorption fields and dwellings with basements. Seepage and the hazard of ground water contamination are severe limitations to use as sites for sanitary landfills and sewage lagoons.

The capability subclass is I.

16—Pits, sand and gravel. This map unit consists of areas from which gravel and sand have been removed for use in construction. The excavations generally are 5 to 15 feet deep, and have steep sides and a nearly level floor. They generally range from about 2 to 20 acres, but some areas are smaller. Some have shallow ponds or have been used for trash disposal.

Most pits have been abandoned, and are sparsely covered with woody shrubs and grasses. Onsite investigation is required to determine the suitability or potential of the map unit for any use and the degree of reclamation needed.

This unit has not been assigned to a capability subclass.

17A—Rappahannock muck, 0 to 1 percent slopes, frequently flooded. This is a very deep, nearly level, very poorly drained soil. It formed on low-lying tidal flats mainly in herbaceous plant remains mixed with some mineral soil material. It overlies a variety of marine and fluvial sediments along the Rappahannock River and its larger tributaries. It is subject to flooding twice daily by brackish water, and is continuously waterlogged. Areas of the soil are elongated, oval, or rectangular. They range from 3 to 800 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 3 inches, black muck (sapric material)

Subsurface layer:
3 to 30 inches, dark olive gray muck (hemic material)

Substratum:
30 to 48 inches, dark olive gray mucky silty clay loam
48 to 65 inches, dark gray silty clay loam
65 to 72 inches, very dark gray muck (sapric material)

Included with this soil in mapping are small areas of soils that are higher on the landscape than the surrounding Rappahannock soil, and commonly support water-tolerant trees. Also included are areas near small tidal pools and streams. The included soils make up not more than 30 percent or less of the map unit.

Soil properties:

Permeability: Moderate.
Organic matter content: High.
Soil reaction: Neutral to moderately alkaline in the natural wet state, but strongly acid when dried.
Water table: Fluctuating tides cover the surface twice daily, and the water table is slightly below to above the surface most of the time.

This soil is poorly suited to most types of urban development because of the seasonal high water table, tidal flooding, and high organic matter content. It is well suited to use as habitat for wetland wildlife. Aquatic plants cover most areas. These include smooth cordgrass, reeds, cattails, arrowleaf, and rushes.

The capability subclass is VIIIw.

18B—Rumford loamy sand, 0 to 6 percent slopes. This is a very deep, nearly level and gently sloping, somewhat excessively drained soil on narrow, upland ridges above 100 feet in elevation and next to drainageways. Areas of this soil commonly are long and narrow to oval. They range from about 3 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 7 inches brown loamy sand

Subsurface layer:
7 to 14 inches, yellowish brown loamy sand

Subsoil:
14 to 23 inches, strong brown sandy clay loam
23 to 31 inches, strong brown sandy loam
31 to 52 inches, yellowish brown loamy sand

Substratum:
52 to 72 inches, brownish yellow fine sand that has white mottles

Included with this soil in mapping, in flatter areas of the map unit, are small areas of well drained Suffolk and Kempsville soils. These soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Rapid or very rapid in the surface layer, moderately in the subsoil, and moderately rapid to very rapid in the substratum.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.

Soil reaction: Extremely acid to strongly acid in the surface layer, extremely acid to moderately acid in the subsoil, and extremely acid to slightly acid in the substratum.
Surface runoff: Slow or medium.
Erosion hazard: Moderate.
Tilth: The surface layer can be easily tilled throughout a wide range of moisture content.
Water table: Below a depth of 6 feet.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed. Some areas are woodland.

This soil is well suited to cultivated crops and moderately well suited to hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to maintain organic matter content, to control erosion, and to increase the water holding capacity of the soil.

This soil is moderately well suited to pasture. Overgrazing cuts up the soft surface and damages the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 100 cubic feet. Seeds and seedlings survive and grow well.

This soil is suited to most types of urban development. In areas used for sewage lagoons or sanitary landfills, contamination is a hazard to ground water and nearby streams because of moderately rapid to very rapid permeability. The sandy texture limits excavation. It causes droughtiness if the soil is used for lawns and landscaping.

The capability subclass is IIs.

19E—Rumford and Emporia soils, 15 to 50 percent slopes. This map unit consists of very deep, moderately steep to very steep soils on side slopes above drainageways and on scarps between terraces. Some areas are mostly Rumford soils, some are mostly Emporia soils, and some consist of both. Areas of these soils are elongated in shape. They range from 5 to 2,000 acres. Slope is complex, and generally ranges from convex to slightly concave. The total acreage of the map unit is about 45 percent somewhat excessively drained Rumford loamy sand, 30 percent well drained Emporia sandy loam, and 25 percent other soils. These soils were mapped together because they are similar in use and management.

The typical sequence, depth, and composition of the layers of the Rumford soils are as follows:

Surface layer:
Surface to 7 inches, brown loamy sand

Subsurface layer:
7 to 14 inches, yellowish brown loamy sand

Subsoil:
14 to 23 inches, strong brown sandy clay loam
23 to 31 inches, strong brown sandy loam
31 to 52 inches, yellowish brown loamy sand

Substratum:
52 to 72 inches, brownish yellow fine sand that has white mottles

The typical sequence, depth, and composition of the layers of the Emporia soils are as follows:

Surface layer:
Surface to 3 inches, grayish brown sandy loam

Subsurface layer:
3 to 9 inches, yellowish brown loam

Subsoil:
9 to 13 inches, yellowish brown clay loam
13 to 24 inches, strong brown clay loam that has yellowish red and yellowish brown mottles
24 to 42 inches, brownish yellow sandy clay loam that has strong brown and yellowish red mottles
42 to 72 inches, yellowish brown sandy clay loam and clay loam that have gray, brown, and red mottles

Included with these soils in mapping are many small areas, generally less than 5 acres in size, of well drained Kempsville soils, moderately well drained Slagle soils, and soils that have slope of less than 15 percent. These included soils generally have been mapped adjacent to the soils in this map unit, and make up 10 percent or less of the map unit. Also included are narrow areas, generally less than 5 acres in size, of poorly drained Bibb soils along drains. These included soils make up 10 percent or less of the map unit. Total included soils make up about 20 percent of the map unit.

Soil properties, Rumford soils:

Permeability: Rapid of very rapid in the surface layer, moderately rapid in the subsoil, and moderately rapid to very rapid in the substratum.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid in the surface layer, extremely acid to slightly acid in the

subsoil, and extremely acid to slightly acid in the substratum.
Surface runoff: Very rapid.
Erosion hazard: Severe.
Wetness: Seeps and springs are common at the lower edge of slopes of these soils.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Soil properties, Emporia soils:

Permeability: Moderately rapid in the surface layer, moderately slow or moderate in the upper part of the subsoil moderately slow or slow in the middle part, and slow to moderate in the lower part.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid to moderately acid, if the soil has not been limed.
Surface runoff: Medium or rapid.
Erosion hazard: Severe.
Water table: Seep areas with a seasonal high water table at a depth of 3 to 4 1/2 feet in winter and spring.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Moderate.

Most areas of the soils in this map unit are woodland (fig. 9). A few areas are used for pasture or hay.

These soils are not suited to cultivated crops and are poorly suited to hay. They are droughty during the growing season. Water erosion is a severe hazard and is a major management concern.

This map unit is poorly suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing increases runoff and causes excessive erosion. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on these soils is high (fig. 10). Estimated average annual production of

Figure 9.—Cleared area to be planted with pines. The soils are Rumford and Emporia soils, 15 to 50 percent slopes.

wood per acre is 110 cubic feet on the north-facing slopes and 100 cubic feet on the south-facing slopes. Slope limits the use of timber equipment on these soils. If equipment is used, erosion is a hazard.

The main limitation of this soil for most types of urban development is slope. Slope is a limitation to use as sites for septic tank absorption fields and small commercial buildings and for many types of recreation. The soil is a fair subgrade material for local roads and streets.

The capability subclass is VIIe.

20D—Rumford and Slagle soils, 6 to 15 percent slopes. This map unit consists of very deep, strongly sloping soils on side slopes and at the heads of drainageways. Some areas are mostly Rumford soils, some are mostly Emporia soils, and some consist of both. Areas of these soils are elongated. They range from 3 to 500 acres. Slope is mainly complex, and generally ranges from convex to slightly concave. The total acreage of the map unit is about 45 percent somewhat excessively drained Rumford loamy sand, 25 percent moderately well drained Slagle fine sandy loam, and 30 percent other soils.

The typical sequence, depth, and composition of the layers of the Rumford soils are as follows:

Surface layer:
Surface to 7 inches, brown loamy sand

Subsurface layer:
7 to 14 inches, yellowish brown loamy sand

Subsoil:
14 to 23 inches, strong brown sandy clay loam
23 to 31 inches, strong brown sandy loam
31 to 52 inches, yellowish brown loamy sand

Substratum:
52 to 72 inches, brownish yellow fine sand that has white mottles

The typical sequence, depth, and composition of the layers of the Slagle soil are as follows:

Figure 10.—Pine plantation on Rumford and Emporia soils, 15 to 50 percent slopes.

Surface layer:
Surface to 5 inches, brown fine sandy loam

Subsurface layer:
5 to 10 inches, light yellowish brown fine sandy loam

Subsoil:
10 to 14 inches, olive yellow loam
14 to 20 inches, yellowish brown sandy clay loam
20 to 29 inches, yellowish brown sandy clay loam that has pale brown and light brownish gray mottles
29 to 48 inches, strong brown sandy clay loam that has yellowish brown, red, and light gray mottles
48 to 58 inches, strong brown, stratified sandy loam, loam, and sandy clay loam, that have yellowish brown, red, and light gray mottles

Substratum:
58 to 72 inches, mottled light gray, strong brown, brownish yellow, and red, stratified loamy sand and sandy clay loam

Included with these soils in most map units are many small areas, generally less than 5 acres in size, of well drained Kempsville and Suffolk soils, moderately well drained Dogue soils, and soils that have slope of less than 6 percent. These included soils make up 20 percent or less of the map unit. Also included are narrow areas, generally less than 5 acres in size, of poorly drained Bibb soils. These included soils are along drainageways and make up 10 percent or less of the map unit. Total included soils make up about 30 percent of the map unit.

Soil properties, Rumford soils:

Permeability: Rapid or very rapid in the surface layer, moderately rapid in the subsoil and moderately rapid to very rapid in the substratum.
Available water capacity: Low.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid in the surface layer, extremely acid to moderately acid in the subsoil, and extremely acid to slightly acid in the substratum.
Surface runoff: Rapid.
Erosion hazard: Severe.
Wetness: Seeps and springs are common at the lower edge of the slopes of these soils.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Soil properties, Slagle soils:

Permeability: Moderately rapid in the surface layer, moderate in the upper part of the subsoil and moderately slow or slow in the lower part, and moderately slow to moderately rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid, if the soil has not been limed.
Surface runoff: Rapid.
Erosion hazard: Severe.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: Seep areas with a perched seasonal high water table at a depth of 1.5 to 3 feet in winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more, but is somewhat restricted by the seasonal high water table.
Shrink-swell potential: Moderate.

Most areas of the soils in this map unit are woodland. A few areas are used for pasture and hay.

These soils are poorly suited to cultivated crops and are moderately well suited to hay. In some areas the soils are droughty during the growing season. Water erosion is a severe hazard, and is a major management concern. Some other management concerns are the need to increase organic matter content and to use lime and fertilizer to offset acidity and to increase fertility. In cultivated areas conservation tillage, cover crops, grasses and legumes included in the cropping system, contour farming, and stripcropping help to reduce runoff and to control erosion.

These soils are moderately well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing increases runoff and causes excessive erosion. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine is high on Rumford soils and very high on Slagle soils. Estimated average annual production of wood per acre is 110 cubic feet on Rumford soils and 125 cubic feet on Slagle soils. Rumford and Slagle soils are managed mostly for pine. Slope limits the use of timber equipment on these soils. If timber equipment is used, however, erosion is a hazard.

The main limitations to use of these soils for urban development are slope and variable permeability. These soil properties limit the soil as sites for septic tank absorption fields and small commercial buildings and for many types of recreation. These soils are good or fair subgrade material for local roads and streets.

The capability subclass is IVe.

21B—Slagle fine sandy loam, 2 to 6 percent slopes. This is a very deep, gently sloping, moderately well drained soil on side slopes of uplands and around the heads of drainageways. Slopes are smooth and slightly convex. Areas of this soil commonly are elongated, but some smaller areas are oval or rectangular. They range from about 3 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 5 inches, brown fine sandy loam

Subsurface layer:
5 to 10 inches, light yellowish brown fine sandy loam

Subsoil:
10 to 14 inches, olive yellow loam
14 to 20 inches, yellowish brown sandy clay loam
20 to 29 inches, yellowish brown sandy clay loam that has pale brown and light brownish gray mottles
29 to 48 inches, strong brown sandy clay loam that has yellowish brown, red, and light gray mottles
48 to 58 inches, strong brown, stratified sandy loam, loam, and sandy clay loam that has yellowish brown, red, and light gray mottles

Substratum:
58 to 72 inches, mottled light gray, strong brown, brownish yellow, and red, stratified loamy sand and sandy clay loam

Included with this soil in mapping are small areas of well drained Kempsville and Emporia soils and moderately well drained Atlee soils. Kempsville and Emporia soils are in slightly higher areas throughout the map unit. Atlee soils are on smoother landscapes. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the upper part of the subsoil and moderately slow or slow in the lower part, and moderately slow to moderately rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid, if the soil has not been limed.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The surface layer is friable and can be easily tilled when moist.
Water table: The perched seasonal high water table ranges from 1.5 to 3 feet in winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more, but is somewhat restricted by the seasonal high water table.
Shrink-swell potential: Moderate.

About half of the acreage of this soil is woodland. The rest is mostly farmed. A few areas are used for pasture. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and wetness commonly interferes with tillage. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to increase organic matter content, to maintain soil tilth, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing and grazing when the soil is too wet cause surface compaction, damage the stands of grasses and legumes, reduce yields, and increase the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, and to control erosion.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 125 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soil is soft when wet, and thus limits the use of heavy timber equipment during wet periods.

The main limitations of the soil for urban development are the seasonal high water table, low strength, and moderately slow permeability in the subsoil. The seasonal high water table and moderately slow permeability in the subsoil limit the soil as sites for buildings, sanitary landfills, and septic tank absorption fields and for most types of recreation. Low strength limits use of the soil as subgrade material for roads and streets.

The capability subclass is IIe.

21C—Slagle fine sandy loam, 6 to 10 percent slopes. This is a very deep, strongly sloping, moderately well drained soil on side slopes of drainageways. Slopes are smooth and slightly concave. Areas of this soil commonly follow the drainageways and are irregularly long and winding. They range from about 3 to 20 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 5 inches, brown fine sandy loam

Subsurface layer:
5 to 10 inches, light yellowish brown fine sandy loam

Subsoil:

10 to 14 inches, olive yellow loam
14 to 20 inches, yellowish brown sandy clay loam
20 to 29 inches, yellowish brown sandy clay loam that has pale brown and light brownish gray mottles
29 to 48 inches, strong brown sandy clay loam that has yellowish brown, red, and light gray mottles
48 to 58 inches, strong brown, stratified sandy loam, loam, and sandy clay loam that have yellowish brown, red, and light gray mottles

Substratum:
58 to 72 inches, mottled light gray, strong brown, brownish yellow, and red, stratified loamy sand and sandy clay loam

Included with this soil in mapping are small areas of well drained Emporia and Kempsville soils. Emporia and Kempsville soils are on narrow ridges and side slopes in slightly higher areas. Also included are small areas of soils that have a clay subsoil and nearly level, colluvial areas. Included soils make up about 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, in the upper part of the subsoil and moderately slow or slow in the lower part, and moderately slow to moderately rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid, if the soil has not been limed.
Surface runoff: Rapid.
Erosion hazard: Severe.
Water table: The perched seasonal high water table ranges from 1.5 to 3 feet in winter and early spring.
Root zone: 60 inches, but is somewhat restricted by the seasonal high water table.
Shrink-swell potential: Moderate.

Most areas of this soil are woodland. A small acreage is cultivated, and some areas are used for pasture.

This soil is moderately well suited to cultivated crops and well suited to hay. The main limitation is slope. Crops respond well to lime and fertilizer. Erosion is a severe hazard and is a major management concern. Conservation tillage, contour tillage, cover crops, and grasses and legumes included in the cropping system, stubble mulching, and crop residue returned to the soil help to maintain organic matter content and soil tilth, to control erosion, to reduce crusting, and to increase water infiltration. Grassed waterways and diversions help to reduce runoff and to control erosion.

This soil is well suited to pasture. Overgrazing causes surface compaction, damages the stands of grasses and legumes, reduces yields, and increases runoff and the erosion hazard. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes, to increase the carrying capacity of pasture, to reduce runoff, and to control erosion.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 125 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soil is soft when wet, and thus limits the use of heavy timber equipment.

The main limitations of the soil for urban development are the seasonal high water table, slope, low strength, and moderately slow permeability in the subsoil. Slope, the seasonal high water table, and moderately slow permeability in the subsoil limit use of the soil as sites for buildings and sanitary facilities and for most types of recreation. The sandy clay loam subsoil has low strength when wet, and thus limits vehicular traffic in unpaved areas.

The capability subclass is IIIe.

22A—State fine sandy loam, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on the broad, level, middle terrace along the Rappahannock River. Areas of the soil are oval or are narrow and elongated and on subdued ridges between more poorly drained soils. They range from about 3 to 150 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 12 inches, brown fine sandy loam

Subsoil:
12 to 26 inches, dark yellowish brown clay loam
26 to 33 inches, yellowish brown sandy clay loam
33 to 42 inches, yellowish brown sandy loam

Substratum:
42 to 72 inches, yellowish brown loamy sand that has pale brown and yellowish brown mottles

Included with this soil in mapping are intricately mixed areas, generally less than 3 acres in size, of moderately well drained Tetotum soils and coarser textured Bojac soils. Tetotum soils are in lower landscape positions and depressions, and Bojac soils are on slightly higher, subdued ridges than State soils. Also included are a few small areas of soils that have a dark surface layer. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Moderate or moderately rapid in the surface layer, moderate in the subsoil and moderately rapid to very rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid in the surface layer and the subsoil and very strongly acid to moderately acid in the substratum, if the soil has been not limed.
Surface runoff: Slow.
Erosion hazard: Wind erosion is a moderate hazard, and water erosion is a slight hazard.
Tilth: The soil can be easily tilled throughout a wide range of moisture content.
Water table: The seasonal high water table is at a depth of 4 to 6 feet during wet periods.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are used for cultivated crops. A few areas are woodland. This is a prime farmland soil.

This soil is very well suited to cultivated crops and hay. Suitable management practices are increasing organic matter content and use of lime and fertilizer to offset acidity and increase fertility. Wind erosion is a moderate hazard. Conservation tillage and cover crops help to control erosion.

This soil is very well suited to pasture. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 140 cubic feet.

The main limitations of this soil for urban development are the seasonal high water table and sandy texture in the substratum. The seasonal high water table is a moderate limitation on sites for dwellings with basements and for septic tank absorption fields. Low strength is a moderate limitation of the soil as subgrade material for local roads and streets.

The seasonal high water table, seepage, and the hazard of ground water contamination are severe limitations to use of the soil as sites for sanitary landfills and sewage lagoons.

The capability subclass is I.

22B—State fine sandy loam, 2 to 6 percent slopes. This is a very deep, gently sloping, well drained soil on the broad, level, middle terrace along the Rappahannock River. Areas of the soil are irregularly oval or are narrow and elongated and on low ridges between more poorly drained soils. They range from about 3 to 25 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 12 inches, brown fine sandy loam

Subsoil:
12 to 26 inches, dark yellowish brown clay loam
26 to 33 inches, yellowish brown sandy clay loam
33 to 42 inches, yellowish brown sandy loam

Substratum:
42 to 72 inches, yellowish brown loamy sand that has pale brown and yellowish brown mottles

Included with this soil in mapping are intricately mixed areas, generally less than 3 acres in size, of moderately well drained Tetotum soils and coarser textured Bojac soils. Tetotum soils are in lower landscape positions and depressions, and Bojac soils are on slightly higher, subdued ridges than State soils. Also included are a few small areas of soils that have a dark surface layer. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Moderate or moderately rapid in the surface layer, moderate in the subsoil and moderately rapid to very rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low to moderate.
Natural fertility: Low.
Soil reaction: Very strongly acid or strongly acid in the surface layer and the subsoil and ranges from very strongly acid to moderately acid in the substratum if the soil has not been limed.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The soil can be easily tilled under a wide range of moisture content.
Water table: The seasonal high water table is at a depth of 4 to 6 feet during the wet period.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are used for cultivated crops. A few areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Suitable management practices are increasing organic matter content and use of lime and fertilizer to offset acidity and to increase fertility. Erosion is a moderate hazard. Conservation tillage, cover crops, and grasses and legumes included in the cropping system help to control erosion.

This soil is well suited to pasture. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 140 cubic feet.

The main limitations of the soil for urban development are the seasonal high water table and sandy texture in the substratum. The seasonal high water table is a moderate limitation to use of the soil as sites for septic tank absorption fields and dwellings with basements. The soil is a good subgrade material for local roads and streets.

The seasonal high water table, seepage, and the hazard of ground water contamination are severe limitations to use of the soil as sites for sanitary landfills and sewage lagoons.

The capability subclass is IIe.

23A—Suffolk sandy loam, 0 to 2 percent slopes. This is a very deep, nearly level, well drained soil on broad, dissected uplands. Areas of this soil are oval or rectangular. They range from about 3 to 150 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 10 inches, brown sandy loam

Subsurface layer:
10 to 13 inches, light yellowish brown sandy loam

Subsoil:
13 to 19 inches, yellowish brown sandy loam
19 to 30 inches, strong brown sandy clay loam
30 to 37 inches, strong brown sandy loam

Substratum:
37 to 44 inches, reddish yellow sand
44 to 72 inches, brownish yellow loamy sand

Included with this soil in mapping are small areas of well drained Kempsville soils in the same general positions as the Suffolk soil and somewhat excessively drained Rumford soils on the higher parts of the landscape. These included soils make up about 10 percent of the map unit. Also included are several large map units, in the vicinity of Dunbrooke, near the intersection of Virginia Routes 620 and 642, that have a seasonal high water table at a depth of 40 to 48 inches.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the subsoil, and moderately rapid or rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid in the surface layer and the subsoil and extremely acid to moderately acid in the substratum.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer can be easily tilled throughout a wide range of moisture content.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed. Some areas are woodland. This is a prime farmland soil.

The soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to maintain organic matter content, to reduce crusting, and to increase water infiltration.

This soil is well suited to pasture. Overgrazing causes surface compaction and reduces the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 115 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

This soil is suited to most kinds of urban development. In areas used for sewage lagoons and sanitary landfills, rapid permeability in the substratum causes a hazard of contamination of ground water and nearby streams.

The capability class is I.

23B—Suffolk sandy loam, 2 to 6 percent slopes. This is a very deep, gently sloping, well drained soil on broad, dissected uplands and side slopes next to drainageways. Areas of this soil commonly are long and narrow. They range from about 3 to 1,000 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 10 inches, brown sandy loam

Subsurface layer:
10 to 13 inches, light yellowish brown sandy loam

Subsoil:
13 to 19 inches, yellowish brown sandy loam
19 to 30 inches, strong brown sandy clay loam
30 to 37 inches, strong brown sandy loam

Substratum:
37 to 44 inches, reddish yellow sand
44 to 72 inches, brownish yellow loamy sand

Included with this soil in mapping are small areas of well drained Kempsville soils in the same position as the Suffolk soil and somewhat excessively drained Rumford soils on the higher parts of the landscape. Included soils make up about 10 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the subsoil, and moderately rapid or rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid in the surface layer and the subsoil and extremely acid to moderately acid in the substratum.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The surface layer can be easily tilled throughout a wide range of moisture content.
Root zone: Typically extends to a depth of 60 inches or more.
Shrink-swell potential: Low.

Most areas of this soil are farmed (fig. 11). Some areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Crops respond well to lime and fertilizer. Conservation

Figure 11.—Hayfield on Suffolk sandy loam, 2 to 6 percent slopes.

tillage, cover crops, grasses and legumes included in the cropping system, and crop residue returned to the soil help to maintain organic matter content, to reduce crusting, to increase water infiltration, and to control erosion.

This soil is well suited to pasture. Overgrazing causes surface compaction and reduces the stands of grasses and legumes. Proper stocking rates, rotation grazing, deferred grazing, and lime and fertilizer help to establish and maintain a mixture of grasses and legumes and to increase the carrying capacity of pasture.

Potential productivity for loblolly pine on this soil is high. Estimated average annual production of wood per acre is 115 cubic feet. Seeds and seedlings survive and grow well if competing vegetation is controlled.

This soil is suited to most types of urban development. In areas used for sewage lagoons and sanitary landfills, permeability causes a hazard of contamination of ground water and nearby streams.

The capability subclass is IIe.

24A—Tetotum loam, 0 to 2 percent slopes. This is a very deep, nearly level, moderately well drained soil in broad or very broad, slightly concave or flat areas. It is below 50 feet in elevation along the Rappahannock River. Areas of this soil are oval. They range from about 3 to 300 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 11 inches, light olive brown loam

Subsoil:
11 to 17 inches, yellowish brown silt loam
17 to 24 inches, yellowish brown clay loam that has light brownish gray mottles
24 to 36 inches, yellowish brown clay loam that has gray mottles
36 to 49 inches, light gray clay loam that has strong brown mottles

Substratum:
49 to 72 inches, light gray sandy loam that has brownish yellow mottles

Included with this soil in mapping are small intermingled areas, generally less than 2 acres in size, of coarser textured Munden soils, well drained State soils, and poorly drained Tomotley soils. State soils are in slightly higher landscape positions, and Tomotley soils are in shallow depressions. Munden soils are in positions similar to those of Tetotum soils. Also included are a few small areas of soils that have a dark surface layer. Included soils make up about 15 to 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the subsoil, and moderate to rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is easily tilled when moist. In some areas it becomes firm and difficult to till if plowed when too wet.
Water table: The seasonal high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more, but is somewhat restricted by the seasonal high water table.
Shirnk-swell potential: Low.

Most areas of this soil are used for cultivated crops. A few areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. The seasonal high water table in late winter and early spring is a major management concern. Other management concerns are the need to increase organic matter and to use lime and fertilizer to offset acidity and to increase fertility.

This soil is well suited to pasture. Major pasture management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Grazing during periods of seasonal wetness often cuts up and compacts the surface and reduces yields. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 125 cubic feet. The seasonal high water table limits the use of equipment.

The main limitation of this soil for urban development is the seasonal high water table. This property severely limits use of the soil as sites for septic tank absorption fields, sewage lagoons, sanitary landfills, and dwellings with basements. The seasonal high water table and low strength moderately limit use of the soil as a subgrade material for local roads and streets.

The capability subclass is IIw.

24B—Tetotum loam, 2 to 6 percent slopes. This is a very deep, gently sloping, moderately well drained soil on the middle terrace along the Rappahannock River, below 50 feet in elevation. Areas of this soil follow side slopes and are long and somewhat winding. They range from about 3 to 50 acres.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 11 inches, light olive brown loam

Subsoil:
11 to 17 inches, yellowish brown silt loam
17 to 24 inches, yellowish brown clay loam that has light brownish gray mottles
24 to 36 inches, yellowish brown clay loam that has gray mottles
36 to 49 inches, light gray clay loam that has strong brown mottles

Substratum:
49 to 72 inches, light gray sandy loam that has brownish yellow mottles

Included with this soil in mapping are small intermingled areas, generally less than 2 acres in size, of coarser textured Munden soils, well drained State soils, and poorly drained Tomotley soils. State soils are in slightly higher landscape positions than the Tetotum soil, and Tomotley soils are in shallow depressions. Munden soils are in positions similar to those of Tetotum soils. Included soils make up about 15 to 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the subsoil, and moderate to rapid in the substratum.
Available water capacity: Moderate.
Organic matter content: Low.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid, if the soil has not been limed.
Surface runoff: Medium.
Erosion hazard: Moderate.
Tilth: The surface layer is easily tilled when moist. In some areas it becomes firm and difficult to till if plowed when too wet.
Water table: The seasonal high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.
Root zone: Typically extends to a depth of 60 inches or more, but is somewhat restricted by the seasonal high water table.
Shrink-swell potential: Low.

Most areas of this soil are used for cultivated crops. A few areas are woodland. This is a prime farmland soil.

This soil is well suited to cultivated crops and hay. Water erosion is a moderate hazard, but is a major management concern. Other management concerns are the need to increase organic matter content and to use lime and fertilizer to offset acidity and to increase fertility. If the soil is cultivated, conservation tillage, cover crops, grasses and legumes included in the cropping system, and crop residue kept on or near the surface help to reduce runoff and to control erosion.

This soil is well suited to pasture. The major management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Overgrazing increases runoff and causes excessive erosion. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes, to reduce runoff, and to control erosion. Lime helps to offset acidity, and fertilizer helps to increase fertility.

Potential productivity for loblolly pine on this soil is very high. Estimated average annual production of wood per acre is 125 cubic feet. The seasonal high water table limits the use of equipment.

The main limitation of this soil for urban development is the seasonal high water table. This soil property severely limits the use of the soil as sites for septic tank absorption fields, sanitary landfills, and dwellings with basements. The seasonal high water table and low strength are moderate limitations to use of the soil as subgrade material for local roads and streets.

The capability subclass is IIe.

25A—Tomotley fine sandy loam, 0 to 2 percent slopes. This is a very deep, poorly drained, nearly level soil on the intermediate terrace of the Rappahannock River. Areas of this soil commonly are elongated and parallel areas of better drained soils in a pattern created by the shoreline recession of past meanderings of the Rappahannock River. They are oval and flat to slightly concave. They range from 3 to 800 acres or more in size.

The typical sequence, depth, and composition of the layers of this soil are as follows:

Surface layer:
Surface to 3 inches, dark grayish brown fine sandy loam

Subsurface layer:
3 to 9 inches, light brownish gray fine sandy loam

Subsoil:
9 to 18 inches, gray loam
18 to 23 inches, gray sandy clay loam that has pale brown and yellowish brown mottles
23 to 49 inches, gray sandy clay loam that has light gray and yellowish brown mottles

Substratum:
49 to 72 inches, light gray clay loam that has yellowish brown mottles

Included with this soil in mapping are small areas, generally less than 3 acres in size, of finer textured Chickahominy soils, somewhat poorly drained Augusta soils, and moderately well drained Tetotum soils. Chickahominy soils are in landscape positions that are slightly lower than those of the Tomotley soil or that are depressional. Augusta and Tetotum soils are in landscape positions that are slightly higher than those of the Tomotley soil. Included soils make up less than 20 percent of the map unit.

Soil properties:

Permeability: Moderately rapid in the surface layer, moderate in the upper part of the subsoil and moderately slow in the lower part.
Available water capacity: Moderate.
Organic matter content: Low to high.
Natural fertility: Low.
Soil reaction: Extremely acid to strongly acid in the surface layer, the subsurface layer, and the subsoil and extremely acid to moderately acid in the substratum, if the soil has not been limed.
Surface runoff: Slow.
Erosion hazard: Slight.
Tilth: The surface layer is easily tilled when moist. In some areas it becomes firm and difficult to till if plowed when too wet.
Water table: The seasonal high water table is between the surface and a depth of 0 to 1 foot in winter and early spring.
Root zone: Typically extends to a depth of 60 inches, but root growth below a depth of 18 inches is somewhat restricted by the seasonal high water table.
Shrink-swell potential: Low.

Most areas of this soil are woodland. A few areas are used for cultivated crops, pasture, and hay. This is a prime farmland soil, where drained.

Unless artificially drained, this soil is poorly suited to cultivated crops and hay. Major management concerns are the seasonal high water table and maintaining drainage systems. Other management concerns are locating outlets for artificial drainage, the need to increase organic matter content, use of lime and fertilizer to offset acidity and to increase fertility, and controlling surface ponding. In cultivated areas, conservation tillage, cover crops, grasses and legumes in the cropping system, and crop residue kept on or near the surface help to increase organic matter content and to maintain soil tilth. Chisel plowing to a depth of 10 to 16 inches every 3 to 5 years improves soil aeration and root development.

This soil is poorly suited to pasture. The major management concerns are establishing and maintaining a mixture of grasses and legumes and preventing overgrazing. Proper stocking rates, rotation grazing, and deferred grazing help to maintain desirable grasses and legumes. Lime and fertilizer help to offset acidity and to increase fertility. Artificial drainage is needed. Overgrazing the pasture decreases some desirable grasses and legumes and reduces yields. Grazing when the soil is wet commonly cuts up and compacts the surface and reduces yields.

Potential productivity for sweetgum on this soil is high. Estimated average annual production of wood per acre is 110 cubic feet. The soil is managed for pine and hardwoods. Seedling mortality is moderate. The seasonal high water table limits the use of timber equipment. Use of timber equipment during periods of wetness compacts and cuts up the surface layer and creates deep tracks and depressions, which increase ponding.

The main limitation of this soil for urban development is the seasonal high water table. This soil property severely limits use of the soil as sites for buildings, sanitary landfills, and septic tank absorption fields and for most types of recreation. The soil is a poor subgrade material for local roads and streets.

The capability unit is IVw, undrained, and IIIw, drained.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. Identification of prime farmland is a major step in meeting the Nation's needs for food and fiber.

The U.S. Department of Agriculture defines prime farmland as the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while using acceptable farming methods. Prime farmland produces the highest yields and requires minimal amounts of energy and economic resources, and farming it results in the least damage to the environment.

An area identified as prime farmland must be used for producing food or fiber or must be available for those uses. Thus, urban and built-up land and water areas are not classified as prime farmland.

The general criteria for prime farmland are as follows: a generally adequate and dependable supply of moisture from precipitation or irrigation, favorable temperature and growing-season length, acceptable levels of acidity or alkalinity, few or no rocks, and permeability to air and water. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not flooded during the growing season. The slope range is mainly 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

The survey area contains about 78,716 acres of prime farmland. That acreage makes up about 43 percent of the total acreage in the survey area and is mainly in the eastern part of the county.

The soil map units that make up prime farmland in the survey area are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location of each unit is shown on the detailed soil maps at the back of this publication. The soil properties and characteristics that affect use and management of the units are described in the section "Detailed Soil Map Units."

Some soils in table 5 are classified as prime farmland if certain limitations of the soil are overcome. The measures needed to overcome the limitations of such soils are given in parentheses after the name of the map unit.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 31 percent of the land area of Essex County is used for crops and pasture. The major crops are corn, soybeans, and the small grains wheat and barley. A small acreage is used for truck crops. A few farms produce hogs or cattle.

Nearly level and gently sloping soils are well suited to grain crops, which is the major crop on these soils. These soils are also well suited to truck crops, such as tomatoes, sweet corn, melons, and tree fruits. Truck crops, however, are not commercially grown to any extent. These soils include Kempsville, Emporia, and Suffolk soils on uplands and Pamunkey, State, Tetotum, and Munden soils on the terraces.

Soil erosion is a hazard on gently sloping soils (those that have slopes of 2 to 6 percent) that are well suited to crops. Erosion is harmful for two reasons. First, if the surface layer is lost through erosion, most of the available nutrients and most of the organic matter are lost. Organic matter improves soil structure, rate of water infiltration, available water capacity, and soil tilth. Erosion of the surface layer is especially damaging on some soils because germination of seeds is difficult in the firm underlying layer. Second, erosion on farmland causes sedimentation of streams and ponds and reduces water quality for municipal use and for fish and wildlife.

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for extended periods helps to control erosion and preserves the productive capacity of the soils. Conservation tillage and a crop rotation in which grass or close-growing crops are rotated with row crops help to control erosion on cropland. Waterways, terraces, and diversions help to control erosion, to reduce or slow runoff, and to increase infiltration.

Soil blowing, or wind erosion, is a hazard on soils that have a sandy surface, such as Molena, Bojac, Catpoint, and Rumford soils. Maintaining a plant cover or using crop residue as a surface mulch helps to control soil blowing.

Drainage is needed on some cropland. On uplands, drainage is needed to a limited extent for seeps and wet spots in drainageways and depressions and lowers the perched seasonal high water table in Atlee and Slagle soils. Drainage is needed for the seasonal high water table in Tomotley, Chickahominy, Newflat, and Augusta soils, and, on the terrace, Munden and Tetotum soils.

The design of surface and subsurface drainage systems varies with the kind of soil. Generally, a subsurface system is needed on Tomotley, Augusta, Munden, and Tetotum soils, but a combined surface and subsurface system is needed on Chickahominy and Newflat soils.

Fertilizers, such as nitrates, phosphates, and potash, are needed in most arable soils in the county. Such soils are commonly moderately acid or strongly acid, and require periodic applications of ground limestone. Applications of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected yield.

The choice of an appropriate cropping system is a major management decision for farmers in the county. A cropping system should be used that (1) does not cause erosion that exceeds a tolerable soil erosion loss for the soils involved, and (2) meets the needs of the farmers and is consistent with the capability of the soils. Cropping systems range from continuous row crops to various kinds of rotations to permanent grass or vegetation. Assistance in choosing an appropriate cropping system can be obtained from the local office of the Soil Conservation Service and the Extension Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. The levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6.

Woodland Management and Productivity

Essex County was originally covered with virgin timber, but most of the land suitable for cultivation has been cleared. The rest of the woodland is generally too steep or too wet for farming, and is composed of second growth hardwoods, loblolly pine, and Virginia pine.

About 60 percent of the county is woodland, most of which is privately owned.

The dominant forest types in the county are: 1) oak-hickory type, mainly on Suffolk, Kempsville, and Rumford soils, and comprising 50 percent of the woodland; 2) loblolly-shortleaf pine type, mainly on Emporia, Slagle, and Atlee soils, and comprising 35 percent of the woodland; 3) oak-gum-cypress type, mainly on Bibb and Levy soils, and comprising 10 percent of the woodland; 4) oak-pine type, mainly on Tomotley, Chickahominy, and Newflat soils, and comprising 5 percent of the woodland.

Many large woodland tracts in the county are managed for loblolly pine. Some management practices include thinning, clearcutting, drumcutting, controlled burning, and reforestation. Erosion is a major management concern during timber harvest and after reseeding.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed in the tables. The table gives the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, that the indicator species can produce. The larger the number, the greater the potential productivity. The number 1 indicates low productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 through 8, high; 9 through 11, very high; and 12 or more, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates steep slopes; *X*, stones or rocks on the surface; *W*, excessive water in or on the soil; *T*, excessive alkalinity, acidity, sodium salts, or other toxic substances in the soil; *D*, restricted rooting depth caused by bedrock, hardpan, or other restrictive layer; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, high content of rock fragments in the soil profile. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R,X,W,T,D,C,S, and F.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that erosion can occur as a result of site preparation or following cutting operations and where the soil is exposed, for example, roads, skid trails, fire lanes, and log handling areas. Forests that are abused by fire or overgrazing are also subject to erosion. The ratings for the erosion hazard are based on the percent of the slope and on the erosion factor K shown in table 15. A rating of *slight* indicates that no particular measures to prevent erosion are needed under ordinary conditions. A rating of *moderate* indicates that erosion control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

The proper construction and maintenance of roads, trails, landings, and fire lanes will help overcome the erosion hazard.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *Slight* indicates that equipment use normally is not restricted either in kind of equipment that can be used or time of year because of soil factors. If soil wetness is a factor, equipment use can be

restricted for a period not to exceed 2 months. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If soil wetness is a factor, equipment use is restricted for 2 to 6 months. A rating of *severe* indicates that equipment use is severely restricted either in kind of equipment or season of use. If soil wetness is a factor, equipment use is restricted for more than 6 months.

Choosing the most suitable equipment and timing harvesting and other management operations to avoid seasonal limitations help overcome the equipment limitation.

Seedling mortality refers to the probability of death of naturally occuring or planted tree seedlings as influenced by kinds of soil or topographic conditions. The factors considered in rating the soils for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and aspect of the slope. A rating of *slight* indicates that under usual conditions the expected mortality is less than 25 percent. A rating of *moderate* indicates that the expected mortality is 25 to 50 percent. Extra precautions are advisable. A rating of *severe* indicates that the expected mortality is more than 50 percent. Extra precautions are important. Replanting may be necessary.

The use of special planting stock and special site preparation, such as bedding, furrowing, or surface drainage, can help reduce seedling mortality.

Windthrow hazard is the likelihood of trees being uprooted (tipped over) by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions are a seasonal high water table and bedrock or a fragipan or other limiting layer. A rating of *slight* indicates that normally no trees are blown down by the wind. Strong winds may break trees but do not uproot them. A rating of *moderate* indicates that moderate or strong winds occasionally blow down a few trees during periods of soil wetness. A rating of *severe* indicates that moderate or strong winds may blow down many trees during periods of soil wetness.

The use of specialized equipment that does not damage surficial root systems during partial cutting operations can help reduce windthrow. Care in thinning or no thinning also can help reduce windthrow.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Common trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, represents an expected volume produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand. One cubic meter per hectare equals 14.3 cubic feet per acre.

The first tree species listed under common trees for a soil is the indicator species for that soil. The indicator species is the species that is common in the area and is generally the most productive on the soil. The productivity class of the indicator species is the number used for the ordination symbol.

Trees to plant are those that are suited to the soil and are planted for commercial wood production.

Recreation

The Rappahannock River, which borders Essex County, provides many recreation opportunities, including boating, fishing, swimming, water-skiing, and hunting. Several public boat landings along the river and a marina at Bowler's Wharf are available. Upland areas provide additional hunting, fishing, and boating. Camping facilities are available at Hunter's Mill Lake Campground, on U.S. Route 17. The County Department of Parks and Recreation organizes and has provided facilities for athletic and recreation activities.

There are no major public recreation areas, although many soils are well suited to the development of recreation facilities. Soils that are best suited are in map units 2, 3, and 5, described in the section "General soil map units."

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

The woodland, cropland, and wetland of Essex County support a varied population of fish and wildlife. Large wooded tracts are mainly on the upland soils, such as Atlee, Emporia, Kempsville, Rumford, and Suffolk soils. These areas and wooded margins of open fields support large numbers of white-tailed deer, wild turkey, red and gray foxes, and squirrels. The cropland throughout the county provide habitat for cottontail, ground hog, and quail, mourning dove, and many other species of birds. In the wooded swamps and tidal marshes Bibb, Levy, and Rappahannock soils support beaver, raccoon, muskrat, snakes, turtles, and numerous species of waterfowl.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, soybeans, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are tall fescue, timothy, orchard grass, and clover.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil

properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggar tick, quackgrass, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, birch, cherry, maple, holly, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are gray dogwood, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope. Examples of wetland plants are smartweed, arrowhead, burreed, pickerel weed, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, slope, and permeability. Examples of shallow water areas are marshes, swamps, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include mourning dove, bobwhite quail, meadow vole, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, frogs, and tree swallow.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the

performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential and slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to other rapidly permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include

less than 5 feet of suitable material and a high content of organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by slope and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope and wetness affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Wetness and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the

susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

Some soils in table 16 are assigned to two hydrologic soil groups. These soils have a seasonal high water table but can be drained. In this instance the first letter applies to the drained condition of the soil and the second letter to the undrained condition.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional, common,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year).

Common is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely, grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched, artesian,* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 16 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, thermic Typic Hapludults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*3*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*4*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Atlee Series

The Atlee series consists of very deep, moderately well drained soils. These soils formed in medium textured to fine textured marine sediments on Coastal Plain uplands. Slope ranges from 0 to 2 percent.

Atlee soils commonly are near Emporia, Kempsville, and strongly sloping Rumford and Slagle soils. Emporia and Kempsville soils are better drained than Atlee soils. Atlee soils are more clayey and more slowly permeable in the lower part of the solum than Kempsville soils. Unlike these Rumford and Slagle soils, Atlee soils are nearly level.

Typical pedon of Atlee silt loam, 0 to 2 percent slopes, 30 yards west of Virginia Route 604, 1 mile south of junction of Virginia Route 684 and U.S. 17, in woodland:

A—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; many fine and medium roots; very strongly acid; clear smooth boundary.

E—2 to 10 inches; pale brown (10YR 6/3) silt loam; weak fine granular structure; friable; many fine and medium roots; few fine pores; very strongly acid; clear smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; slightly hard, firm; slightly sticky, slightly plastic; common fine and medium roots; few fine pores; very strongly acid; clear smooth boundary.

Bt1—14 to 23 inches; yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; hard, firm; sticky, plastic; few fine and medium roots; few fine pores; few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—23 to 26 inches; yellowish brown (10YR 5/8) loam; few fine faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; hard, firm; sticky, plastic; few fine and medium roots; few fine pores; few distinct clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Bt3—26 to 52 inches; yellowish brown (10YR 5/6) clay loam; common medium faint pale brown (10YR 6/3) and few medium distinct light brownish gray (2.5Y 6/2) mottles; moderate coarse prismatic structure parting to weak medium platy and weak medium subangular blocky; hard, very firm; sticky, plastic; compact and brittle in 50 percent of the pedon; few fine and medium roots between prisms; light brownish gray (10YR 6/2) very fine sandy loam and sandy clay loam lenses and coatings, 0 to 2 cm thick, on faces of prisms; few fine prominent yellowish red (5YR 4/6) mottles in the lower part; few faint films of clay on faces of peds; very strongly acid; gradual smooth boundary.

Bt4—52 to 60 inches; multicolored yellowish brown (10YR 5/6) red (2.5YR 4/8) and gray (10YR 6/1) clay loam; weak, thick, platy structure; hard, firm; sticky, plastic; few faint clay films on faces of peds; very strongly acid; gradual smooth boundary.

C—60 to 72 inches; gray (10YR 6/1) clay loam; common coarse prominent red (2.5YR 4/8) and common coarse distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm; sticky, plastic; very strongly acid.

The solum is more than 50 inches thick. Depth to the compact and brittle horizon ranges from 20 to 40 inches. Fine gravel ranges from 0 to 5 percent, by volume, in individual horizons in the lower part of the solum. In unlimed areas reaction ranges from extremely acid to moderately acid in the surface layer and from extremely acid to strongly acid below.

The Ap, or A, horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Its texture is silt loam, loam, or fine sandy loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 or 4. Its texture is silt loam, loam, or fine sandy loam.

The BE horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. Its texture is silt loam, loam, or clay loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. In the upper part of the Bt horizon, above the layer that is 40 to 60 percent brittle, texture is silt loam, loam, or clay loam. In the lower part the horizon is mottled yellow, gray, brown, and red. Texture in the lower part is loam or clay loam.

The C horizon is gray to yellowish brown, strong brown, yellowish red, or red. Its texture is clay loam, silty clay loam, sandy clay, or clay.

Augusta Series

The Augusta series consists of very deep, somewhat poorly drained soils. These soils formed in medium textured to moderately fine textured fluviomarine sediments on the middle terrace along the Rappahannock River. Slope ranges from 0 to 2 percent.

Augusta soils commonly are near Munden, Tetotum, and Tomotley soils. Augusta soils have more clay in the subsoil and are more poorly drained than Munden soils, and are not as well drained as Tetotum soils. They are slightly better drained than Tomotley soils.

Typical pedon of Augusta fine sandy loam, 0 to 2 percent slopes; 3.7 miles east on Virginia Route 632 from U.S. 17, 500 feet north, in a small outfield:

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) fine sandy loam; few fine prominent strong brown (7.5YR 5/8) mottles; weak fine granular structure; friable; many fine roots; common fine tubular pores; neutral; abrupt smooth boundary.

Bt—7 to 18 inches; light olive brown (2.5Y 5/4) clay loam; many medium distinct light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm, friable; slightly sticky, slightly plastic; common fine and medium roots; common fine tubular pores; common distinct clay films on faces of peds; moderately acid; clear smooth boundary.

Btg—18 to 28 inches; light brownish gray (2.5Y 6/2) clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm, friable; slightly sticky, slightly plastic; common fine and medium roots; common fine tubular pores; common distinct clay films on faces of peds; moderately acid; clear smooth boundary.

BCg—28 to 50 inches; light gray (10YR 7/2) sandy loam; common medium distinct strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; very friable; few fine roots; few fine vesicular pores; large vertical, strong brown (7.5YR 5/8) pockets of loamy sand that are massive and somewhat brittle and compact in place; very strongly acid; clear smooth boundary.

Cg—50 to 72 inches; light gray (10YR 7/1) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; sticky, plastic; very strongly acid.

The solum ranges from 40 to 80 inches in thickness. Fine gravel ranges from 0 to 3 percent, by volume, throughout. In unlimed areas reaction is very strongly acid to moderately acid.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Its texture is fine sandy loam or sandy loam.

Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. Some of these pedons also have gray or brown mottles. Texture is fine sandy loam or sandy loam.

Some pedons have a BE horizon that has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. Brown and gray mottles are few or common. Texture is sandy loam, sandy clay loam, or loam.

The Bt horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 4. Its texture is loam, clay loam, or sandy clay loam.

The BC horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 4. Its texture ranges from sandy loam to clay.

The C horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2. Brown mottles range from few to many. Texture is commonly stratified, and ranges from sand to clay loam.

Bibb Series

The Bibb series consists of very deep, poorly drained soils. These soils are moderately permeable, and formed in loamy alluvium on flood plains. They are subject to frequent flooding in late winter and early spring. Slope is dominantly less than 1 percent, but ranges from 0 to 2 percent.

Bibb soils commonly are near strongly sloping Slagle soils and moderately steep to very steep Rumford and Slagle soils. They are not as well drained or as sloping or steep as Emporia, Rumford, and Slagle soils.

Typical pedon of Bibb sandy loam, 0 to 2 percent slopes, frequently flooded, approximately 3,000 feet southwest on Virginia Route 640 from the intersection with U.S. 17, 75 feet east of Virginia Route 640, near Elmwood Creek, in woodland:

A—0 to 4 inches; dark brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; many fine roots; very strongly acid; clear boundary.

Cg1—4 to 22 inches; grayish brown (2.5Y 5/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; many fine roots; very strongly acid; gradual boundary.

Cg2—22 to 36 inches; gray (10YR 6/1) loamy sand; single grain; loose; common fine roots; very strongly acid; gradual boundary.

Cg3—36 to 48 inches; gray (10YR 6/1) sandy loam; massive; friable; common fine roots; strongly acid; gradual boundary.

Cg4—48 to 72 inches; light gray (10YR 7/1) stratified coarse sand and sandy loam; single grain; loose; common fine roots; few loamy sand lenses; strongly acid.

In unlimed areas reaction is very strongly acid or strongly acid.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Its texture is loamy sand, sandy loam, loam, or silt loam.

The C horizon in the upper part, to a depth of 40 inches, has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 or less. Its texture is loamy sand, sandy loam, loam, or silt loam.

The C horizon in the lower part, below a depth of 40 inches, has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. Its texture is stratified and ranges from coarse sand to silt loam.

Bojac Series

The Bojac series consists of very deep, well drained soils. These soils formed in loamy fluvial sediments. They are on low-lying river terraces along the Rappahannock River. Slope ranges from 0 to 2 percent.

Bojac soils are commonly near State, Tetotum, and Munden soils. Bojac soils have less clay in the subsoil than State and Tetotum soils. In addition, they are better drained than Munden and Tetotum soils.

Typical pedon of Bojac loamy sand, 0 to 2 percent slopes, approximately 300 feet northwest of junction of Virginia Routes 606 and 645, and 75 feet southwest of Virginia Routes 606, in woodland:

Oi—1 inch to 0; partly decomposed organic matter and loose needles, twigs, and leaves.

Ap1—0 to 2 inches; dark grayish brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; many fine roots; very strongly acid; abrupt smooth boundary.

Ap2—2 to 7 inches; yellowish brown (10YR 5/4) loamy sand; weak fine granular structure; Ap1 material infiltrated into worm and root channels; very friable;

many fine, few medium roots; very strongly acid; clear smooth boundary.
Bt1—7 to 25 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; common fine, few medium roots; common fine pores; sand grains coated and bridged with clay; very strongly acid; clear smooth boundary.
Bt2—25 to 40 inches; strong brown (7.5YR 5/6) sandy clay loam; weak fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; few fine tubular pores; very strongly acid; clear smooth boundary.
C—40 to 72 inches; brownish yellow (10YR 6/6) loamy sand; common medium distinct light gray (10YR 7/2) and very pale brown (10YR 7/4) mottles; single grain; loose; few fine tubular pores; very strongly acid; diffuse boundary.

The solum ranges from 30 to 50 inches in thickness. Quartz gravel makes up 0 to 5 percent, by volume, of the A and B horizons and 0 to 15 percent of the C horizon. In unlimed areas the solum ranges from extremely acid to slightly acid. The substratum ranges from very strongly acid to moderately acid.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. Its texture is loamy sand or sandy loam.

Some pedons have a BE horizon that has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. Its texture is sandy loam or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. Its texture is sandy loam, fine sandy loam, or sandy clay loam.

Some pedons have a BC horizon, that has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. Its texture is loamy sand or loamy fine sand.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 3 to 8. Some pedons do not have mottles. Texture of the horizon is loamy sand or sand.

Bolling Series

The Bolling series consists of very deep, moderately well drained soils. These soils formed in loamy fluvial sediments. They are on the low, fluvial terrace along the Rappahannock River. Slope ranges from 0 to 2 percent.

Bolling soils commonly are near Molena and Pamunkey soils. They are not as well drained as these other soils.

Typical pedon of Bolling silt loam, 0 to 2 percent slopes, north of Chance on U.S. 17, 4.4 miles east on Virginia Route 632 to farm lane, 2,000 feet north on farm lane, 1,200 feet northwest, in hayfield:

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common fine mica flakes; moderately acid; abrupt smooth boundary.
Bt1—8 to 17 inches; yellowish brown (10YR 5/6) clay loam; moderate fine subangular blocky structure; friable; slightly sticky, slightly plastic; few distinct clay films on faces of peds; many fine mica flakes; moderately acid; gradual smooth boundary.
Bt2—17 to 22 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; few distinct clay films on faces of peds; common fine mica flakes; strongly acid; gradual smooth boundary.
Bt3—22 to 32 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; few distinct clay films on faces of peds; common fine flakes of mica; moderately acid; gradual smooth boundary.
Bt4—32 to 40 inches; light yellowish brown (10YR 6/4) sandy clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; few distinct clay films on faces of peds; common fine mica flakes; moderately acid; abrupt smooth boundary.
C—40 to 72 inches; yellowish brown (10YR 5/4) stratified loamy sand and sand; single grain; loose; common fine mica flakes; moderately acid.

The solum ranges from 30 to 60 inches or more in thickness. Few or common mica flakes are throughout the solum. Reaction ranges from strongly acid to neutral in the surface layer and the upper part of the subsoil and moderately acid to neutral in the lower part.

The A, or Ap, horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Its texture is fine sandy loam, loam, or silt loam.

Some pedons have a BE or BA horizon that has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. Its texture is silt loam or loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 6, and chroma of 4 to 8. Low chroma mottles are within the upper 10 inches of the Bt horizon. Texture of the horizon is sandy clay loam, loam, clay loam, or silty clay loam.

The C horizon in some pedons varies in color. Its texture is stratified loamy sand or sand, and ranges to clay.

Catpoint Series

The Catpoint series consists of very deep, somewhat excessively drained soils. These soils formed in sandy fluvial sediments. They are mainly on low bench terraces along major creeks. Slope ranges from 0 to 6 percent.

Catpoint soils commonly are near Bibb soils, strongly sloping to very steep Rumford soils, and strongly sloping

Slagle and Emporia soils. Unlike Catpoint soils, Bibb soils are subject to flooding. Catpoint soils are not as steep as Rumford, Slagle, and Emporia soils.

Typical pedon of Catpoint loamy sand, 0 to 6 percent slopes, 1.1 miles south of the intersection of U.S. 17 and Virginia Route 624, and 200 feet north of Mount Landing Creek, in woodland:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; common fine roots; very strongly acid; abrupt wavy boundary.

Bw—7 to 20 inches; brownish yellow (10YR 6/6) loamy sand; weak fine granular structure; very friable; common fine roots; 5 percent fine gravel; strongly acid; gradual smooth boundary.

E—20 to 35 inches; very pale brown (10YR 7/4) sand; common medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; few fine roots; 10 percent fine gravel; very strongly acid; gradual smooth boundary.

E and Bt—35 to 72 inches; (E part) very pale brown (10YR 7/3) sand; many fine faint yellow (10YR 7/6) mottles; single grain; loose; (Bt part) few discontinuous yellowish brown (10YR 5/6) sandy loam lamella 1/16 to 1/4 inch thick; few fine roots; very strongly acid; gradual smooth boundary.

The sandy material is more than 60 inches thick. Quartz gravel makes up 0 to 15 percent of the volume throughout. In unlimed areas the soil is very strongly acid to slightly acid.

The A, or Ap, horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. Its texture is fine sand or loamy sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Its texture is sand, fine sand, or loamy sand. Some pedons do not have a Bw horizon.

The E horizon has hue of 10YR or 2.5Y, value of 6 to 8, and chroma of 2 to 6. Its texture is sand or fine sand.

The lamellae in the Bt horizon have a combined thickness of less than 6 inches above a depth of 60 inches. They commonly are each 1/16 to 1/4 inch thick, and they are discontinuous. They have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. They are sandy loam or fine sandy loam.

Some pedons have a C horizon that has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 to 4. It commonly has mottles. Its texture is commonly stratified coarse sand, sand, or fine sand.

Chickahominy Series

The Chickahominy series consists of very deep, poorly drained soils. These soils formed in clayey, fluvial sediments. They are on low-lying flats and in depressions of the middle terrace, below 50 feet in elevation, along the Rappahannock River. Slope ranges from 0 to 2 percent.

Chickahominy soils commonly are near Tetotum and Tomotley soils. They are more poorly drained than Tetotum soils, and have more clay in the subsoil than Tomotley soils.

Typical pedon of Chickahominy silt loam, 0 to 2 percent slopes, 0.6 mile north on U.S. 17 from the intersection with Virginia Route 703, 100 feet northeast, in pasture:

Ap—0 to 8 inches; light brownish gray (2.5Y 6/2) silt loam; moderate medium granular structure; hard, friable; slightly sticky, slightly plastic; common fine roots; 2 percent fine angular quartz gravel; neutral; abrupt smooth boundary.

Btg1—8 to 12 inches; grayish brown (2.5Y 5/2) silty clay; moderate very fine subangular blocky structure; extremely hard, friable; sticky, plastic; common fine roots; common distinct clay films on faces of peds; extremely acid; gradual smooth boundary.

Btg2—12 to 28 inches; dark gray (10YR 4/1) clay; few medium distinct grayish brown (2.5Y 5/2) and few fine prominent yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; extremely hard, friable; sticky, plastic; few fine roots; common distinct clay films on faces of peds; extremely acid; gradual smooth boundary.

Btg3—28 to 39 inches; dark gray (10YR 4/1) clay; common fine prominent yellowish red (5YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate fine subangular blocky structure; extremely hard, firm; sticky, plastic; few fine roots; many distinct clay films on faces of peds; extremely acid; gradual smooth boundary.

Btg4—39 to 46 inches; grayish brown (10YR 5/2) clay; many medium prominent yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; extremely hard, firm; sticky, plastic; few very fine roots; many distinct clay films on faces of peds; 2 percent fine gravel; extremely acid; clear irregular boundary.

BCtg—46 to 72 inches; light gray (2.5Y 7/2) clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; extremely hard, firm; sticky, plastic; few very fine roots; few distinct clay films on faces of peds; thin ironstone concretions on plate surfaces; extremely acid.

The solum is more than 60 inches thick. Quartz gravel makes up 0 to 2 percent, by volume, of the solum. In unlimed areas the soil is extremely acid to strongly acid.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. Where value is 3, it is less than 6 inches thick. Texture is loam or silt loam.

Some pedons have a BE horizon that has hue of 10YR to 5Y, or is neutral, value of 4 to 6, and chroma of

0 to 2. Some pedons have high chroma mottles. Texture of the horizon is loam, silt loam, clay loam, or silty clay loam.

The Bt horizon has hue of 10YR to 5Y, or is neutral, value of 4 to 7, and chroma of 0 to 2. Most pedons have high chroma mottles. Texture of the horizon is clay loam, silty clay loam, silty clay, or clay.

Dogue Series

The Dogue series consists of very deep, moderately well drained soils. These soils formed in clayey, fluvial sediments. They are on broad, middle terraces along the Rappahannock River. Slope ranges from 0 to 2 percent.

Dogue soils commonly are near State, Tetotum, Newflat, and Chickahominy soils. They have more clay in the subsoil than in that of State and Tetotum soils, and are not as poorly drained as Chickahominy and Newflat soils.

Typical pedon of Dogue loam, 0 to 2 percent slopes, 1 1/4 miles east-northeast of Portobago Creek and U.S. 17, along the edge of a cropfield, in a wooded area:

Oi—1 to 0 inch; partly decomposed organic matter and loose leaf litter.

A—0 to 2 inches; dark brown (10YR 4/3) loam; weak fine granular structure; friable; many fine and medium roots; 2 percent gravel; very strongly acid; abrupt smooth boundary.

E—2 to 8 inches; light yellowish brown (2.5Y 6/4) loam; moderate fine granular structure; friable; many fine roots; 2 percent gravel; very strongly acid; gradual smooth boundary.

Bt1—8 to 17 inches; yellowish brown (10YR 5/6) clay loam; moderate fine subangular blocky structure; friable; slightly sticky, slightly plastic; common fine roots; few distinct clay films on faces of peds; 5 percent gravel; few fine pores; very strongly acid; gradual smooth boundary.

Bt2—17 to 24 inches; light olive brown (2.5Y 5/4) clay; few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; sticky, plastic; few fine roots; common distinct clay films on faces of peds; 5 percent gravel; few fine pores; strongly acid; gradual smooth boundary.

Bt3—24 to 35 inches; pale brown (10YR 6/3) clay; few medium distinct yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) mottles; moderate fine and medium subangular blocky structure; friable, sticky, plastic; few fine roots; common distinct clay films on faces of peds; 5 percent gravel; few fine pores; very strongly acid; clear smooth boundary.

Btg—35 to 53 inches; gray (10YR 5/1) clay; few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; sticky, plastic; few fine roots; common distinct clay films on faces of peds; 10 percent gravel; few fine pores; very strongly acid; gradual smooth boundary.

Cg—53 to 72 inches; light gray (2.5Y 7/2) stratified clay loam and sand; few medium distinct yellowish brown (10YR 5/6) mottles; massive; slightly sticky, slightly plastic; 10 percent gravel; very strongly acid.

The solum ranges from 50 to 60 inches or more in thickness. Quartz gravel, by volume, makes up 0 to 15 percent of the solum and 0 to 25 percent of the C horizon. In unlimed areas reaction is extremely acid to strongly acid.

The A, or Ap, horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Its texture is fine sandy loam, loam, or silt loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 to 6. It is fine sandy loam, loam, or silt loam.

Some pedons have a BA horizon that has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 4 to 8. Its texture is loam or clay loam.

The Bt horizon in the upper part has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. In the lower part it has hue of 7.5YR to 2.5Y, or is neutral, value of 4 to 7, and chroma of 0 to 8. In the lower part it has low or high chroma mottles, or is mottled without a dominant matrix color. The Bt horizon is clay loam, sandy clay, or clay.

Some pedons have a BC horizon that has hue of 7.5YR to 2.5Y, or is neutral, value of 4 to 7, and chroma of 0 to 8. Its texture is sandy clay loam, clay loam, or sandy clay.

The C horizon has high or low chroma mottles. Its texture is commonly stratified and ranges from sand to clay loam in the fine earth fraction.

Emporia Series

The Emporia series consists of very deep, well drained soils. These soils formed in stratified, loamy and clayey, fluvial and marine sediments on uplands and side slopes adjacent to major drainageways on the Coastal Plain. Slope ranges from 0 to 50 percent.

Emporia soils commonly are near Kempsville and Slagle soils. Emporia soils are more slowly permeable than Kempsville soils and better drained than Slagle soils.

Typical pedon of Emporia sandy loam, 2 to 6 percent slopes, 1/2 mile south on Virginia Route 635 from its intersection with Virginia Route 636, 5,500 feet east on lane through a wooded area, 500 feet southwest of equipment loading area:

A—0 to 3 inches; grayish brown (2.5Y 5/2) sandy loam; weak fine granular structure; soft, friable; many fine roots; strongly acid; clear smooth boundary.

E—3 to 9 inches; yellowish brown (10YR 5/4) loam; weak fine structure; slightly hard, friable; slightly sticky; many fine and few medium roots; few fine

pores; 2 percent gravel; strongly acid; clear smooth boundary.

Bt1—9 to 13 inches; yellowish brown (10YR 5/8) clay loam; weak fine subangular blocky structure; very hard, friable; sticky, plastic; common fine roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; strongly acid; clear wavy boundary.

Bt2—13 to 24 inches; strong brown (7.5YR 5/6) clay loam; few fine distinct yellowish red (5YR 5/8) mottles and common coarse distinct yellowish brown (10YR 5/6) mottles; fine subangular blocky structure; extremely hard, friable; sticky, plastic; few fine roots; few fine pores; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—24 to 42 inches; brownish yellow (10YR 6/6) sandy clay loam; common coarse distinct strong brown (7.5YR 5/6) and few fine distinct yellowish red (5YR 5/8) mottles; weak thin platy structure parting to moderate medium subangular blocky; slightly brittle and compact in place, firm; slightly sticky, slightly plastic; few fine roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; very strongly acid; gradual smooth boundary.

Bt4—42 to 48 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light gray (10YR 7/2) and many medium distinct pale brown (10YR 6/3) mottles; weak thin platy structure parting to moderate medium subangular blocky; slightly brittle and compact in place, firm; slightly sticky, slightly plastic; few fine pores; common distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt5—48 to 72 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct light gray (10YR 7/1) and red (2.5YR 5/8) mottles; weak very thin platy structure parting to moderate fine subangular blocky; slightly brittle and compact in place, firm; sticky, plastic, common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

The solum is more than 40 inches thick. Rock fragments, by volume, make up 0 to 15 percent of the A and B horizons and 0 to 20 percent of the C horizon. In unlimed areas reaction is very strongly acid to moderately acid.

The Ap, or A, horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Its texture is sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 or 4. Its texture is sandy loam, fine sandy loam, or loam.

Some pedons have an EB, or AB, horizon that has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 4 to 6. Its texture is sandy loam, fine sandy loam, or loam.

The upper part of the Bt horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. The lower part of the Bt horizon has hue of 5YR to 2.5Y, or is neutral, value of 4 to 6, and chroma of 0 to 8, or it is mottled without dominant matrix hue. The Bt horizon is sandy loam, fine sandy loam, loam, sandy clay loam, or clay loam. In some pedons in the lower part it ranges to sandy clay or clay.

Some pedons have a BC horizon that has hue of 5YR to 2.5Y, or is neutral, value of 4 to 6, and chroma of 0 to 8, or it is mottled without dominant matrix hue. Its texture is sandy loam, fine sandy loam, loam, sandy clay loam, or clay loam.

Some pedons have a C horizon that has hue of 5YR to 5Y, or is neutral, value of 3 to 8, and chroma of 0 to 8. Most pedons are mottled or variegated with high or low chroma mottles. Texture of the horizon ranges from sandy loam to clay in the fine earth fraction.

Kempsville Series

The Kempsville series consists of very deep, well drained soils. These soils formed in loamy, fluvial and marine sediments. They are on uplands and side slopes of drainageways on the Coastal Plain. Slope ranges from 0 to 10 percent.

Kempsville soils commonly are near Emporia, Rumford, and Suffolk soils. They do not have a perched seasonal high water table or moderately slow permeability typical of Emporia soils. They do not have as much sand in the subsoil as Rumford soils, and have a thicker subsoil than Suffolk soils.

Typical pedon of Kempsville sandy loam, 2 to 6 percent slopes, 1 1/4 miles east on Virginia Route 684 from Miller's Tavern, 1,000 feet south of Virginia Route 684, in cropland:

Ap—0 to 8 inches; brown (10YR 5/3) sandy loam; weak fine granular structure; soft, very friable; common fine roots; slightly acid; abrupt smooth boundary.

BE—8 to 12 inches; light yellowish brown (10YR 6/4) loam; common medium faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; hard, friable; slightly sticky; common fine roots; few faint thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

Bt1—12 to 22 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; hard, friable; slightly sticky, slightly plastic; few fine roots; few fine tubular pores; few distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—22 to 36 inches; strong brown (7.5YR 5/6) sandy clay loam; common coarse distinct brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; strong brown portion is friable; slightly

sticky, brownish yellow portion (25 percent of horizon) is firm and slightly compact in place; few fine roots; few fine and medium tubular pores; few distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt3—36 to 49 inches; strong brown (7.5YR 5/8) sandy clay loam; weak medium subangular blocky structure; very hard, friable; slightly sticky, few fine roots; 10 percent ironstone fragments up to 4 inches long; few distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4—49 to 72 inches; yellowish brown (10YR 5/8) sandy loam; common medium distinct red (2.5YR 5/8) mottles; weak medium platy structure parting to weak fine subangular blocky; very hard, firm; few fine pores; few distinct clay films and clay coatings in pores; very strongly acid.

The solum ranges from 50 to 80 inches in thickness. Gravel, by volume, ranges from 0 to 20 percent in the A and B horizons and 0 to 25 percent in the C horizon. In unlimed areas reaction is very strongly acid or strongly acid.

The A, or Ap, horizon has hue of 7.5YR to 2.5Y, value of 2 to 5, and chroma of 2 to 4. Its texture is coarse sandy loam, sandy loam, fine sandy loam, or loam in the fine earth fraction.

Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 to 6. Its texture is coarse sandy loam, sandy loam, fine sandy loam, or loam in the fine earth fraction.

The BE horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 4 or 6. Its texture is sandy loam, fine sandy loam, or loam in the fine earth fraction.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. In some pedons in the lower part it has hue of 5YR. Texture of the horizon is fine sandy loam, sandy loam, loam, clay loam, or sandy clay loam in the fine earth fraction. In some pedons a subhorizon of the Bt horizon is brittle and somewhat compact in as much as 40 percent of the volume. This subhorizon commonly has few to many pale brown, very pale brown, or light yellowish brown mottles and a slightly lower clay content than overlying or underlying horizons.

Some pedons have a BC horizon that has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Its texture is sandy loam, loam, or sandy clay loam in the fine earth fraction.

Some pedons have a C horizon that has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8, or it is stratified or mottled with high chroma mottles. Its texture ranges from loamy sand to sandy clay loam in the fine earth fraction. Some pedons have high chroma mottles, and some pedons have low chroma mottles below a depth of 50 inches.

Levy Series

The Levy series consists of very deep, very poorly drained soils. These soils formed in fluvial sediments in low, nearly level backswamp areas and fresh water marshes. They are subject to frequent flooding. Adjacent to tidal marshes, they are subject to almost continuous flooding. Slopes are mainly less than 1 percent, but range to 2 percent.

Levy soils commonly are near Molena, Pamunkey, and Rappahannock soils. Levy soils are composed of mineral material in more than half of the upper 32 inches, whereas Rappahannock soils are composed mostly of organic material. Levy soils are more poorly drained than Molena and Pamunkey soils.

Typical pedon of Levy silt loam, 0 to 2 percent slopes, 2.5 miles north of the confluence of Baylor's Creek and the Rappahannock River, 25 feet from high tide line, into marsh:

A—0 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct dark brown (7.5YR 4/4) mottles; massive; flows very easily between fingers when squeezed; very strongly acid; abrupt smooth boundary.

Cg1—12 to 30 inches; gray (10YR 6/1) silty clay; massive; flows easily between fingers when squeezed; strongly acid; clear smooth boundary.

Cg2—30 to 48 inches; dark gray (10YR 4/1) silty clay; massive; many partly decomposed stems and wood fragments; flows easily between fingers when squeezed; strongly acid; clear smooth boundary.

Oa—48 to 72 inches; very dark gray (10YR 3/1) muck (sapric material); massive; flows easily between fingers when squeezed; strongly acid.

These soils have N value of 0.7 or more in all mineral layers to a depth of 40 inches. Reaction in the surface layer and the substratum is extremely acid to strongly acid.

The A horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. Some pedons do not have high chroma mottles. Texture of the horizon is silt loam or silty clay loam.

The C horizon in the upper part has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay or clay. In the lower part it is variable in color and texture, ranging from sand to clay.

Organic layers are neutral or have hue of 10YR, value of 2 or 3, and chroma of 0 to 2.

Molena Series

The Molena series consists of very deep, somewhat excessively drained soils. These soils formed in sandy, fluvial and marine sediments. They are on the broad,

low-lying terrace along the Rappahannock River. Slope ranges from 0 to 6 percent.

Molena soils commonly are near Pamunkey and Rappahannock soils. Molena soils are coarser textured than Pamunkey soils. Unlike Molena soils, Rappahannock soils are subject to daily tidal flooding.

Typical pedon of Molena loamy sand, 0 to 2 percent slopes, 2.1 miles northeast of the junction of Virginia Route 674 and U.S. 17, 100 feet east of fence, in cropland:

Ap—0 to 8 inches; dark brown (7.5YR 4/4) loamy sand; weak fine granular structure; very friable; many fine roots; mildly alkaline; abrupt smooth boundary.
E—8 to 12 inches; dark yellowish brown (10YR 4/6) loamy sand; weak fine granular structure; very friable; common fine roots; few fine charcoal fragments; mildly alkaline; gradual smooth boundary.
Bt—12 to 23 inches; brown (7.5YR 5/4) loamy sand; weak fine subangular blocky structure; friable; few fine roots; sand grains coated and bridged with clay; 2 percent gravel; few mica flakes; moderately acid; gradual smooth boundary.
BC—23 to 41 inches; strong brown (7.5YR 5/6) sand; single grain; loose; 5 percent gravel; moderately acid; gradual smooth boundary.
C1—41 to 54 inches; strong brown (7.5YR 5/6) gravelly sand; single grain; loose; 34 percent gravel; moderately acid; gradual smooth boundary.
C2—54 to 72 inches; brownish yellow (10YR 6/6) sand; single grain; loose; 12 percent gravel; moderately acid.

The solum ranges from 40 to 60 inches in thickness. Rounded gravel ranges from 0 to 5 percent, by volume, in the solum and 0 to 35 percent in the C horizon. In unlimed areas reaction ranges from very strongly acid to slightly acid in the surface layer and very strongly acid to moderately acid below.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. Its texture is sand or loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 6. Its texture is sand or loamy sand.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. Its texture is loamy fine sand or loamy sand.

The C horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 6 or 8. Its texture is coarse sand or sand in the fine earth fraction.

Munden Series

The Munden series consists of very deep, moderately well drained soils. These soils formed in sandy marine sediments. They are on the middle terrace along the Rappahannock River. Slope ranges from 0 to 2 percent.

Munden soils commonly are near Tomotley, State, and Tetotum soils. Munden soils have less clay in the subsoil than Tetotum soils and are better drained than Tomotley soils. Munden soils are not as well drained as State soils.

Typical pedon of Munden fine sandy loam, 0 to 2 percent slopes, 0.5 mile southwest on Virginia Route 625 from the intersection with U.S. 17, 1,500 feet southeast on Kinloch Estate Road, 1,500 feet southeast of farm buildings, 200 feet south of power line, in cropland:

Ap—0 to 11 inches, brown (10YR 4/3) fine sandy loam; few medium distinct yellowish brown (10YR 5/4) mottles; weak fine granular structure; hard, friable; common fine roots; neutral; abrupt smooth boundary.
Bt1—11 to 23 inches; light olive brown (2.5Y 5/4) sandy loam; weak fine subangular blocky structure; hard, friable; few fine roots; common fine tubular pores; common distinct clay films in pores; 5 percent gravel less than 1/4 inch in diameter; neutral; clear wavy boundary.
Bt2—23 to 30 inches, light yellowish brown (2.5Y 6/4) sandy loam; few medium distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and white (10YR 8/2) mottles; weak fine subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; clay bridging between sand grains; 5 percent gravel less than 1/4 inch in diameter; very strongly acid; clear smooth boundary.
Cg1—30 to 39 inches; light gray (10YR 7/2) loamy sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose, friable; few fine tubular pores; 5 percent gravel less than 1/4 inch in diameter; very strongly acid; clear wavy boundary.
Cg2—39 to 47 inches; stratified pale brown (10YR 6/3), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) loamy sand and sandy loam; massive; hard, compact in place; 5 percent gravel less than 1/4 inch in diameter; very strongly acid; clear wavy boundary.
Cg3—47 to 72 inches; light brownish gray (10YR 6/2) silty clay loam lenses intermixed with strata of fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very hard, firm; slightly sticky, plastic; very strongly acid.

The solum ranges from 30 to 45 inches in thickness. Gravel ranges from 0 to 5 percent, by volume, throughout. In unlimed areas reaction is very strongly acid to moderately acid.

The A, or Ap, horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is fine sandy loam, sandy loam, loamy fine sand, or loamy sand.

Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6. Its texture

is fine sandy loam, sandy loam, loamy fine sand, or loamy sand.

The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Its texture is fine sandy loam, sandy loam, or loam.

Some pedons have a BC horizon that has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6. Its texture is sandy loam or loamy sand. Some of these pedons have lenses of sandy clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6. It has both high and low chroma mottles. It is sand, loamy sand, loamy fine sand, sandy loam, or fine sandy loam and lenses or strata that range from sandy clay loam through silty clay.

Newflat Series

The Newflat series consists of very deep, somewhat poorly drained soils. These soils formed in clayey, fluvial sediments. They are on the broad, level, middle terrace below 50 feet in elevation along the Rappahannock River. Slope ranges from 0 to 2 percent.

Newflat soils commonly are near Chickahominy, State, and Tetotum soils. Newflat soils are slightly better drained than Chickahominy soils, and are more poorly drained and have more clay in the subsoil than State and Tetotum soils.

Typical pedon of Newflat silt loam, 0 to 2 percent slopes, 1/2 mile north on U.S. 17 from the intersection with Virginia Route 703, 800 feet northeast, in pasture:

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) silt loam; moderate fine granular structure; hard, friable; slightly sticky, slightly plastic; common fine roots; slightly acid; abrupt smooth boundary.

Bt—8 to 13 inches; light olive brown (2.5Y 5/4) silty clay loam; few fine and medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, friable; sticky, plastic; common fine roots; common distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Btg1—13 to 29 inches; gray (10YR 5/1) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse columnar structure parting to moderate fine subangular blocky; extremely hard, firm; sticky, plastic; common fine roots; few fine tubular pores; common distinct clay films on faces of peds; 2 percent gravel less than 1/4 inch in diameter; extremely acid; gradual smooth boundary.

Btg2—29 to 42 inches; grayish brown (10YR 5/2) clay loam; many coarse prominent yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; very hard, firm; slightly sticky; few fine roots; 2 percent gravel less than 1/4 inch in diameter; common distinct clay films; extremely acid; clear wavy boundary.

Btg3—42 to 72 inches; light gray (2.5YR 7/2) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; extremely hard, firm; sticky, plastic; few medium clay films on ped faces; thin platy ironstone concretions on upper plate surfaces; extremely acid.

The solum ranges from 60 to 80 inches or more in thickness. Quartz gravel, by volume, ranges from 0 to 2 percent throughout. In unlimed areas the soil is extremely acid to strongly acid.

The A, or Ap, horizon has hue of 10YR or 2.5Y, or is neutral, value of 3 to 5, and chroma of 0 to 2. Its texture is loam or silt loam.

Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 4. Its texture is loam or silt loam.

Some pedons have a BA or BE horizon that has hue of 10YR to 5Y, value of 5 or 6, and chroma of 3 to 6. Its texture is loam, silt loam, clay loam, or silty clay loam.

Pedons that do not have a BA or BE horizon have a Bt horizon that in the upper 4 to 10 inches has hue of 10YR to 5Y, value of 5 or 6, and chroma of 3 to 6. It has common to many high or low chroma mottles. Below this part it has hue of 10YR to 5Y, or is neutral, value of 4 to 7, and chroma of 0 to 2. It has common to many high chroma mottles. It is clay loam, silty clay loam, silty clay, or clay.

Some pedons have a BC horizon that has hue of 10YR to 5Y, or is neutral, value of 4 to 7, and chroma of 0 to 2. Its texture is loam, silt loam, sandy clay loam, clay loam, or clay.

Some pedons have a C horizon that has hue of 10YR to 5Y, or is neutral, value of 4 to 7, and chroma of 0 to 2. Its texture ranges from fine sandy loam to clay.

Pamunkey Series

The Pamunkey series consists of very deep, well drained soils. These soils formed in loamy, fluvial sediments. They are on the nearly level, low, fluvial terrace below 15 feet in elevation along the Rappahannock River. Slope ranges from 0 to 2 percent.

Pamunkey soils commonly are near Molena and Rappahannock soils. They are not subject to daily tidal flooding and are better drained than Rappahannock soils. They have more clay in the subsoil than Molena soils.

Typical pedon of Pamunkey loam, wet substratum, 0 to 2 percent slopes, 4,800 feet northeast on Virginia Route 603 from its intersection with U.S. 17, north of Mount Landing Creek, 300 feet west, in cropland.

Ap—0 to 12 inches; brown (7.5YR 4/4) loam; moderate fine granular structure; hard, friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—12 to 29 inches; yellowish red (5YR 5/8) clay loam; moderate fine subangular blocky structure; very hard, friable; slightly sticky; common fine roots; few fine pores; common distinct clay films on faces of peds; common fine mica flakes; neutral; gradual smooth boundary.

Bt2—29 to 38 inches; yellowish red (5YR 5/8) loam; weak fine subangular blocky structure; hard, friable; slightly sticky; common fine roots; few fine tubular pores; common distinct clay films on faces of peds; common dark concretions; common fine flakes of mica; neutral; gradual smooth boundary.

BC—38 to 51 inches; yellowish red (5YR 4/6) fine sandy loam; weak coarse subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; krotovinas 1 inch in diameter; few fine dark concretions; many fine flakes of mica; moderately acid; clear smooth boundary.

C—51 to 72 inches; strong brown (7.5YR 5/6) loamy fine sand; few medium distinct pale brown (10YR 6/3) mottles; single grain; loose; few fine roots; many fine flakes of mica; moderately acid.

The solum ranges from 40 to 60 inches or more in thickness. Quartz gravel makes up 0 to 15 percent of the volume throughout. Reaction ranges from moderately acid to neutral.

The A, or Ap, horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. The A, or Ap, horizon is fine sandy loam, sand loam, loam, or silt loam.

Some pedons have an E horizon that has hue of 7.5YR to 10YR, value of 5 or 6, and chroma of 2 to 4. Its texture is fine sandy loam, sandy loam, loam, or silt loam.

Some pedons have a BA or BE horizon that has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. Its texture is sandy loam, fine sandy loam, or loam.

The Bt horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. Its texture is fine sandy loam, loam, sandy clay loam, or clay loam.

The BC horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. Its texture is sandy loam, fine sandy loam, loam, sandy clay loam, or clay loam.

The C or 2C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. Its texture ranges from sand to fine sandy loam. Some pedons contain strata of finer texture.

Rappahannock Series

The Rappahannock series consists of very deep, very poorly drained soils. These soils formed in highly decomposed herbaceous organic material overlying stratified fluvial sediments. They are in tidal marsh areas along the Rappahannock River and its major tributaries. Most areas are subject to flooding twice daily by brackish water. Slope is 0 or 1 percent.

Rappahannock soils commonly are near Pamunkey, State, and Tetotum soils. They consist of organic materials not typical of Pamunkey, State, and Tetotum soils. Also, they commonly are subject to flooding twice daily by brackish water, and are in a lower landscape position than Pamunkey, State, and Tetotum soils.

Typical pedon of Rappahannock muck, 0 to 1 percent slopes, frequently flooded, at a boat landing area near the confluence of Mount Landing Creek and the Rappahannock River, 3,500 feet southeast of the intersection of Virginia Route 703 and U.S. 17, 200 feet south of U.S. 17 in marsh:

Oa—0 to 3 inches; black (5Y 2.5/1) muck (sapric material); about 10 percent fiber when rubbed; massive; flows very easily between fingers when squeezed; moderately alkaline; clear boundary.

Oe—3 to 30 inches; dark olive gray (5Y 3/2) mucky peat (hemic material); about 25 percent fiber when rubbed; massive; flows easily between fingers when squeezed; moderately alkaline; clear boundary.

2Cg1—30 to 48 inches; dark olive gray (5Y 3/2) mucky silty clay loam; massive; sticky, slightly plastic; common fibers and few fine roots; moderate sulfide odor; flows with difficulty between fingers when squeezed; mildly alkaline; clear smooth boundary.

2Cg2—48 to 65 inches; dark gray (5Y 4/1) silty clay loam; massive; sticky, slightly plastic; moderate sulfide odor; flows easily between fingers when squeezed; neutral; clear smooth boundary.

O'a—65 to 72 inches; very dark gray (5Y 3/1) muck (sapric material); 5 percent fiber rubbed; massive; flows easily between fingers when squeezed; strong sulfide odor; mildly alkaline.

Reaction ranges from strongly acid to moderately alkaline. After the soils have dried, reaction ranges from very strongly acid to slightly acid. Mineral strata are in the control section below the surface tier.

When rubbed, the organic material in all tiers has hue of 10YR to 5GY, or is neutral, value of 2 or 3, and chroma of 0 to 2. They are muck or mucky peat.

The mineral strata have hue of 10YR to 5GY, or are neutral, value of 2 to 5, and chroma of 0 to 2. They range from silt loam to clay in the surface and subsurface tiers, and include sandy loam and loamy sand in the bottom tier.

Rumford Series

The Rumford series consists of very deep and somewhat excessively drained soils. These soils formed in loamy fluvial and marine sediments on uplands and side slopes adjacent to drainageways on the Coastal Plain. Slope ranges from 0 to 50 percent.

Rumford soils commonly are near Kempsville, Emporia, and Suffolk soils. They are coarser textured than these other soils.

Typical pedon of Rumford loamy sand, 0 to 6 percent slopes, 1 mile south on Virginia Route 650 from Virginia Route 619, 1,500 feet east along edge of field, 50 feet south, in woods:

Ap—0 to 7 inches; brown (10YR 5/3) loamy sand; weak fine granular structure; loose, very friable; many fine and few medium roots and pores; strongly acid; clear smooth boundary.

BE—7 to 14 inches; yellowish brown (10YR 5/4) loamy sand; moderate fine subangular blocky structure; slightly hard, friable; common fine roots and pores; slightly acid; gradual smooth boundary.

Bt1—14 to 23 inches; strong brown (7.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; slightly sticky, slightly plastic; few distinct clay films on faces of peds and in root channels and pores; slightly acid; clear smooth boundary.

Bt2—23 to 31 inches; strong brown (7.5YR 4/6) sandy loam; weak fine subangular blocky structure; soft, very friable; nonsticky, nonplastic; few faint clay films on faces of peds; few fine roots and pores; slightly acid; gradual smooth boundary.

BC—31 to 52 inches; yellowish brown (10YR 5/8) loamy sand; single grain; loose; few fine roots and pores; slightly acid; gradual smooth boundary.

C—52 to 72 inches; brownish yellow (10YR 6/8) fine sand; few medium distinct white (10YR 8/2) mottles; single grain; loose; few fine and medium roots; slightly acid.

The solum ranges from 28 to 55 inches in thickness. Quartz gravel ranges from 0 to 15 percent, by volume, in the A and B horizons and from 0 to 50 percent in the C horizon. In unlimed areas reaction ranges from extremely acid to strongly acid in the A horizon, from very strongly acid to moderately acid in the B horizon, and from extremely acid to slightly acid in the C horizon.

The A, or Ap, horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The BA, or BE, horizon has hue of 5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8. Its texture is loamy sand, sandy loam, or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. Its texture is sandy loam, fine sandy loam, or sandy clay loam.

The BC horizon has hue of 5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 6 to 8. In some pedons it is white or light gray. Its texture ranges from sand to fine sandy loam in the fine earth fraction. In some pedons the horizon is stratified.

Slagle Series

The Slagle series consists of very deep, moderately well drained soils. These soils formed in loamy, fluvial and marine sediments on uplands and side slopes of narrow drainageways on the Coastal Plain. Slope ranges from 2 to 15 percent.

Slagle soils commonly are near Emporia, Kempsville, and Rumford soils. They are more poorly drained than Emporia and Kempsville soils. They are not as well drained as Rumford soils, and do not have the coarse texture characteristic of those soils.

Typical pedon of Slagle fine sandy loam, 2 to 6 percent slopes, about 4,200 feet northeast of junction of U.S. 17 and Virginia Route 601, 100 feet northwest of Virginia Route 601, in cropland:

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam; weak fine granular structure; friable; many fine roots; few worm channels; moderately acid; abrupt smooth boundary.

E—5 to 10 inches; light yellowish brown (10YR 6/4) fine sandy loam; moderate fine granular structure; friable; few very fine roots; few fine pores; moderately acid; clear smooth boundary.

BE—10 to 14 inches; olive yellow (2.5Y 6/6) loam; weak fine subangular blocky structure; friable; few fine roots; few fine pores; 2 percent quartz gravel; moderately acid; clear smooth boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/6) sandy clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; common fine pores; worm channels; common distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—20 to 29 inches; yellowish brown (10YR 5/6) sandy clay loam; many medium distinct pale brown (10YR 6/3) and few medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm and compact in place; slightly sticky, slightly plastic; few fine roots; common fine pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—29 to 48 inches; strong brown (7.5YR 5/6) sandy clay loam; few medium distinct yellowish brown (10YR 5/8), red (2.5YR 4/8), and light gray (10YR 7/2) mottles; weak medium and coarse subangular blocky structure; firm; slightly sticky, slightly plastic; few fine pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

2BCt—48 to 58 inches; strong brown (7.5YR 5/6) stratified sandy loam, loam, and sandy clay loam; common medium distinct yellowish brown (10YR 5/8), red (2.5YR 4/8), and light gray (10YR 7/2) mottles; weak medium subangular blocky structure; firm, slightly sticky; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

2Cg—58 to 72 inches; mottled light gray (10YR 7/2), strong brown (7YR 5/6), brownish yellow; (10YR 6/8) and red (2.5YR 4/8); stratified loamy sand and sandy clay loam; massive; firm; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Quartz gravel, by volume, ranges from 0 to 5 percent throughout. Stratified layers are below a depth of 40 inches. In unlimed areas reaction is very strongly acid or strongly acid.

The Ap, or A, horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Its texture is sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. Its texture is sandy loam, fine sandy loam, or loam.

The BE, or BA, horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 or 6. Its texture is fine sandy loam or loam.

The Bt horizon in the upper part has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 8. In the lower part it has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8, or it is mottled or variegated in shades of red, brown, yellow, olive, or gray. Texture of the horizon is sandy loam, sandy clay loam, loam, or clay loam. In the lower part the horizon includes sandy clay and is stratified.

The C horizon is variable in color. It is gray or is mottled or variegated in shades of red, yellow, brown, olive, or gray. Its texture is variable, and ranges from loamy sand to clay and is stratified.

State Series

The State series consists of very deep, well drained soils. These soils formed in loamy, fluvial and marine sediments. They are on the nearly level or gently sloping, middle terrace along the Rappahannock River. Slope ranges from 0 to 6 percent.

State soils commonly are near Munden, Tetotum, and Tomotley soils. They are better drained than these other soils.

Typical pedon of State fine sandy loam, 0 to 2 percent slopes, 2,000 feet northeast on Virginia Route 674 from U.S. 17, 1,700 feet northwest on lane to farm shed, in cropland:

Ap—0 to 12 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; soft, friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—12 to 26 inches; dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; firm; sticky, plastic; common fine and few medium roots; many fine and medium pores; common distinct clay films on faces of peds; 2 percent gravel; strongly acid; gradual smooth boundary.

Bt2—26 to 33 inches; yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; slightly sticky, slightly plastic; few fine roots; common fine pores; common distinct clay films on faces of peds; 2 percent gravel; strongly acid; gradual smooth boundary.

BC—33 to 42 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; slightly hard, friable; few fine roots and pores; 2 percent gravel; strongly acid; gradual smooth boundary.

C—42 to 72 inches; yellowish brown (10YR 5/4) loamy sand; few coarse distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/8) mottles; single grain; loose; 2 percent gravel; very strongly acid.

The solum ranges from 30 to 55 inches in thickness. Gravel ranges from 0 to 2 percent, by volume, in the solum and from 0 to 15 percent in the C horizon. Reaction is very strongly acid or strongly acid in the surface layer and the subsoil in limed areas, and ranges from very strongly acid to moderately acid in the substratum.

The A, or Ap, horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4. Its texture is fine sandy loam, sandy loam, or loam.

Some pedons have a BA or BE horizon that has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Its texture is sandy loam, fine sandy loam, loam, or sandy clay loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. In some pedons the B horizon in the lower part is mottled. Texture of the horizon is sandy loam, sandy clay loam, loam, or clay loam.

The BC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Its texture is sandy loam, fine sandy loam, loam, or sandy clay loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 2 to 8. It is mottled in shades of brown and gray. Its texture is commonly stratified and includes sands, loamy sand, and sandy loam.

Suffolk Series

The Suffolk series consists of very deep, well drained soils. These soils formed in loamy, fluvial and marine sediments. They are on uplands and side slopes on the Coastal Plain. Slope ranges from 0 to 6 percent.

Suffolk soils commonly are near Emporia, Kempsville, and Rumford soils. They have a more permeable subsoil

than Emporia soils and a sandier substratum than Kempsville soils. They have more clay in the subsoil than Rumford soils.

Typical pedon of Suffolk sandy loam, 0 to 2 percent slopes, 1 mile west of intersection of Virginia Routes 620 and 626, 500 feet south of Virginia Route 626, in cropland:

Ap—0 to 10 inches; brown (10YR 5/3) sandy loam; weak fine granular structure; soft, very friable; common fine roots; common earthworm channels; moderately acid; abrupt smooth boundary.

BE—10 to 13 inches; light yellowish brown (10YR 6/4) sandy loam; weak medium subangular blocky structure; soft, very friable; common fine and very fine roots; few fine tubular pores; Ap material inside worm channels; moderately acid; clear smooth boundary.

Bt1—13 to 19 inches; yellowish brown (10YR 5/8) sandy loam; weak medium subangular blocky structure; hard, friable; slightly sticky, slightly plastic; few fine roots; common fine tubular pores; clay coating on inside of pores; many worm channels; moderately acid; clear smooth boundary.

Bt2—19 to 30 inches; strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; hard, friable; slightly sticky, slightly plastic; few fine roots; common fine tubular pores; common distinct clay films on faces of peds and inside pores; strongly acid; gradual smooth boundary.

BC—30 to 37 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; soft, very friable; few fine roots; common fine tubular pores; sand grains coated and bridged with clay; strongly acid; gradual smooth boundary.

C1—37 to 44 inches; reddish yellow (7.5YR 6/6) sand; single grain; loose; few fine roots; strongly acid; gradual smooth boundary.

C2—44 to 72 inches; brownish yellow (10YR 6/8) loamy sand; common medium distinct very pale brown (10YR 7/3) mottles; single grain; loose; strongly acid.

The solum ranges from 30 to 50 inches in thickness. Quartz gravel makes up 0 to 5 percent, by volume, of the A and B horizons and 0 to 30 percent of the C horizon. In unlimed areas reaction ranges from extremely acid to strongly acid in the A horizon and in the upper part of the B horizon and from extremely acid to moderately acid in the lower part of the B horizon and in the C horizon.

The Ap, or A, horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 3 or 4. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

Some pedons have an E horizon that has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 6. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The BE or BA horizon has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 3 to 6. It is sandy loam or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. In some pedons it has a subhorizon that has hue of 5YR. Texture of the horizon is sandy loam, fine sandy loam, sandy clay loam, loam, or clay loam.

The BC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Its texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The C or 2C horizon has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 2 to 8. In the lower part the C horizon has high or low chroma mottles. Texture of the horizon is sand, fine sand, loamy sand, or loamy fine sand in the fine earth fraction.

Tetotum Series

The Tetotum series consists of very deep, moderately well drained soils. These soils formed in loamy, marine sediments. They are on the nearly level to gently sloping, middle terrace along the Rappahannock River. Slope ranges from 0 to 6 percent.

Tetotum soils commonly are near Munden, State, and Tomotley soils. They are not as well drained as State soils, have more clay in the subsoil than Munden soils, and are better drained than Tomotley soils.

Typical pedon of Tetotum loam, 0 to 2 percent slopes, 3.3 miles east on Virginia Route 632 from the intersection with Virginia Route 633, 200 feet south of Virginia Route 632, 100 feet west of drainage ditch, in cropland:

Ap—0 to 11 inches; light olive brown (2.5Y 5/4) loam; common medium distinct yellowish brown (10YR 5/6) mottles beginning at a depth of 6 inches; moderate medium granular structure; hard, friable; slightly sticky; many fine roots; neutral; abrupt smooth boundary.

Bt1—11 to 17 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; very hard, friable; slightly sticky, slightly plastic; common fine roots; common distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—17 to 24 inches; yellowish brown (10YR 5/6) clay loam; few medium distinct light brownish gray (10YR 6/2) mottles; moderate medium columnar structure parting to moderate medium subangular blocky; very hard, firm; sticky, plastic; common fine roots; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—24 to 36 inches; yellowish brown (10YR 5/8) clay loam; many coarse distinct gray (10YR 6/1) mottles;

weak medium columnar structure parting to moderate medium subangular blocky; extremely hard, firm; sticky, plastic; few fine roots; few fine tubular pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg—36 to 49 inches; light gray (10YR 7/1) clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very hard, firm; sticky, plastic; few distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Cg—49 to 72 inches; light gray (10YR 7/2) sandy loam; common medium distinct brownish yellow (10YR 6/6) mottles; massive; hard, friable; clay flows; very strongly acid.

The solum ranges from 40 to 60 inches or more in thickness. Rounded quartz gravel, by volume, ranges from 0 to 15 percent throughout. In unlimed areas reaction ranges from extremely acid to strongly acid.

The A, or Ap, horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Its texture is silt loam, loam, or fine sandy loam.

The Bt horizon in the upper part has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 8. In the lower part it has hue of 7.5YR to 5Y, value of 5 to 7, and chroma of 1 to 8. Its texture is silt loam, loam, sandy clay loam, or clay loam.

Some pedons have a BC horizon that has hue of 7.5YR to 5Y, value of 5 to 7, and chroma of 1 to 8. Its texture is sandy loam or sandy clay loam.

The C horizon typically is gray, stratified sand to sandy clay loam. Some pedons have a clayey 2C horizon.

Tomotley Series

The Tomotley series consists of very deep, nearly level, poorly drained soils. These soils formed in moderately coarse textured to moderately fine textured, fluviomarine sediments on the intermediate terrace. Slope ranges from 0 to 2 percent.

Tomotley soils commonly are near Chickahominy, Munden, State, and Tetotum soils on the intermediate terrace. They are more poorly drained than Munden, State, and Tetotum soils, and do not have as much clay in the subsoil as Chickahominy soils.

Typical pedon of Tomotley fine sandy loam, 0 to 2 percent slopes, 1.5 miles northeast of Champlain, 50 feet west of farm road, in pasture:

Oi—3 inches to 0; loose needles, leaves, twigs, and partly decomposed leaves and twigs.

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; slightly hard, friable; common fine and few medium roots; very strongly acid; clear smooth boundary.

E—3 to 9 inches; light brownish gray (2.5Y 6/2) fine sandy loam; common medium distinct pale yellow (2.5Y 7/4) mottles; moderate fine granular structure; hard, friable; common fine and few medium roots; few fine tubular pores; 2 percent gravel; very strongly acid; clear smooth boundary.

Btg1—9 to 18 inches; gray (10YR 5/1) loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable; slightly sticky, slightly plastic; common fine and few medium roots; few fine tubular pores; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Btg2—18 to 23 inches; gray (10YR 5/1) sandy clay loam; few medium distinct pale brown (10YR 6/3) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium columnar structure parting to moderate fine and medium angular blocky; very hard, firm; slightly sticky, slightly plastic; few fine roots; few fine tubular pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg3—23 to 33 inches; gray (10YR 5/1) sandy clay loam; common medium distinct light gray (10YR 7/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, firm; slightly sticky, slightly plastic; few fine roots; few fine vesicular pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg4—33 to 49 inches; gray (10YR 5/1) sandy clay loam; common medium distinct light gray (10YR 7/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very hard, firm; slightly sticky, slightly plastic; few fine roots; few fine pores; common distinct clay films on faces of peds; 5 percent cobbles and gravel; very strongly acid; gradual smooth boundary.

Btg5—49 to 72 inches; light gray (2.5Y 7/2) clay loam; few medium distinct yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; very hard, firm; slightly sticky, plastic; few fine roots; common distinct clay films on faces of peds; very strongly acid.

The solum ranges from 40 to 60 inches or more in thickness. Fine gravel ranges from 0 to 5 percent, by volume, of individual horizons in the solum. In unlimed areas, reaction is extremely acid to strongly acid in the surface layer, the subsurface layer, and the subsoil and extremely acid to moderately acid in the substratum.

The A, or Ap, horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. Its texture is fine sandy loam, sandy loam, loam, or silt loam.

The E horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. It has mottles of gray, yellow, brown, or red. Its texture is fine sandy loam, sandy loam, loam, or silt loam.

The Bt horizon is neutral or has hue of 10YR to 5Y, value of 5 to 7, and chroma of 0 to 2. It has yellow, brown, olive, gray, or red mottles. Its texture is loam, sandy clay loam, or clay loam.

Some pedons have a C horizon that has light gray to dark gray matrix colors and strong brown to light olive brown mottles. Its texture is sand, loamy sand, sandy loam, fine sandy loam, or clay loam.

Formation of the Soils

Factors of Soil Formation

This section describes the factors of soil formation as they relate to the soils of Essex County and explains the major processes in the development of soil horizons.

Climate

Temperature and precipitation influence the rates of chemical and physical processes in the soil. Essex County has a warm, continental climate. The rainfall and air temperature are relatively high, and they leach soil nutrients and rapidly oxidize organic matter in the surface layer. The soils are frozen for only a very short period each year, and rarely freeze in wooded areas.

Plant and Animal Life

Plants, animals, bacteria and fungi, and man affect soil formation. The type of vegetation affects the content of organic matter and amount of nutrients in the soil. Most of the soils in the county formed under forest-type vegetation. Animals, particularly burrowing animals and insects, keep the soil open and porous. Bacteria and fungi decompose plant material into organic matter and incorporate it into the soil. Human activities that alter the soil include clearing, plowing, mixing of soil layers, and applying farm chemicals.

Parent Material

Parent material is the unconsolidated mass in which the soil forms, and generally determines the chemical and mineral composition of the soil. The soils in the county formed in sediments that were moved and deposited by marine or stream action. They are in three main landscape positions on the Coastal Plain: upland terraces and side slopes, lowland terraces, and swamps and tidal marshes. Coastal Plain sediments are several hundred feet thick, and are underlain by sand. Emporia, Kempsville, and Suffolk soils are the main soils on upland terraces. Tetotum, State, and Tomotley soils are on lowland terraces. Rappahannock, Bibb, and Levy soils are in swamps and tidal marshes.

Topography

Topography, or relief, modifies the effects of other soil-forming factors, and in many places more than one kind of soil forms from similar parent material. For example, Tetotum and Tomotley soils formed in similar parent material and are adjacent to each other, but Tetotum soils are slightly higher and better drained than Tomotley soils.

Time

Time allows development of a soil profile; consequently, young soils have less well developed horizons than older soils. In Essex County, the soils on the older upland ridges, such as Kempsville and Emporia soils, have deep profile development. The soils that are subject to flooding are Rappahannock, Bibb, and Levy soils. They receive new sediments during each flooding, show little profile development, and are considered young soils.

Major Soil Horizons

The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, in a soil profile. The soil profile extends from the surface down to materials that are little altered by the soil-forming processes.

Most soils contain four major horizons called A, E, B, and C. These major horizons can be further subdivided by the use of numbers and letters to indicate changes within one horizon. The Bt horizon, for example, is a B horizon that has an accumulation of clay.

The A horizon, or surface layer, is characterized by an accumulation of organic matter. The E horizon, or subsurface layer, is the horizon of maximum leaching and eluviation of clay and iron.

The B horizon underlies the E horizon, and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the surface and subsurface layers. In some soils the B horizon formed by alteration of materials in place, rather than by illuviation. The alteration could have been caused by oxidation and reduction of iron or by the weathering of clay minerals. The B horizon commonly has blocky or prismatic structure. Generally it is firmer and lighter in color than the A1 horizon but darker in color than the C horizon.

The C horizon is directly below the B horizon, or in some soils, directly below the A horizon. It consists of materials that have been little altered by the soil-forming processes, but in some soils it is modified by weathering.

Processes of Soil Horizon Differentiation

In Essex County several processes are involved in the formation of soil horizons. Among these are the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes are continually taking place, generally at the same time, throughout the profile. Such processes have been going on for thousands of years.

The accumulation and incorporation of organic matter takes place with the decomposition of plant residue. These additions of residue darken the surface layer and help to form the A horizon. If organic matter has been lost, normally a long time is needed to replace it. In Essex County the organic matter content of the surface layer averages about 1 percent, by weight.

For soils to have distinct subsoil horizons, it is believed that some of the lime and soluble salts must be leached before the translocation of clay minerals. Factors that affect this leaching include the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Well drained and moderately well drained soils in the county have a brownish yellow to strong brown subsoil. These colors have been caused mainly by thin coatings of iron oxides on sand and silt grains, except where the colors were inherited from the parent materials of the soils. The structure of these soils is weak to moderate, subangular blocky. The subsoil in these soils contains more clay than the surface layer.

The reduction and transfer of iron, called gleying, is associated mainly with the wetter, more poorly drained soils. Moderately well drained to somewhat poorly drained soils have yellowish brown and strong brown mottles because of the segregation of iron. In such poorly drained soils as Chickahominy and Tomotley soils, the grayish subsoil is the result of the reduction and transfer of iron in solution.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(4) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate possible without inducing damage to vegetation or related resources. The rate may vary from year to year because of fluctuating forage production.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage and planting system in which crop residue covers at least 30 percent of the soil surface after planting. Where soil erosion by wind is the main concern, the system leaves the equivalent of at least 1,000 pounds per acre of flat small-grain residue on the surface during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy

material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic state to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15

millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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

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

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate,

humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifiying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-81 at Warsaw, Virginia]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	45.9	26.6	36.3	71.0	1.0	77	3.07	3.94	1.99	7	6.7
February---	49.5	28.6	39.1	74.0	8.0	98	2.75	3.70	1.36	6	5.2
March------	57.7	35.3	46.5	83.0	16.0	240	3.44	4.65	2.34	7	3.5
April------	69.7	44.6	57.2	89.0	26.0	511	2.91	4.03	1.87	6	0.1
May--------	77.3	53.6	65.5	93.0	35.0	789	4.07	5.98	2.59	7	.0
June-------	85.0	62.1	73.6	97.0	45.0	1,003	3.68	5.49	1.40	6	.0
July-------	88.4	66.3	77.4	100.0	51.0	1,158	4.39	5.75	2.60	7	.0
August-----	87.0	65.4	76.2	98.0	49.0	1,123	4.29	6.24	2.24	6	.0
September--	81.3	58.8	70.1	95.0	39.0	899	4.20	5.47	1.50	5	.0
October----	70.5	47.2	58.9	87.0	26.0	579	3.49	5.20	1.70	5	.0
November---	60.1	38.5	49.3	79.0	18.0	291	3.20	5.12	1.46	6	0.2
December---	49.6	30.3	40.0	73.0	8.0	114	3.20	4.37	1.98	6	3.1
Year:											
Average---	68.7	46.6	57.7	---	---	---	---	---	---	---	---
Extreme---	---	---	---	105	-4	---	---	---	---	---	---
Total-----	---	---	---	---	---	6,882	42.69	59.94	23.03	74	18.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-81 at Warsaw, Virginia]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 31	April 16	April 25
2 years in 10 later than--	March 28	April 13	April 20
5 years in 10 later than--	March 18	April 5	April 13
First freezing temperature in fall:			
1 year in 10 earlier than--	November 7	October 20	October 8
2 years in 10 earlier than--	November 9	October 22	October 9
5 years in 10 earlier than--	November 18	November 1	October 21

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-81 at Warsaw, Virginia]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	232	193	174
8 years in 10	235	199	179
5 years in 10	247	208	189
2 years in 10	262	231	204
1 year in 10	280	244	205

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1A	Atlee silt loam, 0 to 2 percent slopes	3,732	2.0
2A	Augusta fine sandy loam, 0 to 2 percent slopes	1,441	0.8
3A	Bibb sandy loam, 0 to 2 percent slopes, frequently flooded	7,700	4.2
4A	Bojac loamy sand, 0 to 2 percent slopes	366	0.2
5A	Bolling silt loam, 0 to 2 percent slopes	270	0.1
6B	Catpoint loamy sand, 0 to 6 percent slopes	512	0.3
7A	Chickahominy silt loam, 0 to 2 percent slopes	1,710	0.9
8A	Dogue loam, 0 to 2 percent slopes	731	0.4
9A	Emporia sandy loam, 0 to 2 percent slopes	1,055	0.6
9B	Emporia sandy loam, 2 to 6 percent slopes	11,935	6.5
9C	Emporia sandy loam, 6 to 10 percent slopes	2,981	1.6
10A	Kempsville sandy loam, 0 to 2 percent slopes	2,199	1.2
10B	Kempsville sandy loam, 2 to 6 percent slopes	11,814	6.4
10C	Kempsville sandy loam, 6 to 10 percent slopes	701	0.4
11A	Levy silty clay loam, 0 to 2 percent slopes, frequently flooded	1,337	0.7
12A	Molena loamy sand, 0 to 2 percent slopes	1,562	0.9
12B	Molena loamy sand, 2 to 6 percent slopes	957	0.5
13A	Munden fine sandy loam, 0 to 2 percent slopes	2,169	1.2
14A	Newflat silt loam, 0 to 2 percent slopes	581	0.3
15A	Pamunkey loam, wet substratum, 0 to 2 percent slopes	2,058	1.1
16	Pits, sand and gravel	109	*
17A	Rappahannock muck, 0 to 1 percent slopes, frequently flooded	4,798	2.6
18B	Rumford loamy sand, 0 to 6 percent slopes	2,882	1.6
19E	Rumford and Emporia soils, 15 to 50 percent slopes	41,292	22.5
20D	Rumford and Slagle soils, 6 to 15 percent slopes	19,409	10.6
21B	Slagle fine sandy loam, 2 to 6 percent slopes	4,536	2.5
21C	Slagle fine sandy loam, 6 to 10 percent slopes	1,387	0.8
22A	State fine sandy loam, 0 to 2 percent slopes	2,912	1.6
22B	State fine sandy loam, 2 to 6 percent slopes	1,084	0.6
23A	Suffolk sandy loam, 0 to 2 percent slopes	2,181	1.2
23B	Suffolk sandy loam, 2 to 6 percent slopes	15,106	8.2
24A	Tetotum loam, 0 to 2 percent slopes	7,792	4.2
24B	Tetotum loam, 2 to 6 percent slopes	2,141	1.2
25A	Tomotley fine sandy loam, 0 to 2 percent slopes	5,560	3.0
W	Water	16,680	9.1
	Total	183,680	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
1A	Atlee silt loam, 0 to 2 percent slopes
2A	Augusta fine sandy loam, 0 to 2 percent slopes (where drained)
5A	Bolling silt loam, 0 to 2 percent slopes
8A	Dogue loam, 0 to 2 percent slopes
9A	Emporia sandy loam, 0 to 2 percent slopes
9B	Emporia sandy loam, 2 to 6 percent slopes
10A	Kempsville sandy loam, 0 to 2 percent slopes
10B	Kempsville sandy loam, 2 to 6 percent slopes
13A	Munden fine sandy loam, 0 to 2 percent slopes
15A	Pamunkey loam, wet substratum, 0 to 2 percent slopes
21B	Slagle fine sandy loam, 2 to 6 percent slopes
22A	State fine sandy loam, 0 to 2 percent slopes
22B	State fine sandy loam, 2 to 6 percent slopes
23A	Suffolk sandy loam, 0 to 2 percent slopes
23B	Suffolk sandy loam, 2 to 6 percent slopes
24A	Tetotum loam, 0 to 2 percent slopes
24B	Tetotum loam, 2 to 6 percent slopes
25A	Tomotley fine sandy loam, 0 to 2 percent slopes (where drained)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Barley	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
1A---------- Atlee	IIw	90	30	50	60	3.0	3.5	5.6
2A---------- Augusta	IIIw	100	40	55	65	---	5.0	8.0
3A---------- Bibb	Vw	---	---	---	---	---	---	---
4A---------- Bojac	IIs	120	40	45	55	4.0	3.5	5.6
5A---------- Bolling	IIw	120	40	60	65	3.0	5.0	8.0
6B---------- Catpoint	IIIs	60	20	25	40	2.5	3.0	4.8
7A---------- Chickahominy	IVw	---	---	---	---	---	3.0	4.8
8A---------- Dogue	IIw	125	45	60	65	3.5	3.5	5.6
9A---------- Emporia	I	110	35	55	70	4.0	5.0	8.0
9B---------- Emporia	IIe	100	30	50	70	3.0	4.5	7.2
9C---------- Emporia	IIIe	90	25	45	65	3.0	3.5	5.6
10A---------- Kempsville	I	150	40	50	75	4.0	3.5	5.6
10B---------- Kempsville	IIe	145	40	50	75	4.0	3.5	5.6
10C---------- Kempsville	IIIe	125	30	40	70	3.5	3.0	4.8
11A---------- Levy	VIIw	---	---	---	---	---	---	---
12A, 12B-------- Molena	IIIs	60	25	35	40	2.5	3.0	4.8
13A---------- Munden	IIw	130	40	50	60	3.0	3.5	5.6
14A---------- Newflat	IIIw	85	30	35	45	---	3.0	4.8
15A---------- Pamunkey	I	160	45	50	80	5.0	4.0	6.4

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Barley	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
16**. Pits								
17A---------- Rappahannock	VIIIw	---	---	---	---	---	---	---
18B---------- Rumford	IIs	90	20	25	45	4.0	3.5	5.6
19E---------- Rumford and Emporia	VIIe	---	---	---	---	---	---	---
20D---------- Rumford and Slagle	IVe	74	17	22	30	3.0	2.5	4.0
21B---------- Slagle	IIe	115	35	40	50	2.5	4.0	6.4
21C---------- Slagle	IIIe	100	30	35	40	2.5	3.5	5.6
22A---------- State	I	130	45	60	70	4.0	5.0	8.0
22B---------- State	IIe	120	40	60	70	4.0	5.0	8.0
23A---------- Suffolk	I	125	35	45	60	3.5	3.5	5.6
23B---------- Suffolk	IIe	120	35	45	60	3.5	3.5	5.6
24A---------- Tetotum	IIw	150	40	45	55	2.5	3.0	4.8
24B---------- Tetotum	IIe	145	35	35	50	2.5	2.8	4.5
25A---------- Tomotley	IVw	---	---	---	---	---	2.5	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
1A---------- Atlee	7A	Slight	Slight	Slight	Slight	Loblolly pine-------	76	7	Loblolly pine.
						Virginia pine-------	70	8	
						Southern red oak----	70	4	
2A---------- Augusta	9W	Slight	Moderate	Slight	Moderate	Loblolly pine-------	90	9	Loblolly pine, yellow-poplar.
						Sweetgum------------	90	7	
						White oak-----------	80	4	
						Southern red oak----	80	4	
3A---------- Bibb	9W	Slight	Severe	Severe	Severe	Loblolly pine-------	90	9	Eastern cottonwood, Loblolly pine, yellow-poplar.
						Sweetgum------------	90	7	
4A---------- Bojac	8A	Slight	Slight	Moderate	Slight	Loblolly pine-------	80	8	Loblolly pine.
						Virginia pine-------	75	8	
						Southern red oak----	70	4	
						Sweetgum------------	80	6	
5A---------- Bolling	9W	Slight	Moderate	Slight	Slight	Loblolly pine-------	90	9	Loblolly pine, yellow-poplar, black walnut.
						Virginia pine-------	80	8	
						Yellow-poplar-------	90	6	
6B---------- Catpoint	8S	Slight	Moderate	Moderate	Slight	Loblolly pine-------	80	8	Loblolly pine.
						Sweetgum------------	80	6	
7A---------- Chickahominy	9W	Slight	Severe	Severe	Slight	Loblolly pine-------	88	9	Loblolly pine.
						Sweetgum------------	95	8	
8A---------- Dogue	9W	Slight	Moderate	Slight	Slight	Loblolly pine-------	90	9	Loblolly pine.
						Southern red oak----	80	4	
						Sweetgum------------	90	7	
						Yellow-poplar-------	93	7	
						White oak-----------	80	4	
9A, 9B, 9C------ Emporia	7A	Slight	Slight	Slight	Slight	Loblolly pine-------	75	7	Loblolly pine.
						Southern red oak----	70	4	
10A, 10B, 10C--- Kempsville	8A	Slight	Slight	Slight	Slight	Loblolly pine-------	82	8	Loblolly pine.
						Southern red oak----	74	4	
						Virginia pine-------	74	8	
						Sweetgum------------	80	6	
						Yellow-poplar-------	82	5	
11A---------- Levy	6W	Slight	Severe	Severe	Severe	Sweetgum------------	85	6	Sweetgum, baldcypress.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
12A, 12B-------- Molena	8S	Slight	Moderate	Moderate	Slight	Loblolly pine------- Northern red oak---- White oak-----------	80 86 68	8 5 4	Loblolly pine.
13A------------- Munden	9W	Slight	Moderate	Slight	Slight	Loblolly pine------- Sweetgum------------ White oak-----------	90 90 76	9 7 4	Loblolly pine.
14A------------- Newflat	9W	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Sweetgum------------	90 95	9 8	Loblolly pine.
15A------------- Pamunkey	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Northern red oak---- Yellow-poplar-------	90 80 90	9 4 6	Loblolly pine, yellow-poplar.
17A------------- Rappahannock	--	Severe	Severe	Severe	Severe	----------	--	--	
18B------------- Rumford	8A	Slight	Slight	Slight	Slight	Loblolly pine------- Virginia pine------- Southern red oak----	80 70 65	8 8 3	Loblolly pine.
19E**: Rumford-------- (North aspect)	8R	Severe	Severe	Moderate	Slight	Loblolly pine------- Virginia pine------- Southern red oak----	80 70 65	8 8 3	Loblolly pine.
Emporia-------- (North aspect)	7R	Severe	Severe	Slight	Slight	Loblolly pine------- Southern red oak----	75 70	7 4	Loblolly pine.
19E**: Rumford-------- (South aspect)	6R	Severe	Severe	Severe	Slight	Loblolly pine------- Virginia pine------- Southern red oak----	70 60 55	6 6 3	Loblolly pine.
Emporia-------- (South aspect)	7R	Severe	Severe	Moderate	Slight	Loblolly pine------- Southern red oak----	65 60	6 3	Loblolly pine.
20D**: Rumford--------	8A	Slight	Slight	Moderate	Slight	Loblolly pine------- Virginia pine------- Southern red oak----	80 70 65	8 8 3	Loblolly pine.
Slagle---------	9W	Slight	Moderate	Slight	Slight	Loblolly pine------- Sweetgum------------ Southern red oak---- Yellow-poplar-------	86 86 76 90	9 7 4 6	Loblolly pine, yellow-poplar.
21B, 21C-------- Slagle	9W	Slight	Moderate	Slight	Slight	Loblolly pine------- Sweetgum------------ Southern red oak---- Yellow-poplar-------	86 86 76 90	9 7 4 6	Loblolly pine, yellow poplar.
22A, 22B-------- State	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Southern red oak---- Yellow-poplar------- Virginia pine-------	95 85 100 85	9 4 8 8	Black walnut, yellow-poplar, loblolly pine.
23A, 23B-------- Suffolk	8A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Southern red oak----	82 72 70	8 8 4	Loblolly pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
24A, 24B-------- Tetotum	9W	Slight	Moderate	Slight	Slight	Loblolly pine------- Sweetgum----------- Southern red oak----	88 85 76	9 6 4	Loblolly pine.
25A------------- Tomotley	8W	Slight	Severe	Severe	Severe	Sweetgum----------- Water tupelo--------	91 90	8 10	Loblolly pine, sweetgum.

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1A Atlee	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.
2A Augusta	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
3A Bibb	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
4A Bojac	Slight	Slight	Slight	Slight	Moderate: droughty.
5A Bolling	Moderate: wetness.	Moderate: wetness.	Moderate: small stones, wetness.	Moderate: wetness.	Moderate: wetness.
6B Catpoint	Slight	Slight	Moderate: slope, small stones.	Slight	Severe: droughty.
7A Chickahominy	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
8A Dogue	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness.	Moderate: wetness.	Moderate: wetness.
9A Emporia	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: small stones, percs slowly.	Slight	Slight.
9B Emporia	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Slight.
9C Emporia	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
10A Kempsville	Slight	Slight	Moderate: small stones.	Slight	Slight.
10B Kempsville	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
10C Kempsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
11A Levy	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
12A Molena	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12B---------- Molena	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
13A---------- Munden	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
14A---------- Newflat	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
15A---------- Pamunkey	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
16*. Pits					
17A---------- Rappahannock	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus, excess salt.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: excess salt, excess sulfur, ponding.
18B---------- Rumford	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
19E*: Rumford----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Emporia----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
20D*: Rumford----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
Slagle----------	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness, slope.
21B---------- Slagle	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
21C---------- Slagle	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness, slope.
22A---------- State	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
22B---------- State	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
23A---------- Suffolk	Slight----------	Slight----------	Slight----------	Slight----------	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
23B---------- Suffolk	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
24A---------- Tetotum	Moderate: wetness.	Moderate: wetness.	Moderate: small stones, wetness.	Moderate: wetness.	Moderate: wetness.
24B---------- Tetotum	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones, wetness.	Moderate: wetness.	Moderate: wetness.
25A---------- Tomotley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1A---------- Atlee	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
2A---------- Augusta	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
3A---------- Bibb	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
4A---------- Bojac	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
5A---------- Bolling	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
6B---------- Catpoint	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
7A---------- Chickahominy	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
8A---------- Dogue	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
9A, 9B---------- Emporia	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
9C---------- Emporia	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10A, 10B---------- Kempsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10C---------- Kempsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11A---------- Levy	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Good.
12A, 12B---------- Molena	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
13A---------- Munden	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
14A---------- Newflat	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
15A---------- Pamunkey	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
16*. Pits										
17A---------- Rappahannock	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
18B---------- Rumford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
19E*:										
Rumford----------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Emporia----------	Very poor.	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
20D*:										
Rumford----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Slagle----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
21B---------- Slagle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
21C---------- Slagle	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22A, 22B---------- State	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
23A, 23B---------- Suffolk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
24A---------- Tetotum	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
24B---------- Tetotum	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25A---------- Tomotley	Very poor.	Very poor.	Poor	Fair	Fair	Good	Good	Very poor.	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1A---------- Atlee	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
2A---------- Augusta	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
3A---------- Bibb	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
4A---------- Bojac	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
5A---------- Bolling	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
6B---------- Catpoint	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Severe: droughty.
7A---------- Chickahominy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
8A---------- Dogue	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
9A---------- Emporia	Moderate: wetness.	Slight---------	Moderate: wetness, shrink-swell.	Slight---------	Moderate: low strength.	Slight.
9B---------- Emporia	Moderate: wetness.	Slight---------	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: low strength.	Slight.
9C---------- Emporia	Moderate: slope, wetness.	Moderate: slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope.
10A---------- Kempsville	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
10B---------- Kempsville	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
10C---------- Kempsville	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
11A---------- Levy	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12A---------- Molena	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
12B---------- Molena	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
13A---------- Munden	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
14A---------- Newflat	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
15A---------- Pamunkey	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: low strength.	Slight.
16*. Pits						
17A---------- Rappahannock	Severe: excess humus, ponding.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding.	Severe: flooding, ponding, low strength.	Severe: ponding, flooding.	Severe: excess salt, excess sulfur, ponding.
18B---------- Rumford	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
19E*: Rumford----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Emporia----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
20D*: Rumford----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Slagle----------	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Moderate: low strength, wetness, slope.	Moderate: wetness, slope.
21B---------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Moderate: low strength, wetness.	Moderate: wetness.
21C---------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Moderate: low strength, wetness, slope.	Moderate: wetness, slope.
22A---------- State	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: low strength.	Slight.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
22B---------- State	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: low strength.	Slight.
23A---------- Suffolk	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
23B---------- Suffolk	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
24A---------- Tetotum	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
24B---------- Tetotum	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: low strength, wetness.	Moderate: wetness.
25A---------- Tomotley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1A Atlee	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
2A Augusta	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: wetness.
3A Bibb	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
4A Bojac	Moderate: wetness.	Severe: seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: thin layer.
5A Bolling	Severe: wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
6B Catpoint	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
7A Chickahominy	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
8A Dogue	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
9A, 9B Emporia	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
9C Emporia	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Moderate: slope, wetness, too clayey.	Moderate: slope.	Fair: slope, too clayey, wetness.
10A Kempsville	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
10B Kempsville	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
10C Kempsville	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11A---------- Levy	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
12A, 12B---------- Molena	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
13A---------- Munden	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness, thin layer.
14A---------- Newflat	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
15A---------- Pamunkey	Moderate: wetness, percs slowly.	Severe: seepage.	Severe: seepage, wetness.	Moderate: wetness.	Fair: too clayey, thin layer.
16*. Pits					
17A---------- Rappahannock	Severe: flooding, ponding.	Severe: flooding, excess humus, ponding.	Severe: flooding, ponding, excess humus.	Severe: flooding, ponding.	Poor: ponding, excess humus.
18B---------- Rumford	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
19E*: Rumford----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Emporia----------	Severe: slope, wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
20D*: Rumford----------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Slagle----------	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
21B---------- Slagle	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21C---------- Slagle	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
22A, 22B---------- State	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Moderate: wetness.	Fair: too clayey, thin layer.
23A, 23B---------- Suffolk	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Poor: thin layer.
24A, 24B---------- Tetotum	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
25A---------- Tomotley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1A Atlee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
2A Augusta	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
3A Bibb	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
4A Bojac	Good	Probable	Improbable: too sandy.	Fair: too sandy.
5A Bolling	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, small stones.
6B Catpoint	Good	Probable	Probable	Poor: small stones, area reclaim.
7A Chickahominy	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
8A Dogue	Fair: wetness.	Probable	Improbable: too sandy.	Poor: thin layer.
9A, 9B Emporia	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
9C Emporia	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
10A, 10B Kempsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
10C Kempsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
11A Levy	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
12A, 12B Molena	Good	Probable	Improbable: too sandy.	Fair: too sandy.
13A Munden	Fair: wetness.	Probable	Improbable: too sandy.	Fair: thin layer.
14A Newflat	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
15A---------- Pamunkey	Fair: low strength.	Improbable: thin layer.	Improbable: thin layer, too sandy.	Fair: small stones, area reclaim.
16*. Pits				
17A---------- Rappahannock	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, excess salt, wetness.
18B---------- Rumford	Good----------	Improbable: thin layer.	Probable----------	Fair: small stones, area reclaim.
19E*:				
Rumford----------	Poor: slope.	Improbable: thin layer.	Probable----------	Fair: slope.
Emporia----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
20D*:				
Rumford----------	Good----------	Improbable: thin layer.	Probable----------	Fair: small stones, area reclaim, slope.
Slagle----------	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
21B---------- Slagle	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
21C---------- Slagle	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
22A, 22B---------- State	Good----------	Probable----------	Improbable: too sandy.	Good.
23A, 23B---------- Suffolk	Good----------	Probable----------	Improbable: too sandy.	Fair: small stones.
24A, 24B---------- Tetotum	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
25A---------- Tomotley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1A---------- Atlee	Moderate: seepage.	Severe: piping, wetness.	Percs slowly---	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily, percs slowly.
2A---------- Augusta	Moderate: seepage.	Severe: piping, wetness.	Favorable------	Wetness--------	Wetness--------	Wetness.
3A---------- Bibb	Moderate: seepage.	Severe: piping, wetness.	Flooding-------	Wetness, flooding.	Wetness--------	Wetness.
4A---------- Bojac	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing---	Droughty.
5A---------- Bolling	Moderate: seepage.	Severe: wetness.	Favorable------	Wetness--------	Wetness--------	Favorable.
6B---------- Catpoint	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
7A---------- Chickahominy	Slight---------	Severe: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly, erodes easily.	Wetness, percs slowly.	Wetness, percs slowly.
8A---------- Dogue	Moderate: seepage.	Severe: wetness.	Favorable------	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
9A---------- Emporia	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Soil blowing---	Soil blowing, percs slowly.	Percs slowly.
9B---------- Emporia	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Soil blowing, slope.	Soil blowing, percs slowly.	Percs slowly.
9C---------- Emporia	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing, percs slowly.	Slope, percs slowly.
10A---------- Kempsville	Moderate: seepage.	Slight---------	Deep to water	Soil blowing---	Soil blowing---	Favorable.
10B---------- Kempsville	Moderate: seepage, slope.	Slight---------	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
10C---------- Kempsville	Severe: slope.	Slight---------	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
11A---------- Levy	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12A---------- Molena	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy------	Droughty.
12B---------- Molena	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy------	Droughty.
13A---------- Munden	Severe: seepage.	Severe: seepage, wetness.	Cutbanks cave	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Favorable.
14A---------- Newflat	Slight---------	Severe: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
15A---------- Pamunkey	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable------	Favorable------	Favorable.
16*. Pits						
17A---------- Rappahannock	Slight---------	Severe: excess humus, ponding.	Ponding, flooding, excess salt.	Ponding, flooding, excess salt.	Ponding--------	Wetness, excess salt.
18B---------- Rumford	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy, soil blowing.	Droughty.
19E*:						
Rumford----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Emporia----------	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing, percs slowly.	Slope, percs slowly.
20D*:						
Rumford----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Slagle----------	Severe: slope.	Moderate: thin layer, piping, wetness.	Percs slowly, slope.	Wetness, slope, erodes easily.	Slope, wetness, percs slowly.	Slope, percs slowly.
21B---------- Slagle	Moderate: seepage, slope.	Moderate: thin layer, piping, wetness.	Percs slowly, slope.	Wetness, slope, erodes easily.	Wetness, percs slowly.	Percs slowly.
21C---------- Slagle	Severe: slope.	Moderate: thin layer, piping, wetness.	Percs slowly, slope.	Wetness, slope, erodes easily.	Slope, wetness, percs slowly.	Slope, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
22A---------- State	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
22B---------- State	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
23A---------- Suffolk	Severe: seepage.	Severe: thin layer.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
23B---------- Suffolk	Severe: seepage.	Severe: thin layer.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
24A---------- Tetotum	Moderate: seepage.	Severe: wetness.	Favorable------	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
24B---------- Tetotum	Moderate: seepage, slope.	Severe: wetness.	Slope----------	Wetness, soil blowing, slope.	Wetness, soil blowing.	Favorable.
25A---------- Tomotley	Moderate: seepage.	Severe: piping, wetness.	Favorable------	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1A---------- Atlee	0-10	Silt loam--------	CL, CL-ML	A-4	0	95-100	95-100	60-100	55-90	10-25	2-10
	10-26	Silt loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-85	24-40	6-16
	26-52	Clay loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-90	24-50	6-22
	52-72	Clay loam, silty clay loam, clay.	CL, ML, MH, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	32-60	12-28
2A---------- Augusta	0-7	Fine sandy loam	SM, SM-SC, ML	A-2, A-4	0	90-100	75-100	50-98	30-60	<25	NP-7
	7-50	Sandy clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	75-100	75-100	51-80	20-45	5-25
	50-72	Variable---------	---	---	---	---	---	---	---	---	---
3A---------- Bibb	0-4	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4	0-5	95-100	90-100	60-90	30-60	<25	NP-7
	4-72	Sandy loam, loam, silt loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	60-100	50-100	40-100	30-90	<30	NP-7
4A---------- Bojac	0-7	Loamy sand-------	SM	A-2	0	95-100	95-100	50-100	15-30	<20	NP
	7-40	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	40-72	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
5A---------- Bolling	0-8	Silt loam--------	ML, CL, SM, SC	A-4	0	85-100	75-100	60-95	35-85	<30	NP-10
	8-40	Clay loam, sandy clay loam, silty clay loam.	CL, SC	A-6, A-7	0	95-100	75-100	70-95	40-85	30-45	11-20
	40-72	Sandy clay loam, silty clay loam, clay.	CL, CH, SC	A-6, A-7	0	95-100	75-100	70-100	40-90	30-60	11-35
6B---------- Catpoint	0-7	Loamy sand-------	SM, SW-SM, SM-SC	A-1, A-2	0	85-100	75-100	40-70	10-35	<15	NP-5
	7-35	Sand, loamy fine sand, gravelly sand.	SM, SW, SW-SM, SM-SC	A-1, A-2, A-3	0	65-100	60-100	30-70	4-35	<15	NP-5
	35-72	Fine sand, very gravelly sand, loamy sand.	GM, SM, GW-GM, SW-SM	A-1, A-2, A-3	0-5	25-100	15-100	8-65	4-35	<15	NP
7A---------- Chickahominy	0-8	Silt loam--------	SM, SC, CL-ML	A-4	0	95-100	90-100	75-95	45-90	<25	NP-8
	8-46	Clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	65-90	30-55	12-30
	46-72	Clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	70-90	40-75	15-45
8A---------- Dogue	0-8	Loam-------------	ML, CL, SM, SC	A-4	0	95-100	75-100	60-100	40-85	<30	NP-10
	8-53	Clay loam, clay, sandy clay loam.	CL, CH, SC	A-6, A-7	0	95-100	75-100	65-100	40-90	35-60	16-40
	53-72	Stratified sand to sandy clay loam.	SM, SC, SP-SM, SM-SC	A-2, A-4, A-1	0	80-100	60-100	35-100	10-40	<30	NP-10

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
9A, 9B, 9C---- Emporia	0-9	Sandy loam-------	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	9-24	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	24-42	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-55	8-30
	42-72	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
10A, 10B, 10C---- Kempsville	0-8	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4	0-2	90-100	75-100	45-85	25-65	<18	NP-7
	8-22	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	80-100	50-90	30-70	<22	NP-10
	22-49	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-2, A-6	0-2	90-100	80-100	55-95	30-75	25-40	10-20
	49-72	Stratified loamy sand to sandy clay loam.	SC, SM, SM-SC	A-1, A-2, A-4, A-6	0-5	85-100	75-100	35-85	15-50	<30	NP-15
11A---------- Levy	0-12	Silt loam--------	CL, CH	A-6, A-7	0	100	100	98-100	85-100	30-65	12-35
	12-48	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	100	98-100	85-100	35-65	15-35
	48-72	Variable---------	---	---	---	---	---	---	---	---	---
12A, 12B--------- Molena	0-8	Loamy sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	5-15	---	NP
	8-23	Loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	7-25	---	NP
	23-72	Sand, coarse sand, gravelly sand.	SP, SP-SM	A-2, A-3	0-5	90-100	60-100	51-80	2-12	---	NP
13A---------- Munden	0-11	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	98-100	60-95	35-75	<22	NP-10
	11-30	Sandy loam, loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	98-100	60-95	30-75	<30	NP-15
	30-72	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	98-100	50-90	5-35	<18	NP-7
14A---------- Newflat	0-8	Silt loam--------	SM, SC, CL-ML	A-4	0	95-100	90-100	75-95	45-90	<25	NP-8
	8-42	Loam, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	65-90	30-55	12-30
	42-72	Clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	70-90	40-75	15-45
15A---------- Pamunkey	0-12	Loam-------------	ML, CL, CL-ML	A-4	0	95-100	90-100	65-95	50-85	18-30	2-10
	12-51	Sandy clay loam, clay loam, loam.	CL, SC	A-2, A-6	0-5	80-100	75-100	70-95	30-75	30-40	10-20
	51-72	Stratified sandy loam to sand.	SW, SM, SW-SM, SM-SC	A-1, A-2, A-3	0-10	60-100	50-95	25-70	2-35	<20	NP-6
16*. Pits											

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17A----------	0-30	Muck----------	PT	A-8	0	---	---	---	---	---	---
Rappahannock	30-65	Stratified loamy sand to clay.	CL, SC, ML, SM	A-6, A-4, A-2	0	100	100	95-100	15-95	<40	NP-20
	65-72	Variable---------	---	---	---	---	---	---	---	---	---
18B----------	0-14	Loamy sand-------	SM	A-2, A-1	0	90-100	85-100	45-75	15-30	<20	NP
Rumford	14-52	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	80-100	75-100	55-85	30-50	<34	NP-12
	52-72	Stratified sandy loam to gravelly sand.	SM, SP, GP, GM	A-1, A-2, A-3, A-4	0	50-100	35-100	20-85	2-40	<25	NP-6
19E*:											
Rumford----------	0-14	Loamy sand-------	SM	A-2, A-1	0	90-100	85-100	45-75	15-30	<20	NP
	14-52	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	80-100	75-100	55-85	30-50	<34	NP-12
	52-72	Stratified sandy loam to gravelly sand.	SM, SP, GP, GM	A-1, A-2, A-3, A-4	0	50-100	35-100	20-85	2-40	<25	NP-6
Emporia----------	0-9	Sandy loam-------	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	9-24	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	24-42	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-55	8-30
	42-72	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
20D*:											
Rumford----------	0-14	Loamy sand-------	SM	A-2, A-1	0	90-100	85-100	45-75	15-30	<20	NP
	14-52	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	80-100	75-100	55-85	30-50	<34	NP-12
	52-72	Stratified sandy loam to gravelly sand.	SM, SP, GP, GM	A-1, A-2, A-3, A-4	0	50-100	35-100	20-85	2-40	<25	NP-6
Slagle----------	0-10	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0-12	95-100	90-100	55-95	20-50	<25	NP-10
	10-29	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0-2	95-100	90-100	65-85	35-60	20-40	5-20
	29-58	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6, A-7	0-2	95-100	90-100	75-95	40-75	25-50	8-30
	58-72	Stratified loamy sand to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	90-100	75-100	40-90	20-70	<40	NP-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21B, 21C--------- Slagle	0-10	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0-12	95-100	90-100	55-95	20-50	<25	NP-10
	10-29	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0-2	95-100	90-100	65-85	35-60	20-40	5-20
	29-58	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6, A-7	0-2	95-100	90-100	75-95	40-75	25-50	8-30
	58-72	Stratified loamy sand to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	90-100	75-100	40-90	20-70	<40	NP-25
22A, 22B--------- State	0-12	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	95-100	45-85	25-55	<28	NP-7
	12-42	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	75-100	35-80	24-40	8-22
	42-72	Stratified sand to fine sandy loam.	SM, SM-SC, SP-SM	A-1, A-2, A-3, A-4	0	85-100	75-100	40-90	5-50	<25	NP-7
23A, 23B--------- Suffolk	0-13	Sandy loam--------	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	90-100	50-80	25-60	<20	NP-7
	13-37	Sandy clay loam, clay loam, sandy loam.	SC, CL	A-2, A-6	0	95-100	90-100	50-95	25-75	20-40	10-25
	37-72	Loamy fine sand, fine sandy loam, gravelly sand.	SP, SM, SM-SC	A-1, A-2, A-3, A-4	0	75-100	60-100	30-80	3-50	<18	NP-7
24A, 24B--------- Tetotum	0-11	Loam----------	SM, ML	A-2, A-4	0	85-100	80-100	45-85	25-55	<30	NP-7
	11-49	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-6, A-7	0-2	85-100	80-100	60-95	35-85	30-45	10-20
	49-72	Stratified sandy clay loam to loamy fine sand.	SM, SC, ML, CL	A-2, A-4, A-6	0-2	80-100	75-100	50-95	15-75	<30	NP-15
25A----------	0-9	Fine sandy loam	SM, SM-SC	A-2, A-4	0	98-100	95-100	75-99	25-50	<30	NP-7
Tomotley	9-18	Fine sandy loam, sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	0	98-100	95-100	75-98	30-70	20-40	6-23
	18-49	Fine sandy loam, sandy clay loam, sandy clay.	SM-SC, SC, CL-ML, CL	A-4, A-6, A-7	0	98-100	95-100	75-99	36-75	20-45	6-22
	49-72	Variable---------	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
1A	0-10	7-15	1.10-1.30	0.6-2.0	0.14-0.20	3.6-6.0	Low	0.37	4	5	1-3
Atlee	10-26	10-30	1.20-1.40	0.6-2.0	0.14-0.20	3.6-5.5	Low	0.37			
	26-52	18-35	1.30-1.50	0.2-0.6	0.07-0.12	3.6-5.5	Low	0.37			
	52-72	20-45	1.30-1.60	0.2-2.0	0.11-0.19	3.6-5.5	Moderate	0.37			
2A	0-7	5-20	1.40-1.70	2.0-6.0	0.10-0.15	4.5-6.0	Low	0.20	4	3	.5-2
Augusta	7-50	20-35	1.35-1.60	0.6-2.0	0.12-0.18	4.5-6.0	Low	0.24			
	50-72	---	---	---	---	---	---	---			
3A	0-4	2-18	1.25-1.55	0.6-2.0	0.12-0.18	4.5-5.5	Low	0.20	5	---	.5-2
Bibb	4-72	2-18	1.30-1.60	0.6-2.0	0.12-0.20	4.5-5.5	Low	0.37			
4A	0-7	3-8	1.20-1.50	6.0-20	0.05-0.10	3.6-6.5	Low	0.17	3	2	.5-1
Bojac	7-40	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	Low	0.17			
	40-72	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	Low	0.17			
5A	0-8	5-20	1.20-1.55	0.6-6.0	0.10-0.20	4.5-7.3	Low	0.28	4	5	1-2
Bolling	8-40	20-35	1.30-1.60	0.6-2.0	0.13-0.19	4.5-7.3	Low	0.28			
	40-72	25-55	1.30-1.60	0.6-2.0	0.10-0.19	5.6-7.3	Moderate	0.28			
6B	0-7	0-10	1.30-1.50	>6.0	0.06-0.10	4.5-6.5	Low	0.10	5	1	.5-1
Catpoint	7-35	0-10	1.45-1.65	>6.0	0.02-0.10	4.5-6.5	Low	0.10			
	35-72	0-10	1.45-1.65	>6.0	0.01-0.08	4.5-6.5	Low	0.10			
7A	0-8	10-25	1.20-1.30	0.6-2.0	0.10-0.17	3.6-5.5	Low	0.37	4	---	.5-2
Chickahominy	8-46	27-40	1.25-1.35	0.2-0.6	0.12-0.19	3.6-5.5	Moderate	0.37			
	46-72	35-60	1.30-1.50	<0.06	0.10-0.19	3.6-5.5	High	0.24			
8A	0-8	5-15	1.30-1.45	0.6-2.0	0.14-0.20	3.6-5.5	Low	0.37	4	5	.5-1
Dogue	8-53	35-50	1.45-1.60	0.2-0.6	0.12-0.19	3.6-5.5	Moderate	0.28			
	53-72	5-30	1.30-1.50	0.6-6.0	0.05-0.14	3.6-5.5	Low	0.17			
9A, 9B, 9C	0-9	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-6.0	Low	0.28	4	3	.5-3
Emporia	9-24	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-6.0	Low	0.28			
	24-42	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-6.0	Moderate	0.20			
	42-72	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-6.0	Moderate	0.20			
10A, 10B, 10C	0-8	5-15	1.30-1.40	2.0-6.0	0.08-0.14	4.5-5.5	Low	0.28	4	3	.5-2
Kempsville	8-22	12-24	1.30-1.45	2.0-6.0	0.12-0.18	4.5-5.5	Low	0.24			
	22-49	18-35	1.35-1.65	0.6-2.0	0.12-0.18	4.5-5.5	Low	0.24			
	49-72	5-30	1.30-1.60	0.6-2.0	0.08-0.15	4.5-5.5	Low	0.24			
11A	0-12	27-50	0.50-1.00	0.06-0.2	0.16-0.22	3.6-5.5	High	0.37	5	4	10
Levy	12-48	35-60	0.50-1.10	0.06-0.2	0.16-0.22	3.6-5.5	High	0.32			
	48-72	---	---	---	---	---	---	---			
12A, 12B	0-8	2-7	1.35-1.55	6.0-20	0.05-0.07	4.5-6.5	Low	0.10	5	1	.5-2
Molena	8-23	5-10	1.45-1.60	6.0-20	0.06-0.09	4.5-6.0	Low	0.17			
	23-72	1-5	1.45-1.60	6.0-20	0.03-0.05	4.5-6.0	Low	0.15			
13A	0-11	4-16	1.20-1.35	2.0-6.0	0.08-0.16	4.5-6.0	Low	0.20	4	3	1-2
Munden	11-30	8-18	1.20-1.35	0.6-6.0	0.08-0.18	4.5-6.0	Low	0.17			
	30-72	2-12	1.35-1.55	2.0-20.0	0.04-0.08	4.5-6.0	Low	0.17			
14A	0-8	10-25	1.20-1.30	0.6-2.0	0.10-0.17	3.6-5.5	Low	0.37	4	---	.5-2
Newflat	8-42	25-40	1.25-1.35	0.2-0.6	0.12-0.19	3.6-5.5	Moderate	0.37			
	42-72	35-60	1.30-1.50	<0.06	0.10-0.19	3.6-5.5	High	0.24			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
15A----------	0-12	5-15	1.25-1.55	0.6-2.0	0.14-0.20	5.6-7.3	Low----------	0.28	4	2	.5-2
Pamunkey	12-51	20-35	1.35-1.65	0.6-2.0	0.13-0.19	5.6-7.3	Low----------	0.28			
	51-72	4-18	1.40-1.65	2.0-20	0.04-0.12	5.1-7.3	Low----------	0.28			
16*.											
Pits											
17A----------	0-30	---	0.10-0.60	0.6-2.0	0.22-0.26	5.1-8.4	Low----------	----	---	---	20-65
Rappahannock	30-65	5-40	1.20-1.50	0.6-2.0	0.08-0.20	5.1-8.4	Low----------	0.17			
	65-72	---	---	---	---	---	----------	----			
18B----------	0-14	2-12	1.25-1.45	>6.0	0.06-0.10	3.6-5.5	Low----------	0.17	4	2	.5-1
Rumford	14-52	8-18	1.25-1.45	2.0-6.0	0.10-0.15	3.6-6.0	Low----------	0.17			
	52-72	2-18	1.25-1.50	>2.0	0.04-0.10	3.6-6.5	Low----------	0.17			
19E*:											
Rumford----------	0-14	2-12	1.25-1.45	>6.0	0.06-0.10	3.6-5.5	Low----------	0.17	4	2	.5-1
	14-52	8-18	1.25-1.45	2.0-6.0	0.10-0.15	3.6-6.0	Low----------	0.17			
	52-72	2-18	1.25-1.50	>2.0	0.04-0.10	3.6-6.5	Low----------	0.17			
Emporia----------	0-9	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-6.0	Low----------	0.28	4	3	.5-3
	9-24	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-6.0	Low----------	0.28			
	24-42	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-6.0	Moderate-----	0.20			
	42-72	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-6.0	Moderate-----	0.20			
20D*:											
Rumford----------	0-14	2-12	1.25-1.45	>6.0	0.06-0.10	3.6-5.5	Low----------	0.17	4	2	.5-1
	14-52	8-18	1.25-1.45	2.0-6.0	0.10-0.15	3.6-6.0	Low----------	0.17			
	52-72	2-18	1.25-1.50	>2.0	0.04-0.10	3.6-6.5	Low----------	0.17			
Slagle----------	0-10	8-18	1.30-1.45	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.28	3	---	.5-2
	10-29	12-35	1.30-1.45	0.6-2.0	0.10-0.18	3.6-5.5	Low----------	0.24			
	29-58	18-40	1.35-1.60	0.06-0.6	0.12-0.18	3.6-5.5	Moderate-----	0.24			
	58-72	5-32	1.35-1.50	0.2-6.0	0.08-0.15	3.6-5.5	Low----------	0.24			
21B, 21C---------	0-10	8-18	1.30-1.45	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.28	3	---	.5-2
Slagle	10-29	12-35	1.30-1.45	0.6-2.0	0.10-0.18	3.6-5.5	Low----------	0.24			
	29-58	18-40	1.35-1.60	0.06-0.6	0.12-0.18	3.6-5.5	Moderate-----	0.24			
	58-72	5-32	1.35-1.50	0.2-6.0	0.08-0.15	3.6-5.5	Low----------	0.24			
22A, 22B---------	0-12	5-15	1.25-1.40	0.6-6.0	0.08-0.15	4.5-5.5	Low----------	0.28	5	3	<2
State	12-42	18-34	1.35-1.50	0.6-2.0	0.14-0.19	4.5-5.5	Low----------	0.28			
	42-72	2-15	1.35-1.50	>2.0	0.02-0.10	4.5-6.0	Low----------	0.17			
23A, 23B---------	0-13	6-18	1.35-1.45	2.0-6.0	0.08-0.12	3.6-5.5	Low----------	0.28	4	3	.5-2
Suffolk	13-37	10-33	1.40-1.50	0.6-2.0	0.10-0.15	3.6-5.5	Low----------	0.24			
	37-72	4-10	1.40-1.50	2.0-20	0.04-0.10	3.6-6.0	Low----------	0.17			
24A, 24B---------	0-11	5-15	1.20-1.40	2.0-6.0	0.08-0.15	3.6-5.5	Low----------	0.28	4	3	.5-2
Tetotum	11-49	18-35	1.25-1.45	0.6-2.0	0.14-0.19	3.6-5.5	Low----------	0.32			
	49-72	5-30	1.25-1.45	0.6-20	0.06-0.15	3.6-5.5	Low----------	0.32			
25A----------	0-9	5-20	1.30-1.60	2.0-6.0	0.10-0.15	3.6-5.5	Low----------	0.20	5	3	1-6
Tomotley	9-18	18-35	1.30-1.50	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.20			
	18-49	15-45	1.30-1.60	0.2-2.0	0.12-0.18	3.6-6.0	Low----------	0.20			
	49-72	---	---	---	---	---	----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
1A---------- Atlee	C	None-------	---	---	1.5-2.5	Apparent	Nov-Mar	---	---	High-----	High.
2A---------- Augusta	C	None-------	---	---	1.0-2.0	Apparent	Jan-May	---	---	High-----	Moderate.
3A---------- Bibb	C	Frequent---	Brief	Dec-May	0.5-1.5	Apparent	Dec-Apr	---	---	High-----	Moderate.
4A---------- Bojac	B	None-------	---	---	4.0-6.0	Apparent	Nov-Apr	---	---	Low------	High.
5A---------- Bolling	C	None-------	---	---	1.5-2.5	Apparent	Dec-Mar	---	---	Moderate	High.
6B---------- Catpoint	A	None-------	---	---	4.0-6.0	Apparent	Feb-Apr	---	---	Low------	Moderate.
7A---------- Chickahominy	D	None-------	---	---	0-0.5	Apparent	Nov-Apr	---	---	High-----	High.
8A---------- Dogue	C	None-------	---	---	1.5-3.0	Apparent	Jan-Mar	---	---	High-----	High.
9A, 9B, 9C----- Emporia	C	None-------	---	---	3.0-4.5	Perched	Nov-Apr	---	---	Moderate	High.
10A, 10B, 10C-- Kempsville	B	None-------	---	---	>6.0	---	---	---	---	Low------	Moderate.
11A---------- Levy	D	Frequent---	Very long.	Jan-Dec	+2-+1	Apparent	Jan-Dec	---	---	High-----	High.
12A, 12B------- Molena	A	None-------	---	---	>6.0	---	---	---	---	Low------	High.
13A---------- Munden	B	None-------	---	---	1.5-2.5	Apparent	Dec-Apr	---	---	Low------	High.
14A---------- Newflat	D	None-------	---	---	0.5-1.5	Apparent	Nov-Apr	---	---	High-----	High.
15A---------- Pamunkey	B	None-------	---	---	4.0-6.0	Apparent	Dec-Mar	---	---	Moderate	Moderate.
16*. Pits											
17A---------- Rappahannock	D	Frequent---	Very brief.	Jan-Dec	+2-0.5	Apparent	Jan-Dec	---	---	High-----	High.
18B---------- Rumford	B	None-------	---	---	>6.0	---	---	---	---	Low------	High.
19E*: Rumford-------	B	None-------	---	---	>6.0	---	---	---	---	Low------	High.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
19E*: Emporia	C	None	---	---	3.0-4.5	Perched	Nov-Apr	---	---	Moderate	High.
20D*: Rumford	B	None	---	---	>6.0	---	---	---	---	Low	High.
Slagle	C	None	---	---	1.5-3.0	Perched	Nov-Apr	---	---	Moderate	High.
21B, 21C Slagle	C	None	---	---	1.5-3.0	Perched	Nov-Apr	---	---	Moderate	High.
22A, 22B State	B	None	---	---	4.0-6.0	Apparent	Dec-Jun	---	---	Moderate	High.
23A, 23B Suffolk	B	None	---	---	>6.0	---	---	---	---	Moderate	High.
24A, 24B Tetotum	C	None	---	---	1.5-2.5	Apparent	Dec-Apr	---	---	High	High.
25A Tomotley	B/D	None	---	---	0-1.0	Apparent	Dec-Mar	---	---	High	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Atlee	Fine-loamy, siliceous, thermic Fragiaquic Paleudults
Augusta	Fine-loamy, mixed, thermic Aeric Ochraquults
Bibb	Coarse-loamy, siliceous, acid, thermic Typic Fluvaquents
Bojac	Coarse-loamy, mixed, thermic Typic Hapludults
Bolling	Fine-loamy, mixed, thermic Aquic Hapludalfs
Catpoint	Siliceous, thermic Ultic Udipsamments
Chickahominy	Clayey, mixed, thermic Typic Ochraquults
Dogue	Clayey, mixed, thermic Aquic Hapludults
Emporia	Fine-loamy, siliceous, thermic Typic Hapludults
Kempsville	Fine-loamy, siliceous, thermic Typic Hapludults
Levy	Fine, mixed, acid, thermic Typic Hydraquents
Molena	Sandy, mixed, thermic Psammentic Hapludults
Munden	Coarse-loamy, mixed, thermic Aquic Hapludults
Newflat	Clayey, mixed, thermic Aeric Ochraquults
Pamunkey	Fine-loamy, mixed, thermic Ultic Hapludalfs
Rappahannock	Loamy, mixed, euic, thermic Terric Sulfihemists
Rumford	Coarse-loamy, siliceous, thermic Typic Hapludults
Slagle	Fine-loamy, siliceous, thermic Aquic Hapludults
State	Fine-loamy, mixed, thermic Typic Hapludults
Suffolk	Fine-loamy, siliceous, thermic Typic Hapludults
Tetotum	Fine-loamy, mixed, thermic Aquic Hapludults
Tomotley	Fine-loamy, mixed, thermic Typic Ochraquults

☆ U.S. GOVERNMENT PRINTING OFFICE : 1989 O - 205-507

Accessibility Statement

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.

The USDA Target Center can convert USDA information and documents into alternative formats, including Braille, large print, video description, diskette, and audiotape. For more information, visit the TARGET Center's Web site (http://www.targetcenter.dm.usda.gov/) or call (202) 720-2600 (Voice/TTY).

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).