SOIL SURVEY OF

Elbert, Franklin, and Madison Counties, Georgia

United States Department of Agriculture
Soil Conservation Service
In cooperation with
University of Georgia, College of Agriculture
Agricultural Experiment Stations

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. 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, or age.

Major fieldwork for this soil survey was completed in the period 1967-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the University of Georgia, College of Agriculture, Agricultural Experiment Stations. It is part of the technical assistance furnished to the Broad River Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Sorghum pasture and livestock pond in foreground and Coastal bermudagrass hayfield in background. The soil is Madison sandy loam, 2 to 6 percent slopes.

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Foreword

The Soil Survey of Elbert, Franklin, and Madison Counties contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

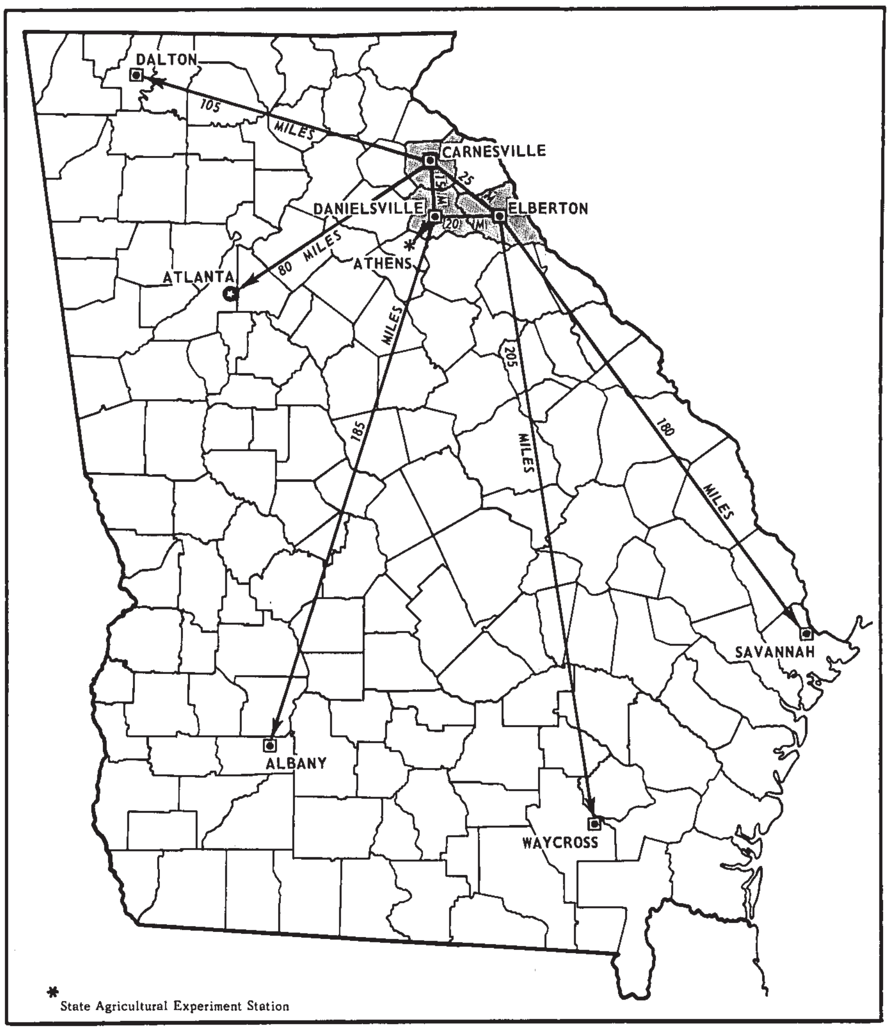
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Dwight M. Treadway

State Conservationist
Soil Conservation Service



Location of Elbert, Franklin, and Madison Counties in Georgia.

SOIL SURVEY OF ELBERT, FRANKLIN, AND MADISON COUNTIES, GEORGIA

By Louie W. Frost, Jr., Soil Conservation Service
Soil surveyed by George G. Brock and Carlos L. McIntyre

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the University of Georgia, College of Agriculture,
Agricultural Experiment Stations

ELBERT, FRANKLIN, AND MADISON COUNTIES are in the northeastern part of Georgia (see facing page). Elberton, Carnesville, and Danielsville, respectively, are the county seats. The population of the three counties was 42,355 in 1960 and 43,563 in 1970. The counties have a total land area of 577,024 acres, or 902 square miles. They are in the Southern Piedmont area of the South Atlantic and Gulf Slope.

Elbert County is the easternmost of the three counties. Originally a plain, it has been thoroughly dissected by rivers and their tributaries. It is drained on its eastern border by the Savannah River and on its western and southern borders by the Broad River. Beaverdam Creek drains part of the center of the county. The Broad and Savannah Rivers meet at the southeast corner of the county to form the Clark Hill Reservoir. A conspicuous exception to the general relief is a plain, at the southeast corner of the county, which is 150 to 250 feet lower than the level of the surrounding plateau. This plain, locally known as the Flatwoods, is less deeply and less completely dissected than the rest of the county. Most of the land in the rest of the county is on broad, gently rolling ridges. Near the creeks and rivers are strong side slopes. The dominant soils on uplands are well drained and have a brownish or reddish, loamy surface layer and a reddish, clayey subsoil. Level to nearly level flood plains that are frequently flooded for short periods are adjacent to the creeks and rivers. The dominant soils on the flood plains are well drained to somewhat poorly drained and loamy. Elevation ranges from about 360 feet above sea level at the southeast corner of the county to about 820 feet above sea level at the northwest corner.

Franklin County is the northernmost of the three counties. Originally a plain, it has been thoroughly dissected by rivers and their tributaries. It is drained by the North Fork Broad River and the Middle Fork Broad River across the central part and by the Hudson River along its southern border. Also, a small part at the northeast corner drains into the Tugaloo River, which helps form the Hartwell Reservoir. Most of the county is characterized by narrow, gently rolling ridges that have gentle to strong side slopes. The dominant soils on uplands are well drained and have a brownish or reddish, loamy surface layer and a reddish, clayey subsoil. Level to nearly level flood plains that are frequently flooded for short periods are adjacent to the creeks and rivers. The predominant soils on these flood plains are mostly well drained to somewhat poorly drained and loamy. Elevation ranges from about 560 feet above sea level at the southeast corner of the county to 900 feet at the northeast corner.

Madison County is the southwestern part of the three-county area. Originally a plain, it has been thoroughly dissected by rivers and their tributaries. It is drained on its northern border by the Hudson River and on its eastern border by the Broad River. The South Fork Broad River drains the interior and most of the southern part of the county. Most of the land is on broad, gently rolling ridges, but is steeper near the main creeks and rivers. The dominant soils on uplands are well drained and have a brownish or reddish, loamy surface layer and a reddish, clayey subsoil. Along the creeks and rivers are level to nearly level flood plains that are frequently flooded for short periods. The dominant soils on these flood plains are well drained to somewhat poorly drained and loamy. Elevation ranges from 400 feet above sea level at the southeast corner of the county to 900 feet in the west-central part.

General nature of the counties

This section provides general information about these counties. The climate, farming, natural resources, and transportation are described.

Climate

Elbert, Franklin, and Madison Counties have long, hot summers because moist tropical air from the Gulf of Mexico persistently covers the area. Winters are cool and fairly short, with only a rare cold wave that moderates in 1 or 2 days. Precipitation is fairly heavy throughout the year, with a slight peak in winter. Prolonged droughts are rare. Summer precipitation, mainly afternoon thundershowers, is adequate for common field crops.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Athens for the period 1951 to 1973. 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 44.2 degrees F, and the average daily minimum temperature is 33.9 degrees. The lowest temperature on record, which occurred at Athens on January 30, 1966, is -1 degrees. In summer the average temperature is 77.9 degrees, and the average daily maximum temperature is 88.5 degrees. The highest recorded temperature, which occurred on August 17, 1954, is 105 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds the base temperature. 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.

Of the total annual precipitation, 25.31 inches, or 50 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 20.35 inches. The heaviest 1-day rainfall during the period of record was 9.93 inches at Athens on June 4, 1967. Thunderstorms occur on about 51 days each year, and most occur in summer.

Snowfall is rare; in 23 percent of the winters, there is no measurable snowfall. In 45 percent, the snowfall, usually of short duration, is less than 2 inches.

The average relative humidity in midafternoon is less than 54 percent. Humidity is higher at night, and the average at dawn is about 86 percent. The percentage of possible sunshine is 61 in summer and 53 in winter. The prevailing wind is from the northwest. Average windspeed is highest, 9.3 miles per hour, in February.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Farming

Most of the land in Elbert, Franklin, and Madison Counties that was not too steep was once cleared and cultivated and subsequently eroded. The smooth, rolling slopes are now slightly to moderately eroded, and some of the steeper areas moderately to severely eroded.

Rainfall is generally adequate for all crops in the survey area, but in an area across the southeast tip of Elbert County, the plastic, clayey soils become waterlogged in spring and early summer. This delays planting sometimes as much as 2 weeks.

With the recognition of soil and water problems, the Broad River Soil Conservation District was formed in 1937. This district included Elbert, Franklin, and Madison Counties as well as five other counties in northeastern Georgia. Since the beginning of operation of the district, farm owners and operators have shown continuing interest in conservation practices that will conserve and protect their soil and water resources.

In 1954 part of Franklin County was included in the North Fork Broad River Watershed, which was a pilot watershed. This was a new approach to conservation. Conservation measures were applied where needed within the watershed.

The three-county area covers 577,024 acres, of which 497,963 acres was inventoried in the Conservation Needs Inventory of 1969. Of the total inventoried acreage, 21.3 percent is cropland, 11.3 percent is pasture, 65.5 percent is forest, and 1.9 percent is listed as other land.

All the area is suitable for farming or woodland except for small, densely populated areas in and around the larger cities and towns. Most of the income from farming is from the sale of livestock, poultry, and livestock products. Soybeans, cotton, corn, and truck crops are grown for sale on a number of farms.

Natural resources

In recent years industry has become one of the main economic activities in the area. The most important industries are granite, which is quarried and shipped from Elbert and Madison Counties, sewing and fireproofing plants, lumber and pulpwood yards, and lumber and textile mills.

Soil is an important natural resource in the counties. Livestock and crops are marketable products that the soil helps produce.

The potential is high for development of recreational facilities in areas around the Hartwell Reservoir in northern Franklin County, and the Clark Hill Reservoir and the proposed Richard B. Russell Reservoir in the southeastern part of Elbert County.

Transportation

In general, most of the area is accessible by good hard-surfaced roads. Interstate Highway 85 extends across the northern part of Franklin County. Rail service is available across the southern part of Madison County and the eastern part of Franklin County and in Bowman and Elberton in Elbert County.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil maps at the back of this publication show, in color, map units or soil associations, that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. The potential of each unit, for each major land use is expressed on the pages that follow.

Elbert County

1. Toccoa-Cartecay association

Level to nearly level, well drained to somewhat poorly drained, loamy alluvial soils that are subject to flooding

This association consists mainly of level to nearly level soils on flood plains of small branches, creeks, and rivers. The soils formed from alluvium washed from adjacent uplands. They are flooded more often than once every 5 years.

This association makes up about 4 percent of Elbert County. Toccoa soils make up about 44 percent of the association, Cartecay soils, about 23 percent, and minor soils the remaining 33 percent.

Toccoa soils are well drained. Typically, the surface layer is brown fine sandy loam 8 inches thick. The upper part of the underlying material is brown and yellowish brown fine sandy loam. The lower part is yellowish brown fine sandy loam that is mottled with strong brown and that extends to a depth of 74 inches. Thin bedding planes of sand, silt loam, and clay loam are in the lower 60 inches.

Cartecay soils are somewhat poorly drained. Typically, they have a brown fine sandy loam to loam surface layer about 7 inches thick. The underlying material is chiefly mottled light brownish gray, strong brown, light yellowish brown, and grayish brown and extends to a depth of 70 inches. These layers range in texture from loamy sand to fine sandy loam.

Minor in this association are sandy and fine textured alluvial soils that are well drained to somewhat poorly drained.

The major soils in this association have high potential for hay (fig. 1), pasture, and corn. Their suitability for other crops is limited by occasional stream overflow and less than adequate drainage. The ponded soils in this association have low potential for farming.

Most of this association has high potential for loblolly pine, black walnut, sycamore, and yellow-poplar, but the ponded soil has low potential for woodland.

The soils in this association have very low potential for all urban uses. Wetness and flooding are limitations. The better drained soils have medium potential for such recreational uses as picnic areas and playgrounds.

2. Cecil-Madison association

Very gently sloping and gently sloping, well drained soils that have a red, clayey subsoil

This association is on moderately broad ridgetops and adjacent side slopes of the uplands. Most slopes are 6 to 10 percent, but some range to 2 percent.

This association makes up about 32 percent of Elbert County. It is in all parts of the county but the southeast. Cecil soils make up about 59 percent of the association, Madison soils about 33 percent, and minor soils the remaining 8 percent.

Cecil soils are well drained. They are very gently sloping and gently sloping and form the greater part of the upland landscape. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of about 60 inches. Below this is saprolite of disintegrated gneiss and granite, in shades of red and brown, that crushes to loam or clay loam and extends to a depth of 65 inches.

Madison soils are well drained, micaceous, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam; the middle part is red clay, and the lower part is red clay loam that extends to a depth of 41 inches. Below this is highly weathered, micaceous saprolite that extends to a depth of 60 inches or more.

Minor in this association are Toccoa and Cartecay soils, which formed in alluvium; Wickham soils on stream terraces; and Cecil and Madison soils on steeper upland slopes. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are occasionally to frequently flooded.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on most of these soils respond well to good management.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management on the eroded soils.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as traffic supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

3. Appling-Cecil association

Very gently sloping and gently sloping, well drained soils that have a yellowish brown or red, clayey subsoil

This association is mainly on broad ridgetops and adjacent side slopes of the uplands. Slopes range from 2 to 10 percent.

This association makes up about 4 percent of Elbert County. It is in small areas over most parts of the county but the southeast. Appling soils make up about 60 percent of the association, Cecil soils about 30 percent, and minor soils the remaining 10 percent.

Appling soils are well drained, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is yellowish brown sandy loam 6 inches thick. The subsoil is yellowish brown to strong brown sandy clay loam to clay in the upper part and mottled brownish yellow, red, strong brown, and yellow clay and sandy clay loam that extends to a depth of 60 inches. Below this, to a depth of 7 feet or more, is red saprolite weathered from granite, gneiss, and coarse grained schist.

Cecil soils are well drained, very gently sloping and gently sloping soils. They are more predominant on the steeper part of the upland landscape. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of about 60 inches. Below this is saprolite of disintegrated gneiss and granite in shades of red and brown; it crushes to loam or clay loam and extends to a depth of 65 inches.

Minor in this association are Toccoa and Cartecay soils, which formed in alluvium, and the steeper Madison, Appling, and Cecil soils on uplands. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are occasionally to frequently flooded. The soils on uplands have a clayey subsoil. Madison soils are micaceous throughout the profile.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on these soils respond well to good management.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the eroded soils.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as traffic-supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

4. Cecil-Madison-Pacolet association

Sloping to moderately steep, well drained soils that have a red, clayey subsoil

This association is mainly on complex side slopes of the uplands adjacent to major drainageways. Slopes range from 10 to 25 percent.

This association makes up about 33 percent of Elbert County. It occurs as scattered areas throughout the county. Cecil soils make up about 36 percent of the association, Madison soils 32 percent, Pacolet soils 17 percent, and minor soils the remaining 15 percent.

Cecil soils are well drained, sloping soils on uplands. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. In a few places this layer is only 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of about 48 inches. Below this is saprolite of weathered gneiss that extends to a depth of 65 inches or more.

Madison soils are well drained, micaceous, sloping to moderately steep soils on uplands. Typically, the surface layer is reddish brown sandy clay loam 3 inches thick. It is a mixture of remnants of the surface layer and the upper part of the subsoil. The upper part of the subsoil is red clay loam, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this is highly weathered mica schist saprolite that extends to hard rock at a depth of 77 inches.

Pacolet soils are well drained, moderately steep soils on uplands. Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The upper few inches of the subsoil is yellowish red sandy clay loam. The middle part of the subsoil is red clay, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this to a depth of 60 inches is mottled yellowish red and yellow saprolite that crushes to fine sandy loam.

Minor in this association are Toccoa and Cartecay soils, which formed in alluvium, and the steeper Ashlar soils on uplands. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are occasionally to frequently flooded. Ashlar soils have a thin subsoil.

This association has low potential for most locally grown row crops because of steep slopes and the erosion hazard. The potential for pasture grasses and legumes is medium. Crops on the major soils respond well to proper fertilization.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and red oak. Erosion hazard, equipment limitations, and seedling mortality are limitations of the soils that have medium potential.

The soils in this association have medium to very low potential for most urban uses. Slope, slow permeability, and low strength are some of the limiting features. Potential is low for most recreational uses.

5. Iredell-Mecklenburg-Davidson association

Very gently sloping and gently sloping, well drained to somewhat poorly drained soils that have a yellowish brown, yellowish red, or dark red dominantly plastic, sticky clayey subsoil

This association is mainly on broad ridgetops and side slopes of the uplands. Slopes are dominantly 6 to 10 percent.

This association makes up about 21 percent of Elbert County. It is in the southeastern part. Iredell soils make up about 54 percent of the association, Mecklenburg soils 22 percent, Davidson soils 7 percent, and minor soils the remaining 17 percent.

Iredell soils are moderately well drained to somewhat poorly drained, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is dark grayish brown sandy loam about 7 inches thick. The upper few inches of the subsoil is dark grayish brown clay loam, and the middle and lower parts are mainly yellowish brown clay that extends to a depth of 34 inches. Below a depth of 34 inches is 3 to 6 feet of weathered diorite, gabbro, or other basic igneous rock.

Mecklenburg soils are well drained, very gently sloping and gently sloping soils on ridgetops and side slopes of the uplands. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. The upper part of the subsoil is yellowish red clay with brownish yellow mottles in the lower part. The lower part is yellowish red clay loam that has yellowish brown mottles and that extends to a depth of 34 inches. Below this is saprolite of highly weathered, friable acidic and basic rock that extends to a depth of 60 inches or more.

Davidson soils are well drained, very gently sloping and gently sloping soils on ridgetops and side slopes of the uplands. Typically, the surface layer is dark reddish brown clay loam 6 inches thick. The subsoil is dark reddish brown and dark red clay loam and clay that extends to a depth of 70 inches or more.

Minor in this association are Toccoa, Cartecay, Wickham, Enon, and Wilkes soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms; Wickham soils are on stream terraces; and Enon and Wilkes soils are on the steeper slopes.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Most of the soils in the association require good management, such as plowing during optimum moisture conditions and returning crop residue to the soil. A large acreage is row cropped.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, and eastern redcedar. Equipment restrictions and seedling mortality are limiting features in woodland management for the soils that have medium potential.

Most of the soils in this association have low to very low potential for most urban uses. Limitations expressed as slow percolation, shrink-swell potential, and low strength can be generally overcome for many uses by good design and careful installation.

6. Enon-Wilkes-Mecklenburg association

Sloping to moderately steep, well drained soils that have a yellow, red, or olive brown, dominantly clayey subsoil

This association is mainly on complex side slopes and narrow ridgetops of the uplands. Slopes range from 10 to 25 percent.

This association makes up 6 percent of Elbert County. It is mainly in the southeastern part. The Enon-Wilkes complex makes up about 62 percent of the association, Mecklenburg soils 20 percent, and minor soils the remaining 18 percent.

Enon soils are well drained and sloping to moderately steep. Typically, the surface layer is dark grayish brown and light olive brown gravelly loam 10 inches thick. The subsoil is dark yellowish brown clay 14 inches thick. Below this is saprolite of partially decomposed acidic and basic rocks. It is yellow, yellowish brown, and grayish green; it crushes to loam and clay loam.

Wilkes soils are well drained, gravelly, and sloping to moderately steep. Typically, the surface layer is very dark grayish brown and light brownish gray gravelly loam 10 inches thick. The subsoil is light olive brown clay loam and gravelly clay loam 9 inches thick. The substratum is partially decomposed acidic and basic rocks. It is light olive brown and greenish saprolite that crushes to fine sandy loam; it extends to a depth of 60 inches or more.

Mecklenburg soils are well drained and are on the less steep side slopes of the uplands. Typically, the surface layer is reddish brown sandy clay loam 4 inches thick. The upper part of the subsoil is red clay. The lower part is red clay loam mottled with yellowish brown; it extends to a depth of 26 inches. Below this is friable, acidic and basic saprolite that crushes to clay loam; it extends to a depth of 60 inches.

Minor soils in this association are Toccoa, Cartecay, Ashlar, Cecil, and Davidson soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Ashlar soils have a thin sandy loam subsoil and are on the steeper parts of the association. Cecil and Davidson soils are well drained and are on the smoother parts.

This association has low potential for row crops because of steepness of slopes. A minor part has medium potential for pasture if management is good.

The major soils in this association have medium potential for loblolly pine, Virginia pine, and eastern redcedar. The moderate erosion hazard and equipment restrictions are limiting features.

This association has low potential for most urban uses. Slope, shrink-swell potential, permeability, and depth to bedrock are limiting features. The association has low potential for generally all developed recreational uses.

Franklin County

1. Toccoa-Cartecay association

Level to nearly level, well drained to somewhat poorly drained, loamy alluvial soils that are subject to flooding

This association consists mainly of level to nearly level soils on flood plains of small branches, creeks, and rivers. The soils formed from alluvium washed from adjacent uplands. They are flooded more often than once every 5 years.

This association makes up about 3 percent of Franklin County. Toccoa soils make up about 40 percent of the association, Cartecay soils about 27 percent, and minor soils the remaining 33 percent.

Toccoa soils are well drained. Typically, the surface layer is brown fine sandy loam 8 inches thick. The upper part of the underlying material is brown and yellowish brown fine sandy loam. The lower part is yellowish brown fine sandy loam that is mottled with strong brown and that extends to a depth of 74 inches. Thin bedding planes of sand, silt, silt loam, and clay loam are in the lower 60 inches.

Cartecay soils are somewhat poorly drained. Typically, they have a brown fine sandy loam to loam surface layer about 7 inches thick. The underlying material is chiefly mottled light brownish gray, strong brown, light yellowish brown, and grayish brown and extends to a depth of 70 inches. These layers range in texture from loamy sand to fine sand.

Minor in this association are sandy and fine textured alluvial soils that are well drained to somewhat poorly drained.

The major soils in this association have high potential for hay, pasture, and corn. Their suitability for other crops is limited by occasional stream overflow and less than adequate drainage. The ponded soils in this association have low potential for farming.

Most of this association has high potential for loblolly pine, black walnut, sycamore, and yellow-poplar, but the ponded soil has low potential for woodland.

The soils in this association have very low potential for all urban uses. Wetness and flooding are limitations. The better drained soils have medium potential for such recreational uses as picnic areas and playgrounds.

2. Gwinnett-Cecil-Madison association

Very gently sloping and gently sloping, well drained soils that have a red to dark red, clayey subsoil

This association is mainly on broad undulating ridgetops and adjacent side slopes of the uplands. Slopes are dominantly 6 to 10 percent.

This association makes up about 19 percent of Franklin County. It is in all parts of the county but the southeast. Gwinnett soils make up about 47 percent of the association, Cecil soils about 20 percent, Madison soils about 12 percent, and minor soils the remaining 21 percent.

The Gwinnett soils are well drained, predominantly gently sloping soils on uplands. Typically, the dark reddish brown sandy clay loam surface layer is 5 inches thick. The subsoil is dark red clay that extends to a depth of 34 inches. Below this is very dark gray and reddish brown saprolite of weathered acidic and basic rock that extends to a depth of 60 inches or more.

Cecil soils are well drained, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of about 58 inches. Below this is saprolite of disintegrated gneiss and granite in shades of red and strong brown; it crushes to clay loam and extends to a depth of 65 inches.

Madison soils are well drained, micaceous, mainly gently sloping soils on uplands. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam, the middle part is red clay, and the lower part is red clay loam that extends to a depth of 41 inches. Below this is highly weathered, micaceous saprolite that extends to a depth of 60 inches or more.

Minor in this association are Hiwassee, Toccoa, Cartecay, and Iredell soils. The Hiwassee soils are reddish and occur on uplands. The Iredell soils have tough, plastic clayey subsoils and are on the uplands. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on most of these soils respond well to good management. A large acreage is pastured and is suited to fescue, the most commonly grown grass.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the eroded soils.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as depth to bedrock, traffic supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

3. Cecil-Madison-Appling association

Very gently sloping and gently sloping, well drained soils that have a red or yellowish brown, clayey subsoil

This association is mainly on broad smooth ridgetops and adjacent short side slopes of the uplands. Slopes are dominantly 6 to 10 percent.

This association makes up about 27 percent of Franklin County. It is throughout most of the county. Cecil soils make up about 60 percent of the association, Madison soils about 14 percent, Appling soils about 8 percent, and minor soils the remaining 18 percent.

Cecil soils are well drained and are very gently sloping and gently sloping. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam to a depth of about 58 inches. Below this is saprolite of disintegrated gneiss and granite in shades of red and strong brown; it crushes to clay loam and extends to a depth of 65 inches.

Madison soils are well drained and are very gently sloping and gently sloping. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam, the middle part is red clay, and the lower part is red clay loam that extends to a depth of 41 inches. Below this is highly weathered, micaceous saprolite that extends to a depth of 60 inches or more.

Appling soils are well drained, very gently sloping and gently sloping soils evenly distributed over the landscape. Typically, the surface layer is yellowish brown sandy loam 6 inches thick. The subsoil is yellowish brown to strong brown sandy clay loam to clay to a depth of 22 inches and mottled brownish yellow, red, strong brown, and yellow clay and sandy clay loam to a depth of 60 inches. Below this to a depth of 7 feet or more is red saprolite weathered from granite, gneiss, and coarse grained schist.

Minor in this association are Toccoa, Cartecay, Gwinnett, and Wickham soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Gwinnett soils have a dark red clayey subsoil and are on uplands. Wickham soils formed on alluvial terraces.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on most of these soils respond well to good management. A large acreage is pastured and is suited to fescue.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the eroded soils, which have medium potential.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as depth to bedrock, traffic-supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

4. Madison-Cecil association

Very gently sloping and gently sloping, well drained soils that have a red, clayey subsoil that is predominantly micaceous

This association is on moderately broad ridgetops and adjacent side slopes of the uplands. Slopes are dominantly 6 to 10 percent.

This association makes up about 12 percent of Franklin County. It is primarily in the southeastern part of the county. Madison soils make up about 57 percent of the association, Cecil soils about 27 percent, and minor soils the remaining 16 percent.

Madison soils are well drained, micaceous, very gently sloping and gently sloping soils evenly distributed over the landscape. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam, the middle part is red clay, and the lower part is red clay loam that extends to a depth of 41 inches. Below this is highly weathered, micaceous saprolite that extends to a depth of 60 inches or more.

Cecil soils are well drained, very gently sloping and gently sloping soils. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam to a depth of 58 inches. Below this is saprolite of disintegrated gneiss and granite in shades of red and strong brown; it crushes to clay loam and extends to a depth of 65 inches.

Minor in this association are Toccoa, Cartecay, and Wickham soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Wickham soils formed on alluvial terraces.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on most of these soils respond well to good management. A large acreage is pastured and is suited to fescue, the most commonly used grass (fig. 2).

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, northern red oak, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the eroded soils, which have medium potential.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as depth to bedrock, traffic supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

5. Gwinnett-Cecil-Pacolet association

Sloping to moderately steep, well drained soils that have a red to dark red, clayey subsoil

This association is mainly on the steeper parts of the uplands that parallel major streams. Slopes range from 10 to 25 percent.

This association makes up about 8 percent of Franklin County. It is in small areas scattered over practically all parts of the county but the southeast. Gwinnett soils make up about 67 percent of the association, Cecil soils about 18 percent, Pacolet soils about 10 percent, and minor soils the remaining 5 percent.

Gwinnett soils are well drained and sloping to moderately steep. Typically, the surface layer is dark reddish brown sandy clay loam 6 inches thick. The subsoil is dark red clay that extends to a depth of 32 inches. Below this to a depth of 60 inches is highly weathered, friable, basic saprolite.

Cecil soils are well drained and sloping. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. In a few places this layer is only 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 48 inches. Below this is saprolite of weathered gneiss that extends to a depth of 65 inches or more.

Pacolet soils are well drained and moderately steep. Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The upper few inches of the subsoil is yellowish red sandy clay loam. The middle part is red clay, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this to a depth of 60 inches is mottled yellowish red and reddish yellow saprolite that crushes to fine sandy loam.

Minor in this association are Ashlar, Appling, Enon, and Wilkes soils. Ashlar soils have a thin loamy subsoil; Appling soils have a moderately thick, clayey subsoil; and Enon and Wilkes soils have a thin, plastic, clayey subsoil.

This association has low potential for most locally grown row crops because of steep slopes and the erosion hazard. The potential for pasture grasses and legumes is medium. Crops on the major soils respond well to proper fertilization and other good management.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and red oak. Erosion hazard, equipment limitations, and seedling mortality are limitations of the eroded soils, which have medium potential.

The soils in this association have medium to very low potential for most urban uses. Slope, slow permeability, and low strength are some of the limiting features. Potential is low for most recreational uses.

6. Madison-Cecil-Pacolet association

Sloping to moderately steep, well drained soils that have a red, clayey subsoil that is predominantly micaceous

This association is mainly on complex slopes of the uplands. The drainage system is well defined. Slopes range from 10 to 25 percent.

This association makes up about 15 percent of Franklin County. It is mostly in the southeastern part of the county. Madison soils make up about 79 percent of the association, Cecil soils about 10 percent, Pacolet soils about 6 percent, and minor soils the remaining 5 percent.

Madison soils are well drained, micaceous, sloping to moderately steep soils on uplands. Typically, the surface layer is brown sandy loam 7 inches thick. The upper part of the subsoil is yellowish red sandy clay loam 6 inches thick. The middle part is red clay, and the lower part is sandy clay loam that extends to a depth of 36 inches. Below this is highly weathered mica schist saprolite that extends to a depth of 60 inches.

Cecil soils are well drained and sloping. They are on ridgetops and upper slopes. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. In a few places this layer is only 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 48 inches. Below this is saprolite of weathered gneiss that extends deeper than 65 inches.

Pacolet soils are well drained, moderately steep soils on uplands. Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The upper few inches of the subsoil is sandy clay loam. The middle part is red clay, and the lower part is sandy clay loam that extends to a depth of 30 inches. Below this to a depth of 60 inches is mottled yellowish red and reddish yellow saprolite that crushes to fine sandy loam.

Minor in this association are Ashlar, Appling, Louisa, Toccoa, and Cartecay soils. Ashlar and Louisa soils have a thin, loamy subsoil, and Appling soils have a moderately thick, clayey subsoil. They are on narrow ridgetops and moderately steep hillsides. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are loamy and are on occasionally to frequently flooded first bottoms.

This association has low potential for most locally grown row crops because of steep slopes and the erosion hazard. The potential for pasture grasses and legumes is medium. These soils respond well to proper fertilization and adequate management.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and red oak. Erosion hazard, equipment limitations, and seedling mortality are limitations of the soils that have medium potential.

The soils in this association have medium to very low potential for most urban uses. Slope, erosion hazard, slow permeability, and low strength are some of the limiting features. Potential is low for most recreational uses.

7. Cecil-Pacolet-Gwinnett association

Sloping to moderately steep, well drained soils that have a red to dark red, clayey subsoil

This association consists mainly of rolling to hilly soils on uplands. The drainage pattern is well defined. Slopes range from 10 to 25 percent.

This association makes up about 16 percent of Franklin County. It is in small areas scattered over practically all parts of the county but the southeast. Cecil soils make up about 49 percent of the association, Pacolet soils about 24 percent, Gwinnett soils about 19 percent, and minor soils the remaining 8 percent.

Cecil soils are well drained, sloping soils on ridgetops and upper slopes of the uplands. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. In a few places this layer is only 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 48 inches. Below this is saprolite of weathered gneiss that extends deeper than 65 inches.

Pacolet soils are well drained, moderately steep soils on uplands. Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The upper few inches of the subsoil is sandy clay loam, the middle part is red clay, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this to a depth of 60 inches is mottled yellowish red and reddish yellow saprolite that crushes to fine sandy loam.

Gwinnett soils are well drained, sloping to moderately steep soils on uplands. Typically, the surface layer is dark reddish brown sandy clay loam 6 inches thick. The subsoil is dark red clay that extends to a depth of 32 inches. Below this to a depth of 60 inches is highly weathered, friable, basic saprolite.

Minor in this association are Ashlar, Appling, Toccoa, and Cartecay soils. Ashlar soils have a thin, loamy subsoil, and Appling soils have a moderately thick, clayey subsoil. They are on ridgetops and steep hillsides. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms.

This association has low potential for most locally grown row crops because of steep slopes and the erosion hazard. The potential for pasture grasses and legumes is medium. These soils respond well to proper fertilization and good management.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and red oak. Erosion hazard, equipment limitations, and seedling mortality are limitations of the soils that have medium potential.

The soils in this association have medium to very low potential for most urban uses. Slope, erosion hazard, slow permeability, and low strength are some of the limiting features. Potential is low for most recreational uses.

Madison County

1. Toccoa-Cartecay association

Level to nearly level, well drained to somewhat poorly drained, loamy alluvial soils that are subject to flooding

This association consists mainly of level to nearly level soils on flood plains of small branches, creeks, and rivers. Soils have formed from alluvium washed from adjacent uplands. These flood plains are flooded more than once every 5 years.

This association makes up about 2 percent of Madison County. Toccoa soils make up about 38 percent of the association, Cartecay soils about 29 percent, and minor soils the remaining 33 percent.

Toccoa soils are well drained and are generally nearer the stream than the other soils. Typically, the surface layer is brown fine sandy loam 8 inches thick. The upper part of the underlying material is brown and yellowish brown fine sandy loam. The lower part is yellowish brown fine sandy loam mottled with strong brown that extends to a depth of 74 inches. Thin bedding planes of sand, loam, silt, and clay loam are in the lower 60 inches.

Cartecay soils are somewhat poorly drained and are near the outer edge of the flood plain on seasonally wet parts of the landscape. Typically, they have a brown fine sandy loam to loam surface layer about 7 inches thick. The underlying layers are chiefly mottled light brownish gray, strong brown, light yellowish brown, and grayish brown to a depth of 70 inches. These layers range from loamy sand to fine sandy loam.

Minor in this association are sandy and fine textured soils that are well drained to somewhat poorly drained.

The major soils in this association have high potential for hay, pasture, and corn. Their suitability to additional crops is limited by occasional stream overflow and less than adequate drainage. The ponded soils in this association have low potential for farming.

The major part of this association has high potential for loblolly pine, black walnut, sycamore, and yellow-poplar. The ponded soils have low potential for woodland.

The soils in this association have very low potential for all urban uses. Wetness and flooding are limitations. The better drained soils in this association have a medium potential for such recreational uses as picnic areas and playgrounds.

2. Madison-Grover association

Very gently sloping and gently sloping, well drained soils that have a red or reddish brown, clayey or loamy subsoil that is micaceous

This association is on moderately broad ridgetops and adjacent side slopes of uplands. Slopes range from 2 to 10 percent.

This association makes up about 45 percent of Madison County. It occurs as scattered areas in practically all parts. Madison soils make up about 84 percent of the association, Grover soils about 8 percent, and minor soils the remaining 8 percent.

Madison soils are well drained, micaceous, predominantly gently sloping soils on uplands. Some are steeper. Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam. The middle part is red clay, and the lower part is clay loam that extends to a depth of 41 inches. Below this is highly weathered, micaceous saprolite that extends to a depth of 60 inches or more.

Grover soils are well drained, micaceous, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is brown sandy loam 10 inches thick. The upper part of the subsoil is reddish brown and brown sandy clay loam mottled with red, brown, and yellow. The lower part is mottled red, light yellowish brown, and brownish yellow sandy clay loam that extends to a depth of 36 inches. Below this is saprolite which extends to a depth of 60 inches. This yellowish red material crushes to sandy loam. The surface layer contains few fine flakes of mica; the other horizons contain many fine flakes.

Minor in this association are Toccoa, Cartecay, Gwinnett, and Wickham soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Gwinnett soils have a clayey subsoil and are on uplands. The loamy Wickham soils formed on alluvial terraces.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on these soils respond well to good management. A large acreage is pastured and is suited to fescue, which is commonly grown.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the soils that have medium potential.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as depth to bedrock, traffic supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

3. Cecil-Gwinnett-Appling association

Very gently sloping and gently sloping, well drained soils that have a red, dark red, or yellowish brown, clayey subsoil

This association is mainly on broad, undulating ridgetops and adjacent short side slopes of the uplands. Most slopes are 6 to 10 percent, but some range to 2 percent.

This association makes up about 19 percent of Madison County. It occurs throughout most of the county. Cecil soils make up about 60 percent of the association, Gwinnett soils about 15 percent, Appling soils about 14 percent, and minor soils the remaining 11 percent.

Cecil soils are well drained, very gently sloping and gently sloping soils on uplands. Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of 60 inches. Below this is saprolite of disintegrated gneiss and granite, in shades of red and brown, that crushes to loam or clay loam and extends to a depth of 65 inches or more.

Gwinnett soils are well drained. They are very gently sloping and gently sloping but are more predominant in the steeper parts of the uplands. Typically, the surface layer is dark reddish brown sandy clay loam 5 inches thick. The subsoil is dark red clay that extends to a depth of 34 inches. Below this is saprolite of weathered very dark gray and reddish brown acidic and basic rock that extends to a depth of 60 inches or more.

Appling soils are well drained, predominantly very gently sloping soils on ridgetops. Typically, the surface layer is yellowish brown sandy loam 6 inches thick. The subsoil is yellowish brown to strong brown sandy clay loam to clay to a depth of 22 inches and mottled brownish yellow, red, strong brown, and yellow clay and sandy clay loam to a depth of 60 inches. Below this to a depth of 7 feet or more is red saprolite weathered from granite, gneiss, and coarse grained schist.

Minor in this association are Toccoa, Cartecay, Davidson, and Hiwassee soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Davidson and Hiwassee soils have a dark red, clayey subsoil and are on uplands.

This association has medium to high potential for most locally grown row crops, pasture grasses, and legumes. Crops on these major soils respond well to good management. A large acreage is pastured and is suited to fescue, a commonly grown grass.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and sycamore. Susceptibility to further erosion, equipment limitations, and seedling mortality are limiting features in woodland management for the eroded soils, which have medium potential.

The soils in this association have medium to high potential for most urban uses. Most limitations, such as depth to bedrock, traffic supporting capacity, shrink-swell potential, and slope, can be overcome by good design and careful installation.

4. Madison-Cecil-Pacolet association

Sloping to moderately steep, well drained soils that have a red, clayey subsoil that is predominantly micaceous

This association is mainly on complex side slopes of the uplands adjacent to major streams. The drainage pattern is well defined. Slopes range from 10 to 25 percent.

This association makes up about 34 percent of Madison County. It is throughout most of the county. Madison soils make up about 63 percent of the association, Cecil soils 11 percent, Pacolet soils about 11 percent, and minor soils the remaining 15 percent.

Madison soils are well drained, micaceous, and sloping to moderately steep. They are more predominant in the sloping part of the uplands. Typically, the surface layer is reddish brown sandy clay loam 3 inches thick. It is a mixture of remnants of the topsoil and the upper part of the subsoil. The upper part of the subsoil is red clay loam; the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this is highly weathered mica schist saprolite that extends to hard rock at a depth of about 77 inches.

Cecil soils are well drained, sloping soils on uplands. Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. In a few places this layer is only 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 48 inches. Below this is saprolite of weathered gneiss that extends to a depth of 65 inches or more.

Pacolet soils are well drained and moderately steep. They are in the steeper part of the uplands. Typically, the surface layer is red sandy clay loam about 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 35 inches. Below this is 3 to 4 feet of red granite saprolite high in mica flakes. It crushes to loam.

Minor soils in this association are Toccoa, Cartecay, Gwinnett, Louisa, and Ashlar soils. The well drained Toccoa soils and the somewhat poorly drained Cartecay soils are on occasionally to frequently flooded first bottoms. Gwinnett soils have a dark red clayey subsoil; Louisa and Ashlar soils have a thin loamy subsoil. They are on hilly uplands.

This association has low potential for most locally grown row crops because of steep slopes and the erosion hazard. The potential for pasture grasses and legumes is medium. These plants respond well to proper fertilization.

The major soils in this association have medium to moderately high potential for loblolly pine, Virginia pine, yellow-poplar, and red oak. Erosion hazard, equipment limitations, and seedling mortality are limitations of the soils that have medium potential.

Broad land use considerations

Land-use decisions are important. Each year considerable acreage is developed for woodland, cropland and pasture, urban use, and other related uses. The general soil map can be very helpful in identifying large areas suitable for farming or other land uses; it cannot be used for selecting sites for specific uses such as for urban structures.

Woodland covers more than 60 percent of the three-county survey area. With very few exceptions, all soil associations have medium to high potential for woodland production. One of the very few exceptions is Cartecay soils, ponded, which is of minor extent in the Toccoa-Cartecay association. This soil has low potential for woodland production because of ponding and flooding.

Pasture and cropland occupy about 35 percent of the survey area, but this acreage can potentially be doubled. Some of the soil associations that are not suitable for pasture and cropland are the steeper parts of the Cecil-Madison-Pacolet, Gwinnett-Cecil-Pacolet, Madison-Cecil-Pacolet, Madison-Cecil-Pacolet, Cecil-Pacolet-Gwinnett, and Enon-Wilkes-Mecklenburg associations. The Cartecay soils in the Toccoa-Cartecay association need either surface or subsurface drainage, and in some places both, before the association can be used as cropland. The Iredell soils in the Iredell-Mecklenburg-Davidson association are slow to warm up in early spring. The heavy, plastic clay subsoil remains wet and prevents early planting.

Vegetable and other specialty crops are uniquely suited to soils of the Toccoa-Cartecay association where proper drainage has been installed. The proximity of a source of water for irrigation and the location of flood-prevention structures above parts of this association also make it desirable.

About 24,500 acres, or 4 percent of the survey area, is in urban or built-up land. This acreage seems small, but will probably increase in the near future, especially in areas in and around Elberton, Royston, and Lavonia and in the southwestern part of Madison County. In general, about two thirds of the land in the survey area has medium to high potential for urban expansion. The remainder of the survey area has low potential for urban expansion. This area is made up of the steeper parts of the Cecil-Madison-Pacolet, Gwinnett-Cecil-Pacolet, Madison-Cecil-Pacolet, and Cecil-Pacolet-Gwinnett associations; the Iredell-Mecklenburg-Davidson and Enon-Wilkes-Mecklenburg associations, in which the Iredell, Mecklenburg, Enon, and Wilkes soils all have high shrink-swell potential and slow permeability; and the Toccoa-Cartecay association, which is subject to flooding.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Cecil and Madison, for example, are the names of two soil series.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Cecil sandy loam, 2 to 6 percent slopes, is one of several phases within the Cecil series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Ashlar complex, 10 to 30 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Cartecay soils is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4. Additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions and potentials

AmB—Appling sandy loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 100 acres.

Typically, the surface layer is yellowish brown sandy loam 6 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown to strong brown sandy clay loam to clay in the upper part and mottled brownish yellow, red, and strong brown clay and sandy clay loam in the lower part. Below this to a depth of 65 inches or more is red saprolite weathered from granite, gneiss, and coarse grained schist.

Included with this soil in mapping are areas of clayey soils that are moderately well drained to somewhat poorly drained. Also included are small areas of soils that have a sandy clay loam surface layer. These included soils make up as much as 25 percent of the mapping unit, but separate areas generally are less than 4 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good. The root zone is deep.

This soil has high potential for local crops and pastures. Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant concerns in woodland use and management.

This soil has high potential for most urban uses. The clayey subsoil has slow permeability, which is a moderate limitation for septic tank absorption fields but can generally be overcome by good design and careful installation. Capability subclass IIe.

AmC—Appling sandy loam, 6 to 10 percent slopes. This deep, well drained, gently sloping soil is on ridgetops and long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 20 acres.

Typically, the surface layer is mainly yellowish brown or grayish brown sandy loam 7 inches thick. The subsoil extends to a depth of about 50 inches. The upper part is strong brown sandy clay loam, the middle part is yellowish red to yellowish brown sandy clay or clay with many mottles of red, brown, and pale brown, and the lower part is red, yellowish red, or strong brown sandy clay loam and clay loam with common to many mottles of red, strong brown, and brownish yellow. Below this to a depth of about 65 inches is red, friable saprolite weathered from granite, gneiss, or coarse grained schist.

Included with this soil in mapping are small areas of Cecil, Grover, and Madison soils. Also included are small areas of a similar soil in which the solum is 30 to 40 inches thick.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good. The root zone is deep.

This soil has high potential for and is suited to all locally grown crops and pastures. Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard if the soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, that help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant concerns in woodland management.

This soil has medium to high potential for urban uses. The slope and slow permeability of the subsoil are limitations. Slow permeability for septic tank absorption fields can generally be overcome by design and construction. Structures can be installed if they are compatible with slope. Capability subclass IIIe.

AmD—Appling sandy loam, 10 to 15 percent slopes. This deep, well drained, sloping soil is on narrow, moderately long side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 10 to 15 acres.

Typically, the surface layer is brown sandy loam 6 inches thick. The subsoil extends to a depth of 42 inches. The upper part is reddish yellow sandy clay loam, the middle part is strong brown sandy clay with common light brown mottles, and the lower part is yellowish red sandy clay loam with common light brown mottles. Below this to a depth of 65 inches is mottled yellowish red, light brown, and light gray saprolite weathered from gneiss.

Included with this soil in mapping are small areas of soils that are similar to this Appling soil except that they have slopes of as much as 25 percent. They are in areas of less than 5 acres. These included soils make up as much as 10 percent of the mapping unit. Also included are small areas of Ashlar, Cecil, and Madison soils.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good. The root zone is deep.

This soil has low potential for row crops because of the steepness of slopes. Erosion is a severe hazard if the soil is cultivated. The potential for pasture is medium.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant management concerns for woodland use.

This soil has medium potential for most urban uses. The slope and slow permeability of the subsoil are limiting features. Structures must be compatible with the landscape, or significant land modification such as shaping and smoothing is essential for best results. Capability subclass IVe.

AnC2—Appling sandy clay loam, 6 to 10 percent slopes, eroded. This deep, well drained, gently sloping soil is on ridgetops and long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 20 acres.

Typically, the surface layer is yellowish brown sandy clay loam 5 inches thick. The subsoil extends to a depth of 50 inches. The upper part is brownish yellow sandy clay loam, the middle part is yellowish brown and brownish yellow sandy clay, and the lower part is yellowish brown sandy clay loam. The middle and lower parts of the subsoil have common mottles of red, yellowish red, or pale yellow. Below this to a depth of 72 inches is mottled yellowish brown, red, and pale yellow saprolite weathered from granite.

Included with this soil in mapping are small areas of soils that are similar to this Appling soil except that slope ranges from 2 to 6 percent. These included soils make up about 15 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is generally poor because of the amount of clay in the surface layer. Although water intake is moderate, runoff is somewhat faster on this soil than on Appling soils that have a sandy loam surface layer.

This soil has medium potential for a wide range of row crops and pastures if management is good. Erosion is a severe hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant woodland management concerns.

This soil has medium to high potential for urban uses. The slope and slow permeability of the subsoil are limitations. Slow permeability in septic tank absorption fields can generally be overcome by good design and installation. Capability subclass IVe.

AnD2—Appling sandy clay loam, 10 to 15 percent slopes, eroded. This deep, well drained, sloping soil is on narrow, moderately long side slopes of the Piedmont Upland. It is adjacent to stream flood plains. The slopes are complex and convex. Individual areas are 10 to 15 acres.

Typically, the surface layer is brown sandy clay loam 4 inches thick. The subsoil is yellowish brown and yellowish red sandy clay that has red, brown, and light brown mottles; it extends to a depth of 55 inches. Below this to a depth of 5 1/2 feet is very pale brown and yellow saprolite that has weathered from granite, gneiss, and coarse grained schist.

Included with this soil in mapping are small areas of soils that are similar to this Appling soil except that the slope ranges to 25 percent. These included soils make up about 20 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is generally poor because of the amount of clay in the surface layer. Although water intake is moderate, runoff is somewhat faster on this soil than on Appling soils that have a sandy loam surface layer.

This soil has low potential for and is poorly suited to row crops because of the steepness of slopes. It has medium potential for pasture if management is good. Erosion is a severe hazard if this soil is not protected.

This soil has moderately high potential for loblolly pine, yellow-poplar, and Virginia pine. There are no significant woodland management concerns.

This soil has medium potential for most urban uses. The slope and slow permeability of the subsoil are limitations. Structures must be compatible with the landscape; otherwise, significant reshaping of the soil is needed. Capability subclass VIe.

AsF—Ashlar complex, 10 to 30 percent slopes. This complex consists of small to large areas of Ashlar soils and similar soils that have a thinner solum. These soils are so intermingled that they could not be separated at the scale of mapping. This sloping to steep complex is on the Piedmont Upland. Individual areas are 10 to 150 acres.

Ashlar soils make up about 55 percent of each mapped area. Typically, the surface layer is 8 inches of brown and light yellowish brown sandy loam. The subsoil is yellowish brown sandy loam about 12 inches thick. The substratum is yellowish brown, mottled, highly weathered granite that crushes to sandy loam. Hard granite is at a depth of 29 inches.

The Ashlar soils are low in natural fertility and organic matter content. They are very strongly acid throughout except for the surface layer in limed areas. Permeability is moderately rapid, and available water capacity is low. Tilth is good. The root zone is moderately deep and is easily penetrated by plant roots.

Soils that are similar to this Ashlar soil make up about 25 percent of each mapped area. These soils have similar colors and texture but have rock at a depth of 22 inches.

Included in mapping are Pacolet soils; similar, steeper soils that have slopes of as much as 50 percent; and some rock outcrops. Also included are small areas of Cecil, Louisa, and Madison soils.

This complex has low potential for row crops and pasture. Its potential is limited by excessive internal drainage and steep slopes.

This complex has moderately high potential for loblolly pine, white pine, yellow-poplar, and red oak. Steepness of slopes causes moderate equipment restrictions and moderate erosion hazard. This limitation can be overcome by good management.

This complex has moderate to low potential for urban uses. It is limited by depth to rock and slope. Capability subclass VIIe.

Ca—Cartecay soils. This map unit consists of somewhat poorly drained, level to nearly level soils on flood plains of small branches, creeks, and rivers. It consists mainly of Cartecay soils and similar soils that have more silt and clay in the underlying layers than Cartecay soils. Mapped areas range from 5 to 150 acres. Individual areas of both soils are large enough to be mapped separately, but because of present and predicted use they were not separated in mapping. Most areas contain both soils, but there are a few areas in which one or the other is not present. Both soils are in about the same position on the landscape.

Cartecay soils make up about 55 percent of each mapped area. Typically, they have a brown fine sandy loam to loam surface layer about 7 inches thick. The underlying layers are chiefly mottled light brownish gray, strong brown, light yellowish brown, and grayish brown to a depth of 70 inches. These layers range from loamy sand to fine sandy loam.

Cartecay soils are low in natural fertility and organic matter content. They are strongly acid to slightly acid throughout except for the surface layer in limed areas. Permeability is moderately rapid, and available water capacity is medium. Tilth is good, and the root zone is deep.

Soils that are similar to Cartecay soils make up about 35 percent of each mapped area. Typically, these loamy soils have mainly the same range of colors for the surface layer and underlying layers as Cartecay soils. However, they have slightly more clay and silt in the underlying layers.

These similar soils are low in natural fertility and organic matter content. They are strongly acid to slightly acid throughout except for the surface layer in limed areas. Permeability is moderately rapid, and available water capacity is medium. Tilth is good, and the root zone is deep.

Included with these soils in mapping are clayey alluvial soils at the outer edges of the flood plains. These included soils make up about 10 percent of the mapping unit.

This map unit has high potential for hay, pasture, and corn where it has been cleared and drained properly. The suitability of additional crops is limited by occasional stream overflows during periods of high rainfall. Limitations can be overcome by proper drainage and control of flooding.

This map unit has high potential for loblolly pine, sweetgum, sycamore, and yellow-poplar. It is seasonally wet and has moderate equipment restrictions when used for woodland. This limitation can be overcome by good management.

This map unit has very low potential for all urban uses. Wetness and flooding are limitations. Major flood control and drainage measures are needed to overcome these adverse features. Capability subclass IIIw.

Cc—Cartecay soils, ponded. This map unit consists of level to nearly level soils on flood plains of the larger streams. It is in concave pockets, in coves, or at the outer edges of flood plains. Typically, the surface is covered throughout most of the year with 1 to 2 feet of water (fig. 3). This unit consists mainly of Cartecay soils and similar soils that have more silt and clay in the underlying layers than Cartecay soils. Mapped areas range from 10 to 100 acres. Individual areas of both soils are large enough to be mapped separately, but because of present and predicted use and management, they were not separated in mapping.

Typically, Cartecay soils have a surface layer of brown fine sandy loam, 7 inches thick, that has light brownish gray mottles. The underlying layers are mottled gray, red, and brown fine sandy loam, sandy loam, and loamy sand to a depth of 70 inches.

Cartecay soils are low in natural fertility and organic matter content. They are strongly acid to slightly acid throughout. Permeability is moderately rapid, and available water capacity is medium. This soil has poor tilth and a shallow root zone because of wetness.

Included in mapping are some clayey alluvial soils. They are at outer edges of the flood plain.

This map unit has low potential for farming; it is therefore not suitable for crops or pasture.

The woodland potential of this unit is low because of frequent flooding and ponding. Equipment limitations and seedling mortality are severe.

The potential for urban uses is very low because of wetness. Capability subclass Vw.

CeB—Cecil sandy loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops and long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas range from less than 5 acres to more than 100 acres.

Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of about 60 inches. The substratum is disintegrated gneiss and granite in shades of red and brown; it crushes to loam or clay loam and extends to a depth of 66 inches or more (fig. 4).

Included with this soil in mapping are areas of a soil that is similar to this Cecil soil except that it has slopes of less than 2 percent or 6 to 10 percent. Also included are soils that have a sandy clay loam surface layer and small areas of Appling, Grover, Gwinnett, and Madison soils.

This soil is low in natural fertility and organic matter content. It is very strongly to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential for local row crops, small grains, pasture grasses and legumes, and hay. It is one of the most productive soils of the area. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if cultivated crops are grown. Minimum tillage, contour farming (fig. 5), and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant management concerns for woodland use.

This soil has high potential for most urban uses. Low strength for road base material and slow permeability for septic tank absorption fields are examples of limitations. These limitations can generally be overcome by good design and careful installation. Capability subclass IIe.

CeC—Cecil sandy loam, 6 to 10 percent slopes. This deep, well drained, gently sloping soil is on narrow ridgetops and moderately long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are less than 5 acres to more than 50 acres.

Typically, the surface layer is reddish brown sandy loam 7 inches thick. The subsoil is red sandy clay loam, clay, and clay loam that extends to a depth of about 58 inches. The substratum is disintegrated gneiss and granite in shades of red and strong brown; it crushes to clay loam and extends to a depth of 66 inches or more.

Included with this soil in mapping are areas of a soil that is similar to this Cecil soil but that has a sandy clay loam surface layer, and other areas of a soil that is similar to this Cecil soil but that has slopes of slightly less than 6 percent or of more than 10 percent. Also included are small areas of Gwinnett, Madison, Grover, or Appling soils.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential and is well suited to and used extensively for all of the locally grown row crops, small grains, pasture grasses, legumes, and hay crops (fig. 6). Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard when this soil is cultivated. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant woodland management concerns.

This soil has medium to high potential for urban uses. Slow permeability, slope, and low strength are limitations. Some limitations can generally be overcome by good design and careful installation. Structures can be installed if they are compatible with slope. Capability subclass IIIe.

CeD—Cecil sandy loam, 10 to 15 percent slopes. This deep, well drained, sloping soil is on moderately long side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to more than 25 acres.

Typically, the surface layer is dark grayish brown sandy loam 6 inches thick. The subsoil is red sandy clay loam and clay and extends to a depth of 50 inches. The substratum is weathered gneiss and granite with small pockets of clay in the weathered material; it extends to a depth of 66 inches or more.

Included with this soil in mapping are areas of a soil that is similar to this Cecil soil but is eroded to the extent that the surface layer is sandy clay loam. Shallow gullies and galled areas have formed. Also included are a few small areas of Appling, Gwinnett, Madison, and Pacolet soils.

This soil is low in natural fertility and organic matter content. It is very strongly to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has low potential for row crops because of the steepness of slopes. Erosion is a severe hazard if the soil is cultivated. The potential for pasture is medium.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant management problems for woodland use.

This soil has medium potential for most urban uses. Slow permeability, slope, and low strength are limiting features. Structures must be compatible with the landscape, or significant land modification such as shaping and smoothing is essential for best results. Capability subclass IVe.

CfC2—Cecil sandy clay loam, 6 to 10 percent slopes, eroded. This deep, well drained, gently sloping soil is on narrow ridgetops and moderately long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas range from 5 to 35 acres or more.

Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. The surface layer is a mixture of the upper part of the subsoil and remnants of the original surface layer. The subsoil is red clay and clay loam that extends to a depth of 50 inches. The substratum is weathered gneiss that extends to a depth of 66 inches or more.

Included with this soil in mapping are small areas that are severely eroded; many shallow gullies and a few deep ones form an intricate pattern. A few small areas of Pacolet soils are also included. These included soils make up about 20 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of the surface texture; it is sticky when wet and hard when dry. The root zone is deep. Runoff is somewhat faster on this soil than on Cecil soils that have a sandy loam surface layer.

This soil has medium potential for pasture and hay crops and other close growing crops. Tillage can be performed satisfactorily only within a relatively narrow range of moisture content because of the surface texture. Erosion on cultivated fields is a severe hazard if this soil is not carefully managed.

This soil has medium potential for loblolly pine and Virginia pine. The use and management are limited by a moderate erosion hazard, equipment restrictions, and seedling mortality, but these limitations can be overcome by good management.

This soil has medium to high potential for urban development. Slow permeability, slope, and low strength are limitations. These limitations can generally be overcome by good design and careful installation and management. Capability subclass IVe.

CfD2—Cecil sandy clay loam, 10 to 15 percent slopes, eroded. This deep, well drained, sloping soil is on short side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 45 acres or more.

Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. The subsoil is red clay and clay loam that extends to a depth of 48 inches. The substratum is weathered gneiss that extends to a depth of 66 inches or more.

Included with this soil in mapping are areas of Pacolet, Madison, and Gwinnett soils. Also included are areas of less eroded Cecil soils that have a sandy loam surface layer.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout the profile except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of the surface texture; the soil is sticky when wet and hard when dry. Runoff is somewhat faster on this soil than on the Cecil soils that have a sandy surface layer. The root zone is deep.

This soil has low potential for row crops because of steepness of slopes and erosion. It has medium potential for permanent pasture if management is good. Erosion is a severe hazard if this soil is not protected.

This soil has medium potential for loblolly pine and Virginia pine. Use and management are limited by the moderate erosion hazard, equipment restrictions, and seedling mortality. These limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has medium potential for most urban uses. Slow permeability, slope, and low strength are limitations. Structures must be compatible with the landscape; otherwise, significant reshaping of the soil is needed. Capability subclass VIe.

DgB—Davidson loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on broad ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 35 acres.

Typically, the surface layer is dark reddish brown loam 7 inches thick. The subsoil is dark reddish brown clay to a depth of 16 inches and dark red clay to a depth of 72 inches.

Included with this soil in mapping are small areas of a similar soil from which most of the original surface layer has been removed by erosion; the surface layer is clay loam. Also included are small areas of Hiwassee, Gwinnett, and Mecklenburg soils. These included soils make up about 30 percent of the mapping unit.

This soil is medium in natural fertility and low in content of organic matter. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is generally good, and the root zone is deep.

This soil has high potential for a wide range of crops, and it can be cultivated intensively if it is well managed. It is also well suited to most pasture plants. Good tilth is easily maintained by returning crop residue to the soil. Erosion is only a moderate hazard if cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant woodland management concerns.

This soil has medium potential for most urban uses. Low strength for road base material, moderate shrink-swell potential for dwelling and light industry foundations, and slow percolation for septic tank absorption fields are examples of limitations. These limitations can generally be overcome by good design and careful installation. Capability subclass IIe.

DhC2—Davidson clay loam, 6 to 10 percent slopes, eroded. This deep, well drained, gently sloping soil is on hillsides of the Piedmont Upland. Slopes are smooth and convex. Individual areas range from 5 to 25 acres.

Typically, the surface is dark reddish brown clay loam 6 inches thick. The subsoil is dark reddish brown and dark red clay loam and clay that extends to a depth of 70 inches.

Included with this soil in mapping are small areas of Hiwassee, Gwinnett, and Cecil soils. Also included are small areas of severely eroded soils that have common shallow gullies and a few deep gullies.

This soil is medium in natural fertility and low in organic matter content. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is generally poor because of the amount of clay in the surface layer. The root zone is deep.

This soil has medium potential for cultivated crops and pastures if it is well managed. The slopes make runoff rapid if this soil is cultivated. The erosion hazard, therefore, is severe. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine and Virginia pine. The use and management are limited by a moderate erosion hazard, but this limitation can be overcome by good management.

This soil has medium potential for most urban uses. Low strength, moderate shrink-swell potential, and slow permeability are some of the limiting features. These limitations can generally be overcome by good design and careful installation. Capability subclass IVe.

DhD2—Davidson clay loam, 10 to 15 percent slopes, eroded. This deep, well drained, sloping soil is on hillsides of the Piedmont Upland. Slopes are complex and convex. Individual areas are 10 to 25 acres.

Typically, the surface layer is dark reddish brown clay loam 5 inches thick. The subsoil is dark red clay that extends to a depth of more than 65 inches.

Included with this soil in mapping are areas of severely eroded soils in which the surface layer is clay; there are common shallow gullies and a few deep gullies. Also included are a few areas of Cecil, Madison, and Mecklenburg soils. These included soils make up as much as 20 percent of the mapping unit.

This soil is medium in natural fertility and low in organic matter content. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of the clayey surface layer, which is sticky when wet and hard when dry. The root zone is deep.

The soil is moderately well suited to most pasture plants in the area, but has low potential for row crops because of steepness of slopes and the erosion hazard. The soil can be tilled satisfactorily only within a relatively narrow range of moisture content because of the surface texture.

This soil has moderately high potential for loblolly pine and Virginia pine. Use and management are limited by the moderate erosion hazard, but this limitation can be overcome by good management.

This soil has medium to low potential for urban uses. Slow permeability, shrink-swell potential, and slope are limiting factors. Good design and careful installation can overcome most of these limitations. Capability subclass VIe.

EwE—Enon-Wilkes complex, 10 to 25 percent slopes. This complex consists of areas of Enon and Wilkes soils that are so intricately intermingled that they cannot be shown separately at the scale of mapping. It is on the sides of narrow, broken ridges adjacent to drainageways and streams. These areas range from 25 to 200 acres. Individual areas of each soil are 1/2 to 4 acres.

Enon gravelly loam makes up about 58 percent of each mapped area. Typically, the surface layer is dark grayish brown and light olive brown gravelly loam 10 inches thick. The subsoil is dark yellowish brown clay that extends to a depth of 24 inches. The substratum is partially decomposed acidic and basic rocks. It is yellow, yellowish brown, and grayish green and crushes to sandy loam, loam, and clay loam (fig. 7).

This soil is medium in natural fertility and contains a low amount of organic matter. The surface and subsurface layers are strongly acid through medium acid, and the subsoil is slightly acid; the underlying material is neutral. Permeability is slow, and available water capacity is medium to high. Tilth is poor, and the root zone is moderately deep.

Wilkes gravelly loam makes up about 32 percent of each mapped area. Typically, the surface layer is very dark grayish brown gravelly loam, and light brownish gray loam 10 inches thick. The subsoil is light olive brown clay loam and gravelly clay loam 9 inches thick. The soil is underlain by partially decomposed acidic and basic rocks at a depth of 19 inches. This layer is light olive brown and greenish material that crushes to sandy loam and that extends to a depth of 60 inches or more.

This soil is medium in natural fertility and contains a low amount of organic matter. It is strongly acid to slightly acid throughout the solum and neutral in the substratum. Permeability is moderately slow, and available water capacity is low. Tilth is poor, and the root zone is shallow.

This complex has low potential for farming because of the steepness of slopes, the gravelly surface, and the depth of the root zone.

The Enon part of this complex has low potential for loblolly pine, Virginia pine, and eastern redcedar. A severe erosion hazard and equipment restrictions and moderate seedling mortality are limiting features, but some of these can be overcome by good management.

The Wilkes part of this complex has medium potential for loblolly pine, Virginia pine, and eastern redcedar. A moderate erosion hazard and equipment restrictions are limiting features but can be overcome by good management.

This complex has very low potential for urban uses. Slow permeability, shrink-swell potential, slope, and depth to bedrock are limiting features. This complex also has low potential for generally all developed recreational uses. Capability subclass VIIe.

GeB—Grover sandy loam, 2 to 6 percent slopes. This deep, well drained, micaceous, very gently sloping soil is on moderately broad ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 25 acres or more.

Typically, the surface layer is brown sandy loam 10 inches thick. The upper part of the subsoil is reddish brown and brown sandy clay loam mottled with red, brown, and yellow, and the lower part is mottled red, light yellowish brown, and brownish yellow sandy clay loam that extends to a depth of 36 inches. The substratum is weathered bedrock with yellowish red colors; it crushes to sandy loam. The surface layer contains few fine flakes of mica; the other horizons contain many fine flakes.

Included with this soil in mapping are small areas of a similar soil that is eroded to the extent that ordinary tillage reaches into the upper part of the subsoil. Shallow gullies and galled spots are present, and there are a few deep gullies. Also included are areas of a clayey, micaceous soil. These included soils make up about 15 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. This soil has good tilth and a deep to moderately deep root zone that is easily penetrated by plant roots.

This soil has high potential for all locally grown row crops, small grain, and pasture grasses. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant limitations for woodland use or management.

This soil has medium potential for most urban uses. The shrink-swell potential, permeability, and traffic supporting capacity are limitations. Some limitations can generally be overcome by good design and careful installation. Capability subclass IIe.

GeC—Grover sandy loam, 6 to 10 percent slopes. This deep, well drained, gently sloping, micaceous soil is on moderately long hillsides of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 40 acres or more.

Typically, the surface layer is grayish brown sandy loam 6 inches thick. The upper few inches of the subsoil is yellowish brown sandy clay loam. The middle and lower parts are strong brown sandy clay loam that extends to a depth of 40 inches. The lower part contains a few yellowish red and red mottles. The substratum is highly weathered mica schist in various shades of red; it extends to a depth of more than 60 inches.

Included with this soil in mapping are areas of a similiar but eroded soil a few yards wide to several acres in size. In these areas the plow layer extends into the upper part of the subsoil, and a few small gullies and a few large gullies have formed. Also included are small areas of Louisa soils. Included soils make up about 20 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. This soil has good tilth and a deep or moderately deep root zone that is easily penetrated by plant roots.

Under good management, this soil has high potential for all of the locally grown row crops, small grains, and pasture plants. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard if cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant limitations for woodland use and management.

This soil has medium potential for urban uses. The shrink-swell potential, permeability, traffic supporting capacity, and slope are limitations. These limitations can generally be overcome by good design and careful installation. Structures can be installed if they are compatible with slope. Capability subclass IIIe.

GgB—Gwinnett sandy loam, 2 to 6 percent slopes. This moderately deep, well drained, very gently sloping soil is on moderately broad to broad ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are less than 5 to more than 25 acres.

Typically, the surface layer is dark reddish brown sandy loam about 6 inches thick. The subsoil is dark red clay that extends to a depth of 34 inches. Below this is highly weathered basic rock that extends to a depth of 60 inches.

Included with this soil in mapping are areas of similar soils that are eroded. In these areas the original surface layer has eroded away and the upper part of the subsoil is at the surface. Also included are small areas of Cecil, Hiwassee, or Madison soils. These included soils make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and this soil can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots.

This soil has high potential for producing most locally grown row crops, small grains, pasture grasses, legumes, and hay. It is one of the most productive soils of the area. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, sycamore, and yellow-poplar. There are no significant limitations for woodland use and management.

This soil has high potential for most urban uses. There are generally no significant limitations. Capability subclass IIe.

GwC2—Gwinnett sandy clay loam, 6 to 10 percent slopes, eroded. This moderately deep, well drained, gently sloping soil is on moderately long side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 50 acres.

Typically, the surface layer is dark reddish brown sandy clay loam 5 inches thick. The subsoil is dark red clay that extends to a depth of 34 inches. Below this is highly weathered very dark gray and reddish brown acidic and basic rock that extends to a depth of 60 inches.

Included with this soil in mapping are areas of soils, a few yards wide to several acres in size, in which the surface layer is only slightly eroded. Also included are similar soils that are severely eroded, and small areas of Cecil, Hiwassee, and Madison soils. These included soils make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. This soil has poor tilth because of the texture of the surface layer; it is sticky when wet and hard when dry. The root zone is deep.

This soil has medium potential for row crops, but pasture grasses, legumes, and hay are better suited. Tillage can be performed satisfactorily only within a relatively narrow range of moisture content because of the texture of the surface layer. Erosion on cultivated fields is a severe hazard if this soil is not carefully managed. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has medium potential for loblolly pine and Virginia pine. Use and management are limited by a moderate erosion hazard, equipment limitations, and seedling mortality, but these limitations can be overcome by good management.

This soil has medium to high potential for urban uses. Slope is the limiting feature. Structures can be installed if they are compatible with slope. Capability subclass IVe.

GwD2—Gwinnett sandy clay loam, 10 to 15 percent slopes, eroded. This moderately deep, well drained, sloping soil is on moderately long, narrow side slopes of the Piedmont Upland. Slopes are complex and convex. Areas vary in size from 5 to 50 acres or more.

Typically, the surface layer is dark reddish brown sandy clay loam about 5 inches thick. The subsoil is dark red clay that extends to a depth of 40 inches. Below this is highly weathered, friable, basic rock that extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Hiwassee soil. Also included are similar soils that are severely eroded. These areas make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of texture of the surface layer; the soil is sticky when wet and hard when dry. The root zone is deep.

This soil has medium potential for most pasture plants common to the area. It has low potential for row crops because of steepness of slopes and the erosion hazard. Tillage can be performed satisfactorily only within a relatively narrow range of moisture content because of the texture of the surface layer.

This soil has medium potential for loblolly pine and Virginia pine. The use and management are limited by the moderate erosion hazard, equipment limitations, and seedling mortality, but these limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has medium potential for most urban uses. Slope is the main limitation. Structures must be compatible with the landscape; otherwise, significant reshaping of the soil is needed. Capability subclass IVe.

GwE2—Gwinnett sandy clay loam, 15 to 25 percent slopes, eroded. This moderately deep, well drained, strongly sloping soil is on moderately long to long side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 50 acres in size.

Typically, the surface layer is dark reddish brown sandy clay loam 5 inches thick. The subsoil is dark red clay that extends to a depth of 32 inches. Below this to a depth of 60 inches is highly weathered acidic and basic rock that crushes to loam. Hard rock is at a depth of more than 60 inches.

Included with this soil in mapping are areas of a similar soil that has a loam surface layer. These included soils make up about 20 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of texture of the surface layer. The root zone is deep.

This soil has low potential and is poorly suited to row crops because of the steep slopes. It has medium to low potential for pasture if management is good. Erosion is a severe hazard if this soil is not protected.

This soil has medium potential for loblolly pine and Virginia pine. Erosion hazard, equipment limitations, and seedling mortality are moderate, but these limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has low potential for most urban uses. Slope is the limiting feature. The soil also has low potential for most recreational uses. Capability subclass VIe.

GwE3—Gwinnett sandy clay loam, 10 to 25 percent slopes, severely eroded. This moderately deep, well drained, sloping to moderately steep soil is on the sides of slopes of the Piedmont Upland. Erosion has significantly altered the soil by forming intermittent shallow and deep gullies. The surface layer is chiefly the upper part of the subsoil. Slopes are complex and convex. Individual areas are 5 to 50 acres.

Typically, the surface layer is dark reddish brown sandy clay loam, 6 inches thick. The subsoil is dark red clay that extends to a depth of 32 inches. Below this to a depth of 60 inches is highly weathered, basic and acidic rock.

Included with this soil in mapping are areas of a similar soil that is steeper. Also included are areas of soils that are sufficiently eroded to form an intricate pattern of shallow gullies and some deeper ones. These included soils make up as much as 30 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, but slow infiltration makes runoff on this soil rapid. Available water capacity is medium. Tilth is poor because of texture of the surface layer. The root zone is deep.

This soil has low potential and is poorly suited to row crops and pasture because of steep slope and severe erosion. Further erosion is a severe hazard if this soil is cultivated.

This soil has medium potential for loblolly pine and Virginia pine. Erosion hazard and equipment limitations are severe and seedling mortality is moderate, but these limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has low potential for most urban uses. Slope is the limiting feature. This soil has low potential for most recreational uses. Capability subclass VIIe.

HsB—Hiwassee loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops, side slopes, and high terraces of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 35 acres.

Typically, the surface layer is dark reddish brown loam about 6 inches thick. The upper part of the subsoil is dark red clay, and the lower part is red and dark red clay loam that extends to a depth of 72 inches. Below this is 2 to 5 feet of dark red, highly weathered basic and crystalline rocks.

Included with this soil in mapping are similar soils that have a thicker clayey subsoil. Also included are small areas of Cecil, Gwinnett, or Madison soils. The included soils make up about 25 percent of this mapping unit, but separate areas generally are less than 2 acres.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential for row crops and pasture. Crops respond well to good management. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, yellow-poplar, and red oak. There are no significant limitations for woodland use.

This soil generally has high potential for most urban uses, but the subsoil has slow permeability, which is a moderate limitation for septic tank absorption fields. This limitation can generally be overcome by good design and careful installation. This soil has moderate limitations for local roads and streets and sites for dwellings because of supporting capacity and shrink-swell potential. Capability subclass IIe.

HsC—Hiwassee loam, 6 to 10 percent slopes. This deep, well drained, gently sloping soil is on ridgetops, side slopes, and high terraces of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 40 acres.

Typically, the surface layer is dark reddish brown loam about 6 inches thick. The upper part of the subsoil is dark red clay, and the lower part is dark red clay loam that extends to a depth of 72 inches. Below this is 5 feet or more of reddish highly weathered basic and crystalline rocks.

Included with this soil in mapping are similar soils that have a thicker clayey subsoil and similar soils that are eroded. Also included are small areas of Cecil, Gwinnett, and Madison soils. The included soils make up about 25 percent of this mapping unit, but none are as much as 5 acres in size.

This soil is low in natural fertility and organic matter content. It is strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential for locally grown crops and pastures and responds well to good management. Tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard if the soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, slash pine, yellow-poplar, and red oak. There are no significant limitations for woodland use.

This soil generally has high potential for most urban uses, but slope and slow permeability of the subsoil are limitations. Slow permeability for septic tank absorption fields can generally be overcome by design and construction. Structures can be installed if they are compatible with slope. The soil has moderate limitations for local roads and streets and sites for dwellings because of supporting capacity and shrink-swell potential. Capability subclass IIIe.

IrB—Iredell sandy loam, 2 to 6 percent slopes. This deep, moderately well drained to somewhat poorly drained, very gently sloping soil is on broad ridgetops and side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 10 to 100 acres.

Typically, the surface layer is dark grayish brown sandy loam about 7 inches thick. The upper few inches of the subsoil is dark grayish brown clay loam, and the middle and lower parts are mainly yellowish brown clay that extends to a depth of 34 inches. Below that is sandy loam material weathered from diorite, gabbro, or other basic igneous rock.

Included with this soil in mapping are similar soils that have a thicker solum. Also included are small areas of Davidson, Mecklenburg, and Wilkes soils and small areas of a more acid soil that has gray mottles. The included soils make up about 15 percent of this mapping unit, but no included soil is generally more than 2 or 3 acres.

This soil is medium in natural fertility and low in organic matter content. It is slightly acid in the surface layer and neutral in the subsoil. Permeability is slow, and available water capacity is high. Tilth is good and the root zone is moderately deep.

This soil has high potential for row crops and pastures. Crops respond well to good management, which includes plowing during optimum moisture conditions. Good tilth is maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has medium potential for loblolly pine, eastern redcedar, and Virginia pine. Equipment limitations and seedling mortality are moderate.

This soil has very low potential for most urban uses. The subsoil has slow permeability, which is a severe limitation for septic tank absorption fields. This limitation cannot generally be overcome. Dwellings, small commercial buildings, and local roads and streets are severely affected by high shrink-swell potential. Capability subclass IIe.

IrC—Iredell sandy loam, 6 to 10 percent slopes. This deep, moderately well drained to somewhat poorly drained, gently sloping soil is on ridgetops and side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 100 acres.

Typically, the surface layer is brown sandy loam about 7 inches thick. The upper part of the subsoil is yellowish brown clay; the lower part is olive sandy clay loam that extends to a depth of 24 inches. The substratum is highly weathered olive and olive yellow igneous rock that crushes to loam. This horizon extends to a depth of 45 inches, where it is underlain by hard bedrock.

Included with this soil in mapping are similar soils that have a thinner solum and a gravelly loam surface layer. Also included are small areas of Davidson, Mecklenburg, and Wilkes soils. In addition, small areas of a more acid soil that has gray mottles and a few small areas of eroded soils are included. The included soils make up about 25 percent of this mapping unit, but separate areas are generally less than 1 1/2 to 3 acres.

This soil is medium in natural fertility and low in organic matter content. It is slightly acid in the surface layer and neutral in the subsoil. Permeability is slow, and available water capacity is high. Tilth is good, and the root zone is moderately deep.

This soil has high potential for row crops and pastures and responds well to good management but it must be plowed during optimum moisture conditions. Good tilth is maintained by returning crop residue to the soil. Erosion is a severe hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has medium potential for loblolly pine, eastern redcedar, and Virginia pine. Equipment limitations and seedling mortality are moderate.

This soil has very low potential for most urban uses. The subsoil has slow permeability, which is a severe limitation for septic tank absorption fields. Dwellings, small commercial buildings, and local roads and streets are severely affected by high shrink-swell potential. Capability subclass IIIe.

LoE—Louisa gravelly loam, 10 to 30 percent slopes. This shallow, somewhat excessively drained, sloping to steep soil is on side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 30 acres.

Typically, the surface is brown gravelly loam about 6 inches thick. The subsoil is strong brown gravelly loam to a depth of 19 inches. Below this is 3 to 6 feet of weathered mica schist.

Included with this soil in mapping are similar, steeper soils. Also included are soils that have clayey texture, and small areas of eroded soils. In addition, small areas of Ashlar, Louisburg, Madison, and Pacolet soils are included. The included soils make up about 30 percent of the mapping unit, but separate areas generally are less than 2 to 3 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderately rapid, and available water capacity is low. Tilth is poor. The root zone is shallow.

This soil has low potential for row crops and pasture. It is too steep for row crops, and only a small acreage is suitable for pasture. It is dominantly covered by a mixed stand of hardwoods.

This soil has medium potential for loblolly pine, Virginia pine, and eastern redcedar. Erosion hazard and equipment limitations are moderate, but good management can help overcome these limitations.

This soil has low potential for most urban uses. The subsoil has rapid permeability, and steepness of slope is a severe limitation for septic tank absorption fields. Slope is a moderate to severe limitation for building foundations and local roads and streets. This soil has moderate or severe limitations affecting most major recreation developments. Capability subclass VIIe.

MdB—Madison sandy loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 40 acres.

Typically, the surface layer is dark grayish brown and brown sandy loam 8 inches thick. The subsoil extends to a depth of 36 inches. The upper part is red clay loam, and the middle and lower parts are red clay and clay loam. The substratum is highly weathered micaceous soil material that extends to a depth of 60 inches or more; it crushes to sandy loam.

Included with this soil in mapping are similar soils that have a thicker solum and other similar eroded soils. Also included are Appling, Cecil, and Grover soils. The included soils make up about 20 percent of this mapping unit, but separate areas are generally less than 2 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is moderately deep to deep.

This soil has high potential for crops and pasture (fig. 8). Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant limitations for woodland use and management.

This soil has medium potential for most urban uses. Depth to bedrock is a limitation for septic tank absorption fields, but this can be generally overcome by good design and careful installation. Traffic supporting capacity is a limitation for local roads and streets. These limitations can be overcome by good design and installation. Capability subclass IIe.

MdC—Madison sandy loam, 6 to 10 percent slopes. This deep, well drained, gently sloping soil is on narrow to broad ridgetops and short side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 25 acres.

Typically, the surface layer is reddish brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red sandy clay loam. The middle and lower parts are red clay and clay loam that extend to a depth of 41 inches. The substratum is highly weathered, micaceous soil material that extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of a similar but eroded soil that has a sandy clay loam surface layer. Also included are small areas of similar soils that have a fine sandy loam surface layer and a thicker solum.

In addition, small areas of Appling, Cecil, and Grover soils are included. The included soils make up about 20 percent of the mapping unit, but separate areas are generally less than 2 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is moderately deep to deep.

This soil has high potential for crops and pasture. Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard if this soil is cultivated and not protected. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant limitations for woodland use and management.

This soil has medium potential for most urban uses. Depth to bedrock is a limitation for septic tank absorption fields, but this can generally be overcome by good design and careful installation. Traffic supporting capacity is a limitation for local roads and streets, and shrink-swell potential is another limitation for foundations of low buildings. These limitations can be overcome by good design and installation. Capability subclass IIIe.

MdD—Madison sandy loam, 10 to 15 percent slopes. This deep, well drained, sloping soil is on side slopes of the Piedmont Upland. Slopes are generally short, complex, and convex. Individual areas are 5 to 40 acres.

Typically, the surface layer is brown sandy loam 5 inches thick. The upper part of the subsoil is yellowish red sandy clay loam. The middle and lower parts are red sandy clay and sandy clay loam. These layers extend to a depth of 39 inches. This is underlain by highly weathered, micaceous soil material that extends to a depth of 67 inches or more.

Included with this soil in mapping are some soils that have a fine sandy loam surface layer and a thicker solum. Also included are small areas of eroded soils. In addition, small areas of Cecil and Louisa soils are included in this mapping unit. The included soils make up about 20 percent of this mapping unit, but separate areas are less than 5 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is moderately deep to deep.

This soil has low potential for row crops and medium potential for pasture. The potential for crops and pasture is limited because of the steepness of slope. Good tilth is maintained by returning crop residue to the soil. Erosion hazard is severe if this soil is cultivated and not protected. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant limitations for woodland use and management.

This soil has medium potential for most urban uses. The steepness of slope is a limitation for septic tank absorption fields. Traffic supporting capacity is low, which is a limitation for local roads and streets. These limitations can be overcome by good design and careful installation procedures in relation with the slope. Capability subclass IVe.

MdE—Madison sandy loam, 15 to 25 percent slopes. This deep, well drained, moderately steep soil is on the sides of short slopes adjacent to streams of the Piedmont Upland. Slopes are generally short, complex, and convex. Individual areas are 5 to 20 acres.

Typically, the surface layer is brown sandy loam 7 inches thick. The upper part of the subsoil is yellowish red sandy clay loam 6 inches thick. The middle and lower parts are red clay and sandy clay loam that extend to a depth of 36 inches. Below this is highly weathered, micaceous soil material that extends to a depth of 60 inches (fig. 9).

Included with this soil in mapping are small areas of similar soils that have a surface layer of gravelly fine sandy loam, fine sandy loam, or sandy clay loam. Also included are small areas of Ashlar, Pacolet, and Louisa soils. The included soils generally make up about 25 percent of the mapping unit, but separate areas are generally less than 4 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is moderately deep to deep.

This soil has low potential for row crops and medium potential for pasture because of steepness of slope.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. Equipment limitations and erosion hazard are moderate.

This soil has low potential for most urban uses. Steepness of slope is a limitation for septic tank absorption fields, local roads and streets, and foundations for low buildings. Slope also limits most recreational development, but this limitation can be overcome with extensive design and construction. Capability subclass VIe.

MfC2—Madison sandy clay loam, 6 to 10 percent slopes, eroded. This deep, well drained, gently sloping soil is on narrow ridgetops and short side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are about 5 to 20 acres.

Typically, the surface layer is reddish brown sandy clay loam 6 inches thick. It is a mixture of the remnants of the topsoil and the upper part of the subsoil. The upper part of the subsoil is red sandy clay and clay, and the lower part is red clay loam that extends to a depth of 36 inches. This is underlain by highly weathered, micaceous soil material that extends to a depth of 60 inches or more.

Included with this soil in mapping are similar soils that have a solum less than 20 inches or more than 38 inches thick. Also included are small areas of Cecil and Appling soils. The included soils make up about 20 percent of this mapping unit, but separate areas generally are less than 3 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor, and the root zone is moderately deep to deep.

If well managed, this soil has low potential for crops and medium potential for pasture. The potential for crops and pasture is limited because of the eroded surface. Erosion is a severe hazard if this soil is cultivated and not protected. Minimum tillage and use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has moderately high potential for loblolly pine, Virginia pine, and eastern redcedar. Susceptibility to erosion, equipment limitations, and seedling mortality are limiting features in woodland management.

This soil has medium potential for most urban uses. Depth to bedrock and slope are limitations, but they can be overcome by good design and careful installation. Capability subclass IVe.

MfD2—Madison sandy clay loam, 10 to 15 percent slopes, eroded. This deep, well drained, sloping soil is on short side slopes adjacent to streams of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 45 acres.

Typically, the surface layer is reddish brown sandy clay loam 3 inches thick. It is a mixture of remnants of the topsoil and the upper part of the subsoil. The upper part of the subsoil is red clay loam, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this is highly weathered, micaceous soil material that extends to hard rock at a depth of 77 inches.

Included with this soil in mapping are small areas of similar soils that have a thinner solum. Also included are small areas of Cecil and Louisa soils. The included soils make up about 25 percent of this mapping unit, but separate areas are generally less than 3 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor, and the root zone is moderately deep to deep.

This soil has low potential for row crops and medium potential for pasture because of steepness of slopes and the eroded surface. Erosion is a severe hazard if this soil is cultivated and not protected.

This soil has moderately high potential for loblolly pine, Virginia pine, and eastern redcedar. Erosion hazard, equipment limitations, and seedling mortality are moderate.

This soil has low potential for most urban uses. Steepness of slope is a limiting feature for septic tank absorption fields, local roads and streets, and foundations for low buildings. Steepness of slope is also a limitation for most recreational developments, but this limitation can be overcome by good design and careful installation. Capability subclass VIe.

MfE2—Madison sandy clay loam, 15 to 25 percent slopes, eroded. This deep, well drained, moderately steep soil is on short side slopes that parallel streams of the Piedmont Upland. Slopes are complex and convex. Individual areas are about 5 to 45 acres.

Typically, the surface layer is yellowish red sandy clay loam 3 inches thick. It is a mixture of remnants of the topsoil and the upper part of the subsoil. The upper part of the subsoil is red sandy clay, the middle part is red clay, and the lower part is red sandy clay loam that extends to a depth of 30 inches. Below this is highly weathered, micaceous soil material that extends to a depth of 60 inches.

Included with this soil in mapping are similar soils that have a thicker solum. Also included are a few small areas of Ashlar, Louisa, and Pacolet soils. The included soils make up about 25 percent of this mapping unit, but separate areas are generally less than 3 acres.

This soil is low in natural fertility and organic matter content. It is strongly acid to very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor, and the root zone is moderately deep to deep.

This soil has low potential for row crops and low potential for pasture because of steepness of slopes and the eroded surface. Erosion is a severe hazard if this soil is cultivated.

This soil has medium potential for loblolly pine, Virginia pine, and eastern redcedar. Erosion hazard and equipment limitations are management concerns.

This soil has low potential for most urban uses. Steepness of slope is a limitation for septic tank absorption fields, local roads and streets, and foundations for low buildings. Steepness of slope is also a limitation for most recreational developments. Capability subclass VIIe.

MkB—Mecklenburg fine sandy loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on broad ridgetops of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to more than 50 acres.

Typically, the surface layer is brown fine sandy loam 5 inches thick. The subsoil extends to a depth of 43 inches. It is yellowish red, red, and brown clay and clay loam and has mottles of brown, yellowish brown, and yellowish red mostly in the middle and lower parts. The substratum is material weathered from basic and acidic rocks.

Included with this soil in mapping are small areas of a similar soil that has a sandy clay loam or sandy loam surface layer. Also included are small areas of Iredell soils. Included soils make up about 20 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is medium acid to slightly acid throughout except for the surface layer in limed areas. Permeability is slow, and available water capacity is medium. Tilth is good, and the root zone is moderately deep to deep.

This soil has moderately high potential for local crops and pastures. Slow permeability limits this soil when the growing season is excessively wet. Good tilth can be maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has medium potential for loblolly pine, shortleaf pine, and eastern redcedar. There are no significant management concerns for woodland use and management.

This soil has low potential for most urban uses. Shrink-swell potential, slow permeability, and traffic supporting capacity are limitations; some of these limitations can be overcome by design and good construction. This soil has medium to high potential for recreational developments. Capability subclass IIe.

MnC2—Mecklenburg sandy clay loam, 6 to 10 percent slopes, eroded. This deep, well drained, gently sloping soil is on side slopes of the Piedmont Upland. Slopes are smooth and convex. Individual areas are 5 to 40 acres.

Typically, the surface layer is reddish brown sandy clay loam 5 inches thick. The upper part of the subsoil is yellowish red clay that has brownish yellow mottles. The lower part of the subsoil is yellowish red clay loam that has yellowish brown mottles and that extends to a depth of 34 inches. The substratum is material weathered from acidic and basic rocks.

Included with this soil in mapping are a few small areas of a similar soil that is severely eroded. Also included are similar soils that have a red surface layer and soils that have a thicker solum. Areas of Iredell soils are included. Included soils make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is medium acid to slightly acid throughout except for the surface layer in limed areas. Permeability is slow, and available water capacity is medium. Tilth is usually poor because of the amount of clay in the surface layer. The root zone is moderately deep to deep.

This soil has medium potential for local crops and pasture. Slow permeability and less than adequate drainage are limitations when the growing season is excessively wet. Erosion is a severe hazard if this soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This soil has medium potential for loblolly pine and shortleaf pine. Erosion hazard, equipment restrictions, and seedling mortality are moderate but can be overcome by good management.

This soil has low potential for most urban uses. Shrink-swell potential, slow permeability, and traffic supporting capacity are limitations; some of these limitations can be overcome by design and good construction. This soil has medium potential for most recreational developments. Capability subclass IVe.

MnD2—Mecklenburg sandy clay loam, 10 to 15 percent slopes, eroded. This well drained, sloping soil is on the sides of slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 20 acres.

Typically, the surface layer is reddish brown sandy clay loam 4 inches thick. The upper part of the subsoil is red clay. The lower part is red clay loam mottled with yellowish brown; it extends to a depth of 26 inches. The substratum is material weathered from acidic and basic rock that crushes to clay loam; it extends to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of a similar soil that is severely eroded. Also included are areas of Wilkes soils. Included soils make up 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is medium acid to slightly acid throughout except for the surface layer in limed areas. Permeability is slow, and available water capacity is medium. Tilth is generally poor because of the amount of clay in the surface layer. The root zone is moderately deep.

This soil has low potential and is poorly suited to row crops because of the steepness of slopes. It has medium potential for pasture if management is good. Erosion is a severe hazard if this soil is not protected.

This soil has medium potential for loblolly pine, shortleaf pine, Virginia pine, and eastern redcedar. Erosion hazard, equipment limitations, and seedling mortality are moderate, but these limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has low potential for most urban uses. Shrink-swell potential, slope, slow permeability, and traffic supporting capacity are limitations; some of these limitations can be overcome by design and good construction. This soil has medium potential for most recreational developments. Capability subclass VIe.

PfE—Pacolet sandy loam, 15 to 25 percent slopes. This deep, well drained, moderately steep soil is on side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 125 acres.

Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The upper few inches of the subsoil is sandy clay loam. The middle and lower parts of the subsoil are red clay and sandy clay loam that extends to a depth of 30 inches. The substratum to a depth of 60 inches is mottled yellowish red and reddish yellow soil material that crushes to fine sandy loam.

Included with this soil in mapping are small areas of a similar soil that is eroded and that has a sandy clay loam surface layer; soils steeper than 25 percent; and Cecil, Gwinnett, and Madison soils. Included soils make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

The potential for row crops on this soil is low because of slope, but the potential for permanent pasture is medium.

This soil has moderately high potential for loblolly pine, yellow-poplar, red oak, and white pine. Moderate equipment limitations and erosion hazard are concerns in woodland management. These limitations can be overcome by logging during drier periods and by maintaining good ground cover.

This soil has very low potential for most urban uses. Slope is the limiting feature. Generally, potential for recreational use is low. Capability subclass VIe.

PgE2—Pacolet sandy clay loam, 15 to 25 percent slopes, eroded. This deep, well drained, moderately steep soil is on side slopes of the Piedmont Upland. Slopes are complex and convex. Individual areas are 5 to 75 acres.

Typically, the surface layer is red sandy clay loam about 3 inches thick. The subsoil is red clay and clay loam that extends to a depth of 35 inches. The substratum to a depth of 60 inches is mottled yellowish red and reddish yellow soil material that crushes to fine sandy loam.

Included with this soil in mapping are areas of a similar soil that is severely eroded. Also included are small areas of Cecil, Gwinnett, and Madison soils. These included soils make up about 35 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is very strongly acid to strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is poor because of the clay content of the surface layer. The root zone is deep.

This soil has low potential and is poorly suited to row crops because of the slope. It has medium to low potential for pasture if management is good. Erosion is a severe hazard if this soil is not protected.

This soil has medium potential for loblolly pine, shortleaf pine, and yellow-poplar. Limitations are severe erosion hazard, equipment limitations, and seedling mortality. These limitations can generally be overcome by maintaining good ground cover, logging during drier seasons, and planting after good land preparation.

This soil has very low potential for most urban uses. Slope is the limiting feature. Potential for recreational use is low. Capability subclass VIIe.

PhC—Pacolet complex, 2 to 10 percent slopes. This complex consists of small areas of Pacolet soils and other, closely intermingled similar soils. Individual areas of these soils were not large enough to map separately; because of present and predicted use, it was not feasible to separate each in mapping. All areas contain Pacolet soil, but proportions of minor soils vary somewhat from one area to another. The complex occurs as very gently sloping to gently sloping soils on ridgetops and hillsides of the Piedmont Upland in areas of 5 to 25 acres. Individual areas of each soil are 1 to 4 acres.

Pacolet soils make up about 55 percent of each mapped area. Typically, the surface layer is dark grayish brown sandy loam 6 inches thick. The upper few inches of the subsoil is yellowish red sandy clay loam. The middle and lower parts of the subsoil are red clay and sandy clay loam that extend to a depth of 30 inches. The substratum is reddish yellow and yellowish red material weathered from granite.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

Cecil, Appling, and Ashlar soils, all of which are similar to Pacolet soils, make up about 45 percent of each mapped area.

This complex has high potential and is suited to all locally grown crops and pasture. Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate to severe hazard if the soil is cultivated and not protected. Minimum tillage and the use of cover crops, including grasses and legumes in the cropping system, help reduce runoff and control erosion.

This complex has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant woodland management concerns.

This complex has medium to high potential for urban uses. The slope and slow permeability of the subsoil are limitations. Structures can be installed if they are compatible with slope. Capability subclass IIIe.

To—Toccoa fine sandy loam. This well drained, level to nearly level soil is on flood plains of small branches, creeks, and rivers. Individual areas are 5 to 200 acres.

Typically, the surface layer is brown fine sandy loam 8 inches thick. The upper part of the underlying material is brown and yellowish brown fine sandy loam. The lower part is yellowish brown fine sandy loam that is mottled with strong brown and that extends to a depth of 74 inches. Thin bedding planes of sand, silt, loam, and clay loam are in the lower 60 inches.

Included with this soil in mapping are areas of soils that have sandy and fine textured profiles. Also included are small areas of a similar soil that is somewhat wetter. Included soils make up about 25 percent of the mapping unit.

This soil is moderate to low in natural fertility and low in organic matter content. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderately rapid, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential for hay, pasture, corn, and soybeans. The suitability of other crops is limited by occasional stream overflow during periods of high rainfall. Limitations can be overcome by proper control of flooding.

This soil has very high potential for loblolly pine, sweetgum, black walnut, and yellow-poplar. There are no serious management concerns.

This soil has very low potential for all urban uses because of occasional flooding. Major flood control measures are needed to overcome this limitation. This soil has medium potential for such recreational uses as picnic areas and playgrounds. Capability subclass IIw.

WhB—Wickham sandy loam, 2 to 6 percent slopes. This deep, well drained, very gently sloping soil is on stream terraces of the Piedmont. Slopes are smooth and convex. Individual areas are 5 to 85 acres.

Typically, the surface layer is brown sandy loam 7 inches thick. The upper part of the subsoil is reddish brown and yellowish red sandy clay loam and clay loam. The lower part is yellowish red and strong brown sandy clay loam that has yellowish brown and red mottles and that extends to a depth of 51 inches. A buried subsoil extends to a depth of 60 inches or more. It is mottled yellowish brown, yellowish red, and brownish yellow sandy clay loam.

Included with this soil in mapping are small areas of similar soils that are steeper; soils that have a clayey subsoil; and areas of Hiwassee and Toccoa soils. These areas are 2 to 4 acres in size and make up about 25 percent of the mapping unit.

This soil is low in natural fertility and organic matter content. It is strongly acid to medium acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Tilth is good, and the root zone is deep.

This soil has high potential for local crops and pastures. Crops respond well to good management, especially fertilization. Good tilth is easily maintained by returning crop residue to the soil. Erosion is a moderate hazard if this soil is cultivated and not protected.

This soil has moderately high potential for loblolly pine, yellow-poplar, and red oak. There are no significant management concerns for woodland use and management.

This soil has high potential for most urban uses. There are no significant limitations that generally cannot easily be overcome by good design and careful installation. Capability subclass IIe.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns when using the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best adapted to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential and needed practices in the survey area for those in the agribusiness sector—equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil Maps for Detailed Planning." When making plans for management systems for individual fields or farms, check the detailed information given in the description of each soil.

More than 212,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory of Georgia. Of this total, 71,000 acres was used for permanent pasture, 32,000 acres for row crops, 27,000 acres for close-grown crops, 8,000 acres for rotation hay and pasture, 24,000 acres for hayland, 38,000 acres for conservation use only, and 12,000 acres for temporarily idle cropland.

The potential of the soils in Elbert, Franklin, and Madison Counties is good for increased production of food. About 132,000 acres of potentially good cropland is currently used as woodland, and about 53,000 acres as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1967, an estimated 4,000 acres was urban and built-up land in the survey area; this figure has been growing gradually. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major soil problem on about 90 percent of the cropland and pasture in Elbert, Franklin, and Madison Counties. If the slope is more than 2 percent, erosion is a hazard. Madison, Cecil, and Pacolet soils, for example, have slopes of 2 to 6 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as the Madison, Cecil, Gwinnett, and Pacolet soils, and on soils with a layer in or below the subsoil that limits the depth of the root zone. Such layers include bedrock, as in Ashlar and Wilkes soils. Erosion also reduces productivity on soils that tend to be droughty, such as Ashlar and Wilkes soils. Second, soil erosion on farmland results in sedimentation. Control of erosion minimizes sedimentation and improves quality of water for municipal use, for recreation, and for fish and wildlife.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of the gently sloping Cecil, Gwinnett, Madison, and Appling soils. On these soils, cropping systems that provide substantial vegetative cover are required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residues on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer, such as the eroded Cecil, Madison, and Gwinnett soils. Cropping systems of planting directly into the previous crop residue or of no-till planting are increasing in the area. No-till systems disturb only small bands of soil, are very effective in reducing erosion on sloping land, and can be adapted to most soils in the survey area.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most practical on deep, well-drained soils that have regular slopes. Appling, Cecil, Davidson, Grover, Gwinnett, Hiwassee, Iredell, Madison, Mecklenburg, and Wickham soils are suitable for terraces. The other soils are less suitable for terracing and diversions because of irregular slopes or bedrock at a depth of less than 40 inches.

Contouring and contour stripcropping are widespread erosion control practices in the survey area. They are best adapted to soils with smooth uniform slopes, including most areas of the sloping Appling, Cecil, Davidson, Grover, Gwinnett, Hiwassee, Iredell, Madison, Mecklenburg, and Wickham soils.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is required only on a small acreage in the survey area. Some soils are naturally so wet that the production of crops common to the area is generally not possible. These are the occasionally flooded and frequently flooded Cartecay soils, which make up about 20,575 acres in the survey area.

The moderately well drained to somewhat poorly drained Iredell soils generally cannot be drained because of their tight, plastic, clayey subsoil. This soil requires a long time to dry out after wet seasons and should be plowed only under optimum moisture conditions.

The design of both surface and subsurface drainage systems varies with the crop to be grown. A combination of surface drainage and tile drainage is needed in most areas of the poorly drained and very poorly drained soils used for intensive row cropping. Drains have to be more closely spaced in soils with slow permeability than in the more permeable soils. Tile drainage usually works well with the Cartecay soils, although finding adequate outlets is sometimes a problem.

Soil fertility is low in most soils of the three counties. All soils are naturally acid in the surface layer.

Many soils on uplands are naturally very strongly acid, and require applications of ground limestone to raise the pH level sufficiently for good plant growth. Available potash levels are naturally low in most of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a sandy loam surface layer that is reddish or brownish and low in content of organic matter. Generally these soils do not form crust layers after rains, but areas that have sandy clay loam and are eroded do. The crust is hard when dry and is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residues, manure, and other organic material can help to improve soil structure and to reduce crust formation.

The Iredell soils are clayey, and tilth is a concern because the soil often stays wet until late in spring. If they are wet when plowed, they tend to be very cloddy when they dry and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area are corn, cotton, soybeans, and grain sorghum. Truck crops can be grown if economic conditions are favorable.

Wheat and oats are the common close-growing crops. Rye is sometimes grown, and fescue is grown for seed.

Special crops grown commercially in the survey area are vegetables and peaches. A small acreage throughout the area is used for watermelons. In addition, large areas can be adapted to other special crops such as apples and grapes.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. These are Cecil, Davidson, Gwinnett, Hiwassee, Madison, Mecklenburg, and Wickham soils having slopes of 6 percent or less, and they total about 87,000 acres. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation 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 5. 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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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 in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils 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 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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 few 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 landforms 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 too cold or too 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, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability unit is identified in the description of each soil map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

Woodland management and productivity

W. P. THOMPSON, forester, Soil Conservation Service, helped prepare this section.

Virgin forest originally covered most of Elbert, Franklin, and Madison Counties. Approximately 62 percent of the total land area in the three-county area is now in commercial forest.

Good stands of trees are growing on the forest lands of these counties. Loblolly, shortleaf, and Virginia pines and mixed upland hardwoods grow on the ridges and lower slopes. Yellow-poplar, sycamore, gum, maple, water oak, red oak, and white oak grow on the bottom lands.

The value of the wood products is substantial but is much below its potential. Other values include wildlife, recreation, natural beauty, and conservation of soil and water. This section has been provided to explain how soils affect tree growth and management in these counties.

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland 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 important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *important 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. Important 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.

Trees to plant are those that are suitable for commercial wood production (fig. 10) and that are suited to the soils.

Engineering

STEPHEN A. DANIELS, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 11, for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

JESSE MERCER, JR., biologist, Soil Conservation Service, helped prepare this section.

Elbert, Franklin, and Madison Counties contain soils suitable for many types of recreational activity common in this area. The population and proximity of these counties at the present time does not support a variety of private recreation developments. Activities most common in the survey area are golfing, picnicking, hunting, and fishing.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

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

Wildlife habitat

JESSE MERCER, JR., biologist, Soil Conservation Service, helped prepare this section.

Land use in Elbert, Franklin, and Madison Counties provide habitat for a variety of wildlife species. The estimated 357,000 acres of woodland supports deer, squirrel, raccoon, many nongame animals, and songbirds. Quail, rabbit, and dove are most abundant around cropland areas. The many streams and impoundments provide habitat for waterfowl and other wildlife depending on an aquatic environment. Beaver are numerous. The many acres of beaver ponds are especially attractive to woodducks. Hunting and fishing are among the most popular outdoor recreation activities.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties 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 fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties 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, beggarweed, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountain-mahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils that have a 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. 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 high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hardpan generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Georgia Department of Transportation.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-66T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57); shrinkage (D-427); volume change (ABER) (*1*).

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Appling series

The Appling series consists of deep, well drained, moderately permeable, yellowish brown soils that formed in material weathered from granite, gneiss, and coarse grained schist. These soils are on ridgetops and side slopes of the uplands. Slope ranges from 2 to 15 percent but is dominantly 2 to 10 percent.

Typical pedon of Appling sandy loam, 2 to 6 percent slopes, in Elbert County; 1 mile northeast on Old Middleton Road from intersection of Old Middleton Road and Georgia Highway 17; 120 yards south in sericea lespedeza field:

Ap—0 to 6 inches; yellowish brown (10YR 5/4) sandy loam; weak fine granular structure; very friable; many fine roots; few worm holes; strongly acid; clear wavy boundary.

B1—6 to 11 inches; yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; few fine roots; few quartz pebbles; strongly acid; gradual wavy boundary.

B21t—11 to 16 inches; yellowish brown (10YR 5/8) sandy clay; common fine distinct red mottles; moderate medium subangular blocky structure; firm; few fine roots; few thin discontinuous clay films; few fine concretions of iron; few fine flakes of mica; strongly acid; gradual wavy boundary.

B22t—16 to 22 inches; strong brown (7.5YR 5/8) clay; many fine distinct red mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; many discontinuous clay films; few fine concretions of iron; few fine flakes of mica; strongly acid; gradual wavy boundary.

B23t—22 to 40 inches; mottled brownish yellow (10YR 6/8), red (2.5YR 4/8), and strong brown (7.5YR 5/6) clay; moderate medium subangular blocky structure; firm; few fine roots; many continuous clay films on faces of peds; few fine flakes of mica; strongly acid; gradual wavy boundary.

B3—40 to 60 inches; red (2.5YR 4/8) sandy clay loam; common medium distinct yellow (10YR 7/6) mottles; weak medium subangular blocky structure; friable; few continuous clay films on faces of peds; many fine flakes of mica; few small bodies of parent material; strongly acid; gradual wavy boundary.

C—60 to 65 inches; red (2.5YR 4/6) saprolite that crushes to sandy loam; many coarse distinct light yellowish brown (10YR 6/4) mottles; massive; very friable; many flakes of fine mica; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 5 feet and is as much as 40 feet or more in some areas. In unlimed areas, reaction ranges from very strongly acid to strongly acid throughout.

The Ap horizon is pale brown (10YR 6/3), pale yellow (2.5Y 7/4), light yellowish brown (2.5Y 6/4), yellowish brown (10YR 5/4, 5/6), and grayish brown (10YR 5/2) sandy loam 5 to 9 inches thick. In eroded areas, it is light yellowish brown (10YR 6/4), yellowish brown (10YR 5/8), or brown (10YR 5/3) sandy clay loam 4 to 6 inches thick. The B1 horizon is 4 to 6 inches thick and is yellowish brown (10YR 5/4, 5/6, 5/8) or yellowish red (5YR 4/8, 5/6, 5/8). Color of the Bt horizon is yellowish red (5YR 4/6, 5/6, 5/8), reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6, 5/8), brownish yellow (10YR 6/6, 6/8), and yellowish brown (10YR 5/6, 5/8). Mottles have value of 4 to 6 and chroma of 4 to 8 and are none to common in the B21t horizon and common to many in B22t and B23t horizons. These horizons are sandy clay, clay, and clay loam, 28 to 37 inches thick. The B3 horizon ranges from red (2.5YR 4/6, 5/8, 5/6) to brownish yellow (10YR 6/6) and is mottled. This horizon contains common mottles with value of 4 to 7 and chroma of 6 to 8. It is 11 to 20 inches thick. The C horizon is weathered granite, schist, or gneiss. Texture ranges from sandy loam to sandy clay loam.

Appling soils are associated on the same landscape with mainly Cecil, Grover, Gwinnett, and Madison soils. They are less red than Cecil, Gwinnett, and Madison soils. They contain fewer flakes of mica than Grover soils and are more clayey in the subsoil.

Ashlar series

The Ashlar series consists of moderately deep, well drained to excessively drained, yellowish brown soils that formed in material weathered from granite and gneiss. Ashlar soils are on side slopes of the uplands. Slope ranges from 10 to 30 percent but is dominantly 25 to 30 percent.

Typical pedon of Ashlar complex, 10 to 30 percent slopes, in Elbert County; west from Rehobeth Baptist Church 0.6 mile; south 1.1 miles on county paved road; west 0.8 mile on woods road to small bridge; northwest (280 degrees) for 420 yards; 50 yards north in hardwood stand adjacent to drainageway:

01—2 inches to 0; partially decomposed hardwood and pine leaves, needles, and twigs.

A1—0 to 3 inches; brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; many fine and medium roots; 5 percent angular pebbles and stones; few flakes of mica; very strongly acid; clear smooth boundary.

A2—3 to 8 inches; light yellowish brown (10YR 6/4) sandy loam; weak medium granular structure; very friable; many fine and medium roots; 5 percent angular pebbles and stones; few flakes of mica; very strongly acid; gradual wavy boundary.

B2—8 to 20 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few fine and medium roots; 10 percent angular pebbles and stones; few flakes of mica; very strongly acid; gradual wavy boundary.

C—20 to 29 inches; yellowish brown (10YR 5/8) sandy loam; common medium faint light yellowish brown (10YR 6/4) mottles and streaks; massive; firm in place; very friable when dug out; common hard pebbles and cobbles; common flakes of mica; very strongly acid; abrupt broken boundary.

R—29 inches; hard granite bedrock high in content of mica.

The solum ranges from 14 to 22 inches in thickness. Depth to bedrock ranges from 22 to 40 inches. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout.

The A1 horizon ranges from very dark grayish brown (10YR 3/2) to brown (10YR 4/3) sandy loam and fine sandy loam 3 to 10 inches thick. The A2 horizon ranges from light yellowish brown (10YR 6/4) to grayish brown (10YR 5/2). It is sandy loam or fine sandy loam 4 to 6 inches thick. The B horizon is strong brown (7.5YR 5/6) to yellowish brown (10YR 5/4, 5/6, 5/8) sandy loam to coarse sandy loam 8 to 12 inches thick. The C horizon is highly weathered granite 8 to 15 inches thick. Few to common flakes of mica are in the solum and the C horizon.

Ashlar soils are associated on the same landscape with Cecil, Grover, Louisa, Madison, and Pacolet soils. They do not have an argillic horizon, which Cecil, Grover, Madison, and Pacolet soils have. They are less micaceous and shallower to hard rock than Louisa soils.

Cartecay series

The Cartecay series consists of somewhat poorly drained, rapidly permeable, loamy soils that formed in alluvial sediment on flood plains along small branches, creeks, and rivers. Slope ranges from 0 to 2 percent.

Typical pedon of Cartecay soils in Elbert County; south 1.4 miles from Whites Academy on county paved road; 2.4 miles west on county dirt road; northwest 1,320 yards on abandoned woods road; 30 yards south in wooded stream bottom:

A1—0 to 7 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; very friable; common fine and medium roots; common fine flakes of mica; medium acid; abrupt smooth boundary.

C1—7 to 22 inches; mottled light brownish gray (10YR 6/2), reddish yellow (7.5YR 6/6), and yellowish red (5YR 5/6) loamy sand and sandy loam; single grained; very friable; few fine roots; common fine flakes of mica; medium acid; clear smooth boundary.

C2—22 to 27 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/8), and reddish yellow (7.5YR 6/8) fine sandy loam; massive; very friable; few fine roots; common fine flakes of mica; slightly acid; clear smooth boundary.

C3—27 to 38 inches; strong brown (7.5YR 5/8) loamy sand; common coarse distinct light brownish gray (10YR 6/2) mottles; single grained; loose; few fine roots; common fine flakes of mica; strongly acid; clear smooth boundary.

C4—38 to 48 inches; mottled light yellowish brown (2.5YR 6/4) and light brownish gray (10YR 6/2) sandy loam; massive; very friable; few fine roots; common fine flakes of mica; medium acid; gradual smooth boundary.

C5g—48 to 62 inches; grayish brown (10YR 5/2) sandy loam; massive; very friable; few fine roots; common fine flakes of mica; partially decomposed bark, leaves, and twigs; slightly acid; gradual smooth boundary.

C6g—62 to 70 inches; grayish brown (10YR 5/2) sandy loam; common streaks of light brownish gray (10YR 6/2); massive; very friable; few fine roots; common fine flakes of mica; partially decomposed bark, leaves, and twigs; slightly acid.

Depth to bedrock is greater than 5 feet. In unlimed areas reaction ranges from strongly acid to slightly acid throughout.

The A1 or Ap horizon ranges from reddish brown (5YR 4/4), yellowish brown (10YR 5/4), and brown (10YR 5/3; 7.5YR 5/4) to grayish brown (2.5Y 5/2). Texture ranges from sandy loam to loam. The upper part of the C horizon has colors of yellowish red (5YR 4/6, 4/8), reddish brown (5YR 4/4), brown (10YR 5/3), pale brown (10YR 6/3), yellowish brown (10YR 5/8), and light yellowish brown (10YR 6/4) with mottles of chroma of 2 or less within 20 inches of the surface. The texture of the upper part of the C horizon is loamy sand, fine sandy loam, and loam. Strata of silt loam and sandy loam are in horizons between depths of 10 to 40 inches. The lower part of the C horizon is mottled grayish brown (2.5YR 5/2; 10YR 5/2), dark grayish brown (10YR 4/2), gray (N 5/0; 5Y 5/1; 10YR 6/1, 5/1), strong brown (7.5YR 5/8), and light brownish gray (10YR 6/2) sandy loam, loamy sand, and sand. There are few to many flakes of mica throughout the profile.

Cartecay soils are associated on the same landscape with Toccoa soils. They are not so well drained as Toccoa soils, which do not have gray mottles in the upper 20 inches of the profile.

Cecil series

The Cecil series consists of deep, well drained, moderately permeable, red soils that formed in residuum weathered from granite, gneiss, and schist. Cecil soils are on ridgetops and side slopes. Slope ranges from 2 to 15 percent but is dominantly 2 to 10 percent.

Typical pedon of Cecil sandy loam, 6 to 10 percent slopes, in Franklin County; south 0.7 mile on Georgia Highway 106 from intersection of Georgia Highway 59 and Georgia Highway 106; east 0.9 mile on county paved road; 25 feet west of road in edge of fescue pasture:

Ap—0 to 7 inches; reddish brown (5YR 4/4) sandy loam; moderate medium granular structure; friable; many fine roots; few pebbles; medium acid; abrupt smooth boundary.

B1—7 to 11 inches; red (2.5YR 4/6) sandy clay loam; moderate fine and medium subangular blocky structure; firm; common fine roots; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

B21t—11 to 24 inches; red (2.5YR 4/6) clay; moderate medium and coarse subangular blocky structure; firm; common fine roots; continuous clay films on faces of peds; common fine flakes of mica; strongly acid; gradual wavy boundary.

B22t—24 to 40 inches; red (2.5YR 4/6) clay loam; few fine distinct strong brown mottles; moderate medium subangular blocky structure; friable; few fine roots; patchy clay films on faces of peds; common fine flakes of mica; very strongly acid; gradual wavy boundary.

B3—40 to 58 inches; red (2.5YR 4/6) clay loam; weak medium subangular blocky structure; friable; many fine flakes of mica; very strongly acid; gradual wavy boundary.

C—58 to 66 inches; red (2.5YR 4/6) clay loam; common coarse faint red (2.5YR 5/6) and common medium distinct strong brown (7.5YR 5/6) mottles; massive (rock structure); friable; many fine flakes of mica; very strongly acid.

The solum ranges from 40 to 60 inches or more. Depth to bedrock is greater than 5 feet. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout.

The A or Ap horizon is yellowish red (5YR 5/6, 5/8), reddish brown (5YR 4/3, 4/4), brown (7.5YR 4/2, 5/4; 10YR 4/3, 5/3), and dark grayish brown (10YR 4/2) sandy loam 6 to 13 inches thick. In eroded areas the surface layer is red (2.5YR 4/6, 5/6) to reddish brown (2.5YR 4/4; 5YR 4/4, 5/4) sandy clay loam 3 to 5 inches thick. The B1 horizon is red (2.5YR 4/6, 4/8, 5/8) to yellowish red (5YR 4/6, 5/6) sandy clay loam or clay loam 4 to 8 inches thick. The Bt horizon is red (10YR 4/6, 4/8; 2.5YR 4/6, 4/8, 5/6) sandy clay, clay, or clay loam 25 to 31 inches thick. The B3 horizon is red (2.5YR 4/6, 4/8, 5/8) sandy clay loam or clay loam 10 to 20 inches thick. This horizon contains brownish mottles with value of 4, 5, or 6 and chroma of 4 or 8. The C horizon is weathered gneiss, granite, or schist. Texture ranges from sandy loam to clay loam.

Cecil soils are associated on the same landscape with Appling, Grover, Gwinnett, and Madison soils. They have a redder Bt horizon than Appling soils. They contain fewer flakes of mica than Grover and Madison soils and are less red and have a thicker solum than Gwinnett soils.

Davidson series

The Davidson series consists of deep, well drained, moderately permeable, dark reddish soils that formed in material weathered from diorite and similar rocks. Davidson soils are on ridgetops and side slopes. Slope ranges from 2 to 15 percent but is dominantly 2 to 10 percent.

Typical pedon of Davidson loam, 2 to 6 percent slopes, in Elbert County; 4.8 miles north of the Elbert and Lincoln County line on Georgia Highway 79; 50 feet north of road in pasture:

Ap—0 to 7 inches; dark reddish brown (2.5YR 3/4) loam; moderate fine granular structure; friable; many fine roots; few black concretions; slightly acid; clear smooth boundary.

B21t—7 to 16 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine subangular blocky structure; firm; common fine roots; few black concretions; continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—16 to 57 inches; dark red (10R 3/6) clay; moderate fine subangular blocky structure; firm; few black concretions; continuous clay films on faces of peds; few pebbles; medium acid; gradual smooth boundary.

B23t—57 to 72 inches; dark red (2.5YR 3/6) clay; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few black concretions; continuous clay films on faces of peds; 2 percent pebbles; common flakes of mica; strongly acid.

Solum thickness is 60 to 72 inches or more. Depth to bedrock is 5 to 10 feet or more. In unlimed areas reaction ranges from strongly acid to medium acid throughout.

The A or Ap horizon is dark reddish brown (5YR 3/3, 3/4; 2.5YR 2/4, 3/4) and dusky red (10R 3/4) loam or clay loam 5 to 8 inches thick. The upper part of the Bt horizon is dark reddish brown (2.5YR 3/4), dark red (2.5YR 3/6; 10R 3/6), and dusky red (10R 3/2, 3/4). In places the lower part of the Bt horizon contains mottles with value of 5 and chroma of 6. The Bt horizon is 43 to 70 inches thick. If present, the B3 horizon is red (2.5YR 4/6; 10R 4/6) or dark red (2.5Y 3/6) and is 18 to 24 inches thick. In places this horizon contains common mottles with value of 5 or 6 and chroma of 6. The C horizon is weathered, brownish basic rock between depths of 60 and 86 inches or more. The texture is clay loam or loam.

Davidson soils are associated on the same landscape with Cecil, Gwinnett, Hiwassee, Iredell, Madison, Mecklenburg, and Wilkes soils. They have a darker red subsoil than Cecil and Madison soils and have less weatherable minerals than Hiwassee soils. Gwinnett soils have a thinner solum. Iredell soils have more than 35 percent base saturation, a yellowish subsoil, montmorillonitic clays, and poorer drainage. Mecklenburg soils have higher color values throughout and more than 35 percent base saturation. Wilkes soils have a thin solum and higher color values throughout.

Enon series

The Enon series consists of well drained, slowly permeable, yellowish soils that formed in material weathered from diorite, gabbro, quartz, and related acidic and basic rocks. Enon soils are on side slopes. Slope ranges from 10 to 25 percent but is dominantly 15 to 25 percent.

Typical pedon of Enon gravelly loam, in an area of Enon-Wilkes complex, 10 to 25 percent slopes, in Elbert County; south 7.5 miles on Bobby Brown State Park road from junction of Bobby Brown State Park road and Georgia Highway 72; 100 feet east of road in stand of hardwoods and pines:

01—1 inch to 0; partially decomposed hardwood leaves and twigs.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam; weak medium granular structure; friable; few stones; 35 percent quartz pebbles; many fine and medium roots; strongly acid; clear smooth boundary.

A2—6 to 10 inches; light olive brown (2.5Y 5/4) gravelly loam; moderate medium granular structure; friable; few stones; 25 percent quartz pebbles; common fine and medium roots; strongly acid; gradual wavy boundary.

B21t—10 to 17 inches; dark yellowish brown (10YR 4/4) clay; moderate coarse angular blocky structure; very firm; common fine black concretions; few fine roots; continuous clay films on faces of peds; slightly acid; gradual wavy boundary.

B22t—17 to 24 inches; dark yellowish brown (10YR 4/4) clay; moderate medium angular blocky structure; very firm; common highly weathered grayish green (5G 5/2) rock fragments; few fine roots; discontinuous clay films on faces of peds; slightly acid; clear wavy boundary.

C1—24 to 30 inches; mottled yellowish brown (10YR 5/6) and yellow (10YR 7/6) loam and clay loam and grayish green (5G 5/2) rock fragments; rock structure; few fine roots; neutral; abrupt wavy boundary.

C2—30 to 60 inches; weathered greenish gabbro and diorite rock; rock structure; crushes to sandy loam; neutral.

The solum ranges from 20 to 35 inches in thickness. Depth to bedrock is more than 5 feet. In unlimed areas reaction ranges from strongly acid to medium acid in the solum and is neutral in the C horizon.

The A horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), dark brown (10YR 3/3), brown (10YR 5/3), and yellowish brown (10YR 5/4) gravelly loam and loam 5 to 12 inches thick. Color of the Bt horizon is dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4, 5/6), or strong brown (7.5YR 5/6). This horizon is clay or clay loam 14 to 18 inches thick. The C horizon is various shades of brown, green, gray, yellow, and black weathered saprolite that crushes to sandy loam, loam, or clay loam. Continuous hard rock is below a depth of 60 inches.

Enon soils are associated on the same landscape with mainly Davidson, Iredell, Mecklenburg, and Wilkes soils. They are yellower throughout than Davidson soils. Their solum is thicker than that of the Wilkes soils. Iredell soils have montmorillonitic mineralogy, and Mecklenburg soils have a redder subsoil.

Grover series

The Grover series consists of deep, well drained, moderately permeable, brownish, micaceous soils that formed in material weathered from mica schist and gneiss. Grover soils are on ridgetops and hillsides. Slope ranges from 2 to 10 percent.

Typical pedon of Grover sandy loam, 2 to 6 percent slopes, in Madison County; south 2.5 miles of Danielsville on U.S. Highway 29; east 1.5 miles on dirt road; northeast 1 mile on another dirt road; 100 feet west of house in edge of cultivated field:

Ap—0 to 10 inches; brown (10YR 5/3) sandy loam; few streaks of yellowish brown (10YR 5/6); weak fine granular structure; very friable; brownish streaks produced by deep plowing; few fine roots; few pebbles; few fine flakes of mica; medium acid; abrupt wavy boundary.

B21t—10 to 20 inches; reddish brown (5YR 5/4) sandy clay loam; common medium faint brown (7.5YR 5/4) and common medium distinct red (2.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few pebbles; continuous clay films on faces of peds; many fine flakes of mica; very strongly acid; gradual wavy boundary.

B22t—20 to 27 inches; brown (7.5YR 5/4) sandy clay loam; many medium distinct red (2.5YR 5/8) and many coarse distinct yellow (10YR 7/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; patchy clay films on faces of peds; many fine flakes of mica; very strongly acid; gradual wavy boundary.

B3—27 to 36 inches; mottled red (2.5YR 5/6), light yellowish brown (2.5Y 6/4), and brownish yellow (10YR 6/6) sandy clay loam; weak medium subangular blocky structure; friable; patchy clay films on faces of peds; many fine flakes of mica; very strongly acid; gradual wavy boundary.

C—36 to 60 inches; yellowish red (5YR 5/6) sandy loam; massive; very friable; material exhibits faint structure of parent rock; many fine flakes of mica; very strongly acid.

The solum ranges from 35 to 48 inches in thickness. Depth to hard rock is more than 48 inches. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout.

In areas not cultivated, the A1 horizon is brown (10YR 5/3) or grayish brown (10YR 5/2) and is about 3 to 4 inches thick. In cultivated areas, the Ap horizon is grayish brown (10YR 5/2), brown (10YR 5/3), or light yellowish brown (10YR 6/4) and is 5 to 10 inches thick. The A2 horizon, when present, is light yellowish brown (10YR 6/4) or pale brown (10YR 6/3) coarse sandy loam or sandy loam 3 to 4 inches thick. There are few to common flakes of mica. The B1 horizon, where present, is yellowish brown (10YR 5/4) or strong brown (7.5YR 5/6) sandy loam or sandy clay loam 3 to 4 inches thick. The B2t horizon is reddish brown (5YR 5/4), yellowish red (5YR 5/8), brown (7.5YR 5/4), strong brown (7.5YR 5/6, 5/8), and yellowish brown (10YR 5/4) sandy clay loam or clay loam 14 to 25 inches thick. These horizons have mottles with value of 5 to 6 and chroma of 4 to 8. The B3 horizon is similar in color and texture to the Bt horizon. There are common to many flakes of mica. The C horizon is mostly highly weathered mica schist, mica gneiss, or granite high in content of flakes of mica. Colors range from light red (2.5YR 6/6, 6/8) through reddish yellow (7.5YR 6/6). This material crushes to sandy loam or loam. There are common to many flakes of mica.

Grover soils are associated on the same landscape with Appling, Madison, and Cecil soils. They resemble the Appling soils in color but have less clay in the subsoil and contain much more mica throughout. Grover soils are not so red and clayey in the subsoil as Madison and Cecil soils, though Grover soils formed from comparable parent material and are similar to Madison soils in content of mica.

Gwinnett series

The Gwinnett series consists of moderately deep, well drained, moderately permeable, dark red soils that formed in material weathered from acidic and basic rocks. Gwinnett soils are on ridgetops and side slopes. Slope ranges from 2 to 25 percent but is dominantly 2 to 10 percent.

Typical pedon of Gwinnett sandy clay loam, 6 to 10 percent slopes, eroded, in Franklin County; north 2.5 miles on county paved road from Poplar Springs Camp Ground; west 0.7 mile along county dirt road; east in road cut:

Ap—0 to 5 inches; dark reddish brown (2.5YR 3/4) sandy clay loam; weak medium granular structure; friable; many fine and few medium roots; few pebbles; few fine flakes of mica; strongly acid; abrupt smooth boundary.

B21t—5 to 25 inches; dark red (2.5YR 3/6) clay; moderate medium subangular blocky structure; firm; few medium roots; few fine flakes of mica; continuous clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—25 to 34 inches; dark red (2.5YR 3/6) clay; moderate medium angular blocky structure; firm; few fine flakes of mica; continuous clay films on faces of peds; medium acid; gradual wavy boundary.

Cr—34 to 60 inches; very dark gray (5YR 3/1) and reddish brown (2.5YR 4/4) soft saprolite that crushes to loam; common fine flakes of mica.

The solum ranges from 25 to 40 inches in thickness. Depth to rippable bedrock is 20 to 40 inches, and depth to hard rock is 5 feet or more. In unlimed areas reaction ranges from very strongly acid to medium acid throughout.

In slightly eroded areas the Ap horizon is dark reddish brown (2.5YR 3/4) or dark red (2.5YR 3/6) sandy loam 6 to 7 inches thick. In eroded areas, the surface layer is dark reddish brown (2.5YR 3/4) or dark red (2.5YR 3/6) sandy clay loam 3 to 6 inches thick. The Bt horizon is dark reddish brown (2.5YR 3/4) and dark red (2.5YR 3/6; 10R 3/6) sandy clay and clay. This horizon is 25 to 35 inches thick. The Cr horizon (saprolite) is various shades of red, brown, and gray, weathered acidic and basic rock that crushes to loam or clay loam. It extends from a depth of 29 to a depth of more than 70 inches.

Gwinnett soils are associated on the same landscape with Cecil, Davidson, Hiwassee, and Madison soils. They have a redder surface layer and a darker red subsoil than Cecil and Madison soils. The solum in Hiwassee and Davidson soils is more than 40 inches thick.

Hiwassee series

The Hiwassee series consists of deep, well drained, moderately permeable, dark red soils that formed in clayey material weathered from basic or mixed acidic and basic crystalline rocks. Hiwassee soils are on ridgetops, side slopes, and high terraces. Slope ranges from 2 to 10 percent but is dominantly 6 to 10 percent.

Typical pedon of Hiwassee loam, 6 to 10 percent slopes, in Franklin County; 0.9 mile southwest of Little Creek bridge on Georgia Highway 326; north 0.4 mile on county dirt road; 50 feet east in lespedeza field:

Ap—0 to 6 inches; dark reddish brown (2.5YR 3/4) loam; weak medium granular structure; very friable; common fine and medium roots; few basic and quartz pebbles; medium acid; clear smooth boundary.

B21t—6 to 25 inches; dark red (2.5YR 3/6) clay; few black (N 2/0) concretions; moderate medium subangular blocky structure; firm; few fine roots; few quartz pebbles; thin continuous clay films on faces of peds; few fine flakes of mica; strongly acid; gradual wavy boundary.

B22t—25 to 51 inches; dark red (2.5YR 3/6) clay loam; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; common fine flakes of mica; very strongly acid; gradual wavy boundary.

B3—51 to 72 inches; red (2.5YR 4/6) clay loam; weak medium subangular blocky structure; very friable; common highly weathered basic rock fragments with many fine flakes of mica; strongly acid.

The solum ranges from 48 to 72 inches in thickness. Depth to hard rock is more than 5 feet. In unlimed areas, reaction ranges from very strongly acid to strongly acid throughout the solum and the C horizon.

The Ap horizon is dusky red (2.5YR 3/2) and dark reddish brown (2.5YR 3/4) 6 to 7 inches thick. The B horizon is dark red (10R 3/6; 2.5YR 3/6) clay or clay loam 42 to 66 inches thick. The C horizon is dark red (2.5YR 3/6; 10R 3/6) and red (2.5YR 4/6, 4/8), highly weathered basic rock that crushes to sandy loam or loam. This horizon extends from a depth of 50 inches to a depth of 62 inches or more.

Hiwassee soils are associated on the same landscape with mainly Cecil, Davidson, Gwinnett, Madison, and Wickham soils. Hiwassee soils predominantly have a dark red subsoil; Cecil, Madison, and Wickham soils are not so red. Weatherable minerals make up more than 10 percent of Hiwassee soils but less than 10 percent of Davidson soils. Gwinnett soils have a solum less than 40 inches thick.

Iredell series

The Iredell series consists of deep, moderately well drained to somewhat poorly drained, slowly permeable, yellowish brown soils that formed in material weathered from diorite, gabbro, and other basic igneous rocks. Iredell soils are on broad ridgetops and side slopes. Slope ranges from 2 to 10 percent but is dominantly 2 to 6 percent.

Typical pedon of Iredell sandy loam, 2 to 6 percent slopes, in Elbert County; 1 mile south of Elberton to junction of Georgia Highways 17 and 72; southeast 2.3 miles on Georgia Highway 17 to improved county road; 0.9 mile on dirt road to pasture:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine granular structure; very friable; few fine and medium roots; common pebbles; few black concretions; slightly acid; abrupt smooth boundary.

B1—7 to 12 inches; dark grayish brown (10YR 4/2) clay loam; moderate medium subangular blocky structure; friable; few medium roots; few clay films on faces of peds; few quartz pebbles; few black concretions; neutral; clear smooth boundary.

B21t—12 to 18 inches; yellowish brown (10YR 5/6) clay; common medium distinct yellowish red (5YR 5/6) mottles; moderate medium angular blocky structure; firm, plastic; continuous clay films on faces of peds; few black concretions; neutral; clear smooth boundary.

B22t—18 to 28 inches; yellowish brown (10YR 5/4) clay; moderate medium blocky structure; very firm, plastic; continuous clay films on faces of peds; neutral; clear smooth boundary.

B3—28 to 34 inches; olive (5Y 4/3) clay loam; common medium distinct mottles of light olive brown (2.5Y 5/6) and light gray (2.5Y 7/2); moderate medium blocky structure; very firm; neutral; clear smooth boundary.

C—34 to 60 inches; soft greenish, gray, and black saprolite that crushes to sandy loam; rock structure; mildly alkaline.

The solum ranges from 20 to 34 inches in thickness. Depth to hard rock is 3 1/2 to 6 feet. In unlimed areas reaction ranges from slightly acid in the surface layer to neutral in the subsoil.

The Ap horizon is dark grayish brown (10YR 4/2; 2.5Y 4/2), dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), brown (10YR 4/3), and olive brown (2.5Y 4/4) 5 to 9 inches thick. The B1 horizon, where present, is yellowish brown (10YR 5/6), brown (10YR 4/3), dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and olive brown (2.5Y 4/4). This horizon is sandy clay loam or clay loam 3 to 7 inches thick. The Bt horizon is yellowish brown (10YR 5/6, 5/4) and olive brown (2.5Y 4/4) and is 12 to 21 inches thick. The B3 horizon is similar to the Bt horizon in color, and it is also olive (5Y 5/4). It is loam, sandy clay loam, or clay loam 6 to 8 inches thick. The C horizon is greenish gray saprolite weathered from basic igneous rocks; it is 14 to more than 30 inches thick.

Iredell soils are associated on the same landscape with Davidson, Mecklenburg, and Wilkes soils. Iredell soils are not so red in the Bt horizon as Mecklenburg and Davidson soils. Iredell soils have a thicker solum than Wilkes soils, and they do not have mixed mineralogy.

The Iredell soils in this survey area have a transitional horizon (B1) and are mottled in the B horizon; otherwise, they are similar to Iredell soils in morphology, use, and behavior.

Louisa series

The Louisa series consists of shallow, somewhat excessively drained, moderately rapidly permeable, brownish soils that formed in material weathered from mica schist or mica gneiss. Louisa soils are sloping to steep on side slopes. Slope ranges from 10 to 30 percent.

Typical pedon of Louisa gravelly loam, 10 to 30 percent slopes, in Madison County; 1.8 miles west on Georgia Highway 98 from intersection of Georgia Highway 09 and U.S. Highway 29; south 1.2 miles on county dirt road; 50 feet north of road in stand of hardwoods:

02—1 inch to 0; partially decomposed hardwood leaves and twigs.

A1—0 to 6 inches; brown (7.5YR 4/4) gravelly loam; weak fine granular structure; very friable; common fine and medium roots; 25 percent coarse fragments of mica schist; common fine flakes of mica; medium acid; clear wavy boundary.

B2—6 to 19 inches; strong brown (7.5YR 5/6) gravelly loam; moderate medium granular structure; friable; few fine and medium roots; 30 percent coarse fragments of mica schist; many fine flakes of mica; strongly acid; gradual wavy boundary.

Cr—19 to 60 inches; tilted layers of mica schist with fine sandy loam material between them and strong brown (7.5YR 5/6) gravelly loam; very friable; few medium roots; 40 percent coarse fragments of mica schist; many fine flakes of mica.

The solum ranges from 16 to 20 inches in thickness. Depth to rippable bedrock is 16 to 20 inches, and depth to hard bedrock ranges from 5 to 10 feet or more. In unlimed areas reaction ranges from strongly acid to medium acid throughout the solum and C horizon.

The A horizon is brown (7.5YR 4/4) and dark grayish brown (10YR 4/2) gravelly loam 5 to 6 inches thick. The B horizon is strong brown (7.5YR 5/6) and brown (7.5YR 4/4; 10YR 4/3) gravelly loam and gravelly sandy loam 11 to 13 inches thick. In about 40 percent of the pedons there is an argillic horizon 3 to 10 inches thick; it is red (2.5YR 4/6), yellowish red (7.5YR 4/6, 5/8), or strong brown (7.5YR 5/6, 5/8) sandy clay loam or clay loam and is commonly gravelly. The Cr horizon is highly weathered mica schist or mica gneiss. This horizon extends to a depth of 60 inches and in places to more than 120 inches.

Louisa soils are associated on the same landscape mainly with Ashlar, Louisburg, Madison, and Pacolet soils. They are more micaceous throughout than Ashlar or Louisburg soils. Madison and Pacolet soils have a thicker solum and a continuous argillic horizon.

Madison series

The Madison series consists of deep, well drained, moderately permeable, reddish micaceous soils that formed in material weathered from mica schist, mica gneiss, or other micaceous metamorphic rocks. The Madison soils are on fairly smooth ridgetops and irregular side slopes. Slope ranges from 2 to 25 percent but is dominantly 6 to 15 percent.

Typical pedon of Madison sandy loam, 6 to 10 percent slopes, in Madison County; 2.6 miles west of Colbert on Georgia Highway 72; north 2.6 miles on dirt road; 200 yards west of road in large cultivated field:

Ap—0 to 6 inches; reddish brown (5YR 5/4) sandy loam; weak fine granular structure; very friable; many fine flakes of mica; many fine roots; strongly acid; abrupt smooth boundary.

B1—6 to 9 inches; yellowish red (5YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; many fine and medium flakes of mica; thin discontinuous clay films on faces of peds; few fine and medium roots; strongly acid; abrupt smooth boundary.

B2t—9 to 29 inches; red (2.5YR 4/6) clay; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; many medium and large flakes of mica; few medium roots; strongly acid; clear smooth boundary.

B3—29 to 41 inches; red (2.5YR 4/6) clay loam; weak medium subangular blocky structure; friable; many medium and few large flakes of mica; strongly acid; clear smooth boundary.

C—41 to 60 inches; red (2.5YR 5/6) highly weathered micaceous soil material; strongly acid.

The solum ranges from 30 to 42 inches in thickness. Depth to bedrock is greater than 5 feet. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout the solum and C horizon.

The A or Ap horizon is dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), brown (10YR 5/3; 7.5YR 4/4, 5/4), strong brown (7.5YR 5/6), yellowish red (5YR 4/6, 5/6), or reddish brown (5YR 4/4, 5/4) sandy loam or sandy clay loam 2 to 10 inches thick. There are few to many flakes of mica. The B1 horizon, if present, is yellowish red (5YR 4/6, 5/6, 5/8) or red (2.5YR 4/6, 5/8). This horizon is sandy clay loam or clay loam 3 to 7 inches thick. The B2t horizon is red (2.5YR 4/6, 4/8) clay or clay loam 8 to 20 inches thick. The B3 horizon is yellowish red (5YR 4/6, 4/8, 5/6), light red (2.5YR 6/6), and red (2.5YR 4/6, 4/8, 5/8) sandy clay loam or clay loam 6 to 12 inches thick. There are common to many flakes of mica. The C horizon is various shades of red and is occasionally mottled with pink and brown. It is dominantly highly weathered mica schist, quartz mica schist, and mica gneiss 3 to more than 6 feet thick. There are common to many flakes of mica.

Madison soils are associated on the same landscape mainly with Appling, Cecil, Grover, and Louisa soils. They have a redder subsoil than Appling, Grover, and Louisa soils and contain more mica than Appling soils. Madison soils have a continuous argillic horizon, which is lacking in Louisa soils.

Mecklenburg series

The Mecklenburg series consists of deep, well drained, slowly permeable, reddish soils that formed in material weathered from acidic and basic crystalline rocks. Mecklenburg soils are very gently sloping on broad ridgetops to sloping on side slopes of the uplands. Slope ranges from 2 to 15 percent but is dominantly 2 to 10 percent.

Typical pedon of Mecklenburg fine sandy loam, 2 to 6 percent slopes, in Elbert County; 11 miles southeast of Elberton on Georgia Highway 72 to junction with Georgia Highway 79; south 6 miles on Georgia Highway 79 to county dirt road; 4 miles west on county dirt road; 150 yards west of road in fescue pasture:

Ap—0 to 5 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; friable; many fine roots; common black concretions; slightly acid; clear smooth boundary.

B21t—5 to 15 inches; yellowish red (5YR 4/8) clay; moderate medium subangular blocky structure; firm; few fine and medium roots; plastic and sticky when wet; continuous clay films on faces of peds; common black concretions; slightly acid; gradual wavy boundary.

B22t—15 to 22 inches; red (2.5YR 4/6) clay; moderate medium angular blocky and subangular blocky structure; very firm; continuous clay films on faces of peds; few medium roots; plastic and sticky when wet; common black concretions; slightly acid; gradual wavy boundary.

B23t—22 to 37 inches; yellowish red (5YR 4/8) clay; common medium prominent mottles of yellowish brown (10YR 5/4) increasing in number with depth; moderate medium angular blocky and subangular blocky structure; firm; few black concretions; plastic and sticky when wet; continuous clay films on faces of peds; slightly acid; gradual wavy boundary.

B3—37 to 43 inches; strong brown (7.5YR 5/8) clay loam; common medium distinct mottles of yellowish red (5YR 4/6); weak medium subangular blocky structure; firm, plastic when wet; slightly acid; gradual wavy boundary.

C—43 to 60 inches; mottled brown, red, and gray weathered basic and acidic rock; massive; friable; medium acid.

The solum ranges from 27 to 40 inches in thickness. Depth to bedrock is greater than 4 feet. In unlimed areas reaction is medium acid to slightly acid throughout.

The Ap horizon is reddish brown (5YR 4/4) or brown (7.5YR 5/4, 4/4) fine sandy loam 5 to 7 inches thick; in eroded areas it is sandy clay loam 4 to 6 inches thick. The Bt horizon ranges from red (2.5YR 4/6) to yellowish red (5YR 4/6, 4/8, 5/6) and either has common mottles with value of 5 and 6 and chroma of 4 and 6 or is not mottled. These horizons are 14 to 25 inches thick. The B3 horizon ranges from yellowish red (5YR 4/8, 5/6, 5/8) to strong brown (7.5YR 5/8). This horizon either has mottles with value of 4, 5, and 7 and chroma of 4 and 6 or is not mottled. It is sandy clay loam and clay loam 4 to 8 inches thick. The C horizon is weathered acidic and basic rock that crushes to sandy loam, sandy clay loam, or clay loam.

Mecklenburg soils are associated on the same landscape with Davidson, Iredell, and Wilkes soils. They are less red in the subsoil than Davidson soils and have base saturation of more than 35 percent 50 inches below the top of the argillic horizon. Iredell soils have a yellower subsoil and higher shrink-swell properties than Mecklenburg soils. Wilkes soils are thinner, less red, and have bedrock at a shallower depth.

Pacolet series

The Pacolet series consists of deep, well drained, moderately permeable, red soils that formed in material weathered from granite, gneiss, and schist. Pacolet soils are on side slopes of the uplands. Slope ranges from 2 to 25 percent but is mainly 15 to 25 percent.

Typical pedon of Pacolet sandy loam, 15 to 25 percent slopes, in Elbert County; 0.6 mile west on county dirt road from Rehobeth Baptist Church; north 50 feet on paved road; west 1.1 miles on county dirt road; 700 yards north of road in stand of hardwoods:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) sandy loam; moderate fine granular structure; very friable; common fine and medium roots; few fine flakes of mica; very strongly acid; clear smooth boundary.

B1—6 to 9 inches; yellowish red (5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable; few medium roots; few fine flakes of mica; strongly acid; clear wavy boundary.

B2t—9 to 27 inches; red (2.5YR 4/6) clay; moderate medium subangular blocky structure; firm; few medium roots; common fine flakes of mica; thin patchy clay films; strongly acid; gradual wavy boundary.

B3—27 to 30 inches; red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable; few fine roots; many fine flakes of mica; patches of reddish yellow parent material; strongly acid; gradual wavy boundary.

C—30 to 60 inches; mottled yellowish red (5YR 5/6) and reddish yellow (7.5YR 6/6) fine sandy loam; massive; friable; highly weathered granite with many flakes of mica; strongly acid.

The solum ranges from 26 to 38 inches in thickness. Depth to hardness is 5 to 10 feet or more. In unlimed areas reaction ranges from very strongly acid to medium acid throughout.

The A1 horizon is brown (10YR 5/3), dark grayish brown (10YR 4/2), and very dark grayish brown (10YR 3/2) sandy loam 3 to 6 inches thick. The Ap or A2 horizon, if present, is yellowish red (5YR 5/8), strong brown (7.5YR 5/6), and brown (10YR 5/3) and is 5 to 7 inches thick. In eroded areas the surface layer is red (2.5YR 4/6), reddish brown (5YR 4/3, 4/4), yellowish red (5YR 4/6), and brown (7.5YR 4/4) sandy clay loam 2 to 4 inches thick. The B1 horizon is red (2.5YR 4/6) or yellowish red (5YR 5/6) sandy clay loam or clay loam 3 to 6 inches thick. The Bt horizon is clay or sandy clay 10 to 18 inches thick. The B3 horizon is sandy clay loam or clay loam 3 to 14 inches thick. The C horizon is weathered granite, gneiss, and schist 22 to more than 30 inches thick. The texture of this horizon is fine sandy loam or clay loam.

Pacolet soils are associated on the same landscape mainly with Ashlar, Cecil, Gwinnett, and Madison soils. They are deeper and have a more clayey subsoil than Ashlar soils. Their solum is thinner than the solum in Cecil soils. Gwinnett soils have a darker red subsoil. Madison soils contain common to many flakes of mica throughout.

Toccoa series

The Toccoa series consists of well drained, moderately rapidly permeable, loamy soils that formed in alluvium washed from adjacent uplands. The Toccoa soils are level to nearly level and are on flood plains. Slope ranges from 0 to 2 percent.

Typical pedon of Toccoa fine sandy loam, in Madison County; north 1.2 miles on Vineyard Baptist Church road from Paoli; west 300 yards to pastured area along Holly Creek flood plain:

Ap—0 to 8 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; very friable; many fine roots; strongly acid; gradual smooth boundary.

C1—8 to 14 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure to massive; very friable; many fine and medium roots; many fine and medium flakes of mica; strongly acid; clear smooth boundary.

C2—14 to 32 inches; yellowish brown (10YR 5/6) fine sandy loam; massive; friable; few medium roots; many fine and medium flakes of mica; thin bedding planes of fine sand and silt; medium acid; abrupt smooth boundary.

C3—32 to 74 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct mottles of strong brown (7.5YR 5/6); massive; friable; many fine and medium flakes of mica; thin bedding planes of sand; silt loam, and clay loam; medium acid.

Depth to bedrock is greater than 5 feet. In unlimed areas reaction ranges from strongly acid to medium acid throughout.

The Ap horizon is reddish brown (5YR 4/3), dark reddish brown (5YR 3/4), brown (7.5YR 4/4), and very dark grayish brown (10YR 3/2) and is 8 to 10 inches thick. The C1 horizon is reddish brown (5YR 4/4) and brown (10YR 5/3, 4/3; 7.5YR 4/4) sandy loam or fine sandy loam. The C2 horizon has color and texture similar to the Ap and C1 horizons. The C3 horizon is reddish brown (5YR 4/4) to yellowish brown (10YR 5/6) sandy loam, fine sandy loam, and loam. Some pedons contain common mottles with value of 5 to 6 and chroma of 2 to 6 in the C3 horizon. The texture variations are similar to those in the C1 and C2 horizons. Bedding planes of contrasting textures are more pronounced in the C3 horizon, and in places a few layers are gravelly. Between depths of 12 and 42 inches, very thin, irregular bands of sand, silt loam, clay loam, or sandy clay are in some pedons. Between these depths, content of clay ranges from 10 to about 18 percent. The sand fraction averages more than 15 percent coarser than very fine sand.

Toccoa soils are associated on the same landscape mainly with Cartecay soils. They are better drained and do not have grayish mottles within the upper 20 inches of the profile.

Wickham series

The Wickham series consists of deep, well drained, moderately permeable, yellowish red soils that formed on stream terraces in old alluvium 4 to 10 feet thick. The Wickham soils are in small areas where sediment has been deposited just above the present flood plains and adjacent to the larger streams. Slope ranges from 2 to 6 percent.

Typical pedon of Wickham sandy loam, 2 to 6 percent slopes, in Elbert County; southeast 3.3 miles on county dirt road from Bethel Grove Baptist Church; 300 yards north of road in cultivated field:

Ap—0 to 7 inches; brown (7.5YR 4/4) sandy loam; weak fine granular structure; friable; few fine roots; few flakes of mica; medium acid; clear wavy boundary.

B1—7 to 11 inches; reddish brown (5YR 4/4) sandy clay loam; weak medium subangular blocky structure; friable; few fine roots; few flakes of mica; very strongly acid; clear smooth boundary.

B21t—11 to 30 inches; yellowish red (5YR 4/6) clay loam; weak medium subangular blocky structure; friable; few fine roots; few flakes of mica; thin patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

B22t—30 to 38 inches; yellowish red (5YR 4/6) sandy clay loam; common medium distinct yellowish brown (10YR 5/6) mottles and few medium faint red (2.5YR 4/6) mottles; weak medium subangular blocky structure; friable; few flakes of mica; common pebbles; very strongly acid; gradual wavy boundary.

B3—38 to 51 inches; strong brown (7.5YR 5/6) sandy clay loam; common fine distinct light yellowish brown (10YR 6/4) mottles and common medium distinct red (2.5YR 4/6) mottles; weak medium granular structure; very friable; few flakes of mica; few pebbles; very strongly acid; abrupt wavy boundary.

IIB2t—51 to 60 inches; mottled yellowish brown (10YR 5/6), yellowish red (5YR 5/6), and brownish yellow (10YR 6/6) sandy clay loam; weak medium subangular blocky structure; friable; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is 5 to 10 feet or more. In unlimed areas reaction is very strongly acid to medium acid throughout.

The Ap horizon is reddish brown (5YR 4/4) or brown (10YR 5/3; 7.5YR 4/4) and is 7 to 9 inches thick. The B1 horizon is reddish brown (5YR 5/4, 5/3) or yellowish red (5YR 4/6, 5/6) sandy loam or sandy clay loam 4 to 5 inches thick. The B2t horizon is red (2.5YR 4/6) or yellowish red (5YR 4/6, 4/8, 5/6) sandy clay loam or clay loam 25 to 33 inches thick. Few to common mottles with value of 4, 5, or 6 and chroma of 6 or 8 are in the lower part of the Bt horizon of some pedons. The B3 horizon is yellowish red (5YR 5/6) or strong brown (7.5YR 5/6) sandy loam or sandy clay loam 13 to 16 inches thick; some layers have gravel. Some pedons contain mottles with value and chroma of 4 or 6. The C horizon ranges from yellowish red (5YR 4/6, 5/6, 5/8) through very pale brown (10YR 7/4) sandy loam or sandy clay loam. The C horizon is not in some pedons. The underlying material is a buried B horizon.

Wickham soils are associated on the same landscape mainly with Hiwassee and Toccoa soils. They are less red in the subsoil and contain less clay than Hiwassee soils. Toccoa soils do not have a Bt horizon and have a C horizon of recent alluvium.

Wilkes series

The Wilkes series consists of well drained, moderately slowly permeable, brownish soils that formed in diorite, gabbro, quartz, and related acidic and basic rocks. Wilkes soils are on side slopes. Slope ranges from 10 to 25 percent but is dominantly 15 to 25 percent.

Typical pedon of Wilkes gravelly loam, in an area of Enon-Wilkes complex, 10 to 25 percent slopes, in Elbert County; south 7.5 miles on Bobby Brown State Park road from junction of Bobby Brown State Park road and Georgia Highway 72; 200 yards southwest in edge of stand of hardwoods:

01—1 inch to 0; undecomposed hardwood and pine leaves and twigs.

A1—0 to 7 inches; very dark grayish brown (2.5Y 3/2) gravelly loam; weak medium granular structure; friable; few stones; 20 percent quartz pebbles; many fine and medium roots; strongly acid; clear smooth boundary.

A2—7 to 10 inches; light brownish gray (2.5Y 6/2) loam; weak medium granular structure; friable; 5 percent quartz pebbles; common fine and medium roots; strongly acid; clear wavy boundary.

B2t—10 to 16 inches; light olive brown (2.5Y 5/4) clay loam; moderate medium angular blocky structure; firm; few fine and medium roots; continuous clay films on faces of peds; slightly acid; clear wavy boundary.

B3—16 to 19 inches; light olive brown (2.5Y 5/4) gravelly clay loam; weak medium angular blocky structure; friable; few greenish weathered rocks; 25 percent quartz pebbles; few fine roots; few discontinuous clay films on faces of peds; slightly acid; abrupt wavy boundary.

Cr—19 to 60 inches; light olive brown and greenish saprolite that crushes to a sandy loam; rock structure; friable; few fine roots; neutral.

The solum ranges from 12 to 19 inches in thickness. Depth to rippable bedrock is 12 to 19 inches, and depth to hard bedrock is 40 to 80 inches. In unlimed areas reaction is strongly acid to slightly acid in the solum and neutral in the C horizon.

The A1 or Ap horizon is yellowish brown (10YR 5/4), grayish brown (10YR 5/2), brown (10YR 4/3), and very dark grayish brown (10YR 3/2; 2.5Y 3/2) gravelly loam 2 to 7 inches thick. The A2 horizon is light brownish gray (2.5Y 6/2), pale brown (10YR 6/3), and light olive brown (2.5Y 5/4) loam 3 to 5 inches thick. The Bt horizon is light yellowish brown (2.5Y 6/4), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light olive brown (2.5Y 5/4) sandy clay loam, clay loam, and clay 6 inches thick. The B3 horizon, if present, is 3 to 4 inches thick; it is light olive brown (2.5Y 5/4). Mottles or bodies of black, green, and gray saprolite are in the B horizon in places. The Cr horizon is highly weathered, basic saprolite that crushes to sandy loam or loam. Continuous hard rock is below a depth of 60 inches.

Wilkes soils are associated on the same landscape with Davidson, Enon, Iredell, and Mecklenburg soils. They have a thinner, browner solum than Davidson soils. Enon and Mecklenburg soils have a thicker solum, and Iredell soils have a thicker Bt horizon and montmorillonitic mineralogy.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*7*). Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18 the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

GLENN L. BRAMLETT, soil scientist, Soil Conservation Service, helped prepare this section.

In this section, the factors of soil formation are discussed and related to the formation of soils in the survey area, and the processes of soil formation are explained.

Soil is produced when parent material, climate, relief, and plants and animals interact for a period of time (*5*). These factors determine the nature of the soil that forms at any point on the earth. All of these factors affect the formation of each soil, but the relative importance of each factor differs from place to place. In some areas one factor may dominate in the formation of a soil and determine most of its properties. For example, soils that formed in quartz sand generally have faint horizons because quartz sand is highly resistant to weathering. Even in quartz sand, however, a distinct profile can be formed under certain types of vegetation if the relief is low and flat, and if the water table is high. The five factors of soil formation are discussed in the paragraphs that follow.

Parent material

Parent material is the unconsolidated mass from which soil forms. It is largely responsible for the chemical and mineral composition of a soil. Most of the soils in Elbert, Franklin, and Madison Counties formed from residual materials, that is, materials weathered from the underlying rock.

Metamorphic rock underlies most of the area (*4*). Nearly all of Madison County, the eastern third of Franklin County, and the northern part of Elbert County are underlain by biotite gneiss and schist, which include injection gneiss; Madison soils are dominant in this area. The eastern part of Elbert County is underlain by hornblende gneiss and slate; Iredell, Mecklenburg, and Wilkes soils are dominant.

Igneous rocks underlie the remainder of the area. The northwestern part of Franklin County is underlain by granite gneiss, which includes diorite injection gneiss; Pacolet soils are dominant. The west-central part of Elbert County, near Elberton, is underlain by biotite and muscovite granite and porphyritic granite; Cecil and Appling soils are dominant.

The proportion of felsic and mafic minerals and quartz in the parent rocks affects the amount of clay in the soils. Ashlar soils, for example, formed in material weathered from siliceous rock and quartz sand, which are very resistant to weathering. These soils, therefore, have faint horizons; in small, scattered areas hard rock is exposed. In contrast, Gwinnett and Hiwassee soils formed from parent material less resistant to weathering and contain fairly large quantities of clay, which weathered chiefly from feldspars. Madison and Louisa soils, on the other hand, also contain appreciable amounts of clay, but the material from which they formed contains muscovite, which is resistant to weathering and is retained in the soil.

Climate

Climate affects the formation of soils through its influence on the rate of weathering of rocks and the decomposition of minerals and organic matter. It also affects biological activity in the soils and the leaching and movement of weathered materials.

Elbert, Franklin, and Madison Counties have a moist, temperate climate. The average daily minimum temperature is about 32.6 degrees F in January, and the average daily maximum is about 89 degrees F in August. The warm, moist climate promotes rapid weathering of hard rock. Consequently, in much of the area, the soils are 3 to 6 feet thick over a thick layer of loose, disintegrated, weathered rock, which blankets the hard rock underlying the county.

About 50 inches of precipitation falls annually. Much of this percolates through the soil, moves dissolved or suspended materials downward, and leaves the soils generally low in bases. Plant remains decay rapidly and produce organic acids that help to hasten the breakdown of minerals in the underlying rock. Thus, the organic-matter content is low in the surface layer of soils that have good drainage.

Relief

Relief influences soil formation through its effect on runoff, movement of water within the soil, plant cover, and, to some extent, soil temperature.

The length, shape, steepness, and aspect of slopes hasten or delay runoff. Runoff is more rapid on steep slopes; therefore, steep soils erode faster than level soils, even if both are of the same material. For example, soils on steep slopes underlain by rock generally are thinner and have a more weakly expressed profile than soils that formed in similar material on broad, fairly level ridgetops. Rock outcrops also are more common.

A level or nearly level surface allows more time for water to penetrate and percolate through the soil profile. This in turn influences the solution and translocation of soluble materials. The moisture available in the soil also determines to a significant extent the amount and kinds of plants that grow. Thus, steep soils that have a slowly permeable surface layer are generally drier than level or nearly level soils and produce less vegetation.

Elbert, Franklin, and Madison Counties range from nearly level to very steep but are not extremely hilly. The effect of relief on soil temperature, therefore, is not so pronounced as it is in more mountainous areas. In general, however, slopes that face south are warmer than those that face north.

Plants and animals

Plants, animals, bacteria, and other organisms are active in the soil-forming processes. The changes they bring about depend mainly on the life processes peculiar to each. The kinds of plants and animals that live on and in the soil are determined, in turn, by the climate, the parent material, the relief, and the age of the soil.

Most of the soils in Elbert, Franklin, and Madison Counties formed under a forest of hardwoods and softwoods. These trees supply most of the organic matter available in the soils. The hardwoods contribute more organic matter than the softwoods. The organic matter content in most of the soils is low to medium.

Growing plants provide a cover that helps to reduce erosion and stabilize the surface. Leaves, twigs, roots, and entire plants accumulate on the surface of forest soils and then decompose through the action of percolating water and of micro-organisms, earthworms, and other forms of life. The roots of plants widen cracks in the rocks, permitting more water to penetrate. Also, the uprooting of trees by wind influences the formation of soils through the mixing of soil layers and the loosening of underlying material.

Small animals, earthworms, insects, and micro-organisms influence the formation of soils by mixing organic matter into the soil and by accelerating the formation of organic matter by breaking down the remains of plants. Small animals burrow into the soil and mix the layers. Earthworms and other small invertebrates feed on the organic matter in the upper few inches. They slowly but continually mix the soil material and may alter it chemically. Bacteria, fungi, and other micro-organisms hasten the weathering of rocks and the decomposition of organic matter.

Time

Generally, a long time is required for a soil to form. Most of the soils on uplands have been in place long enough for distinct horizons to develop, but some soils that formed in alluvium have not.

Most soils in Elbert, Franklin, and Madison Counties have distinct horizons. The surface layer contains an accumulation of organic matter. Silicate clay minerals have formed and moved downward to produce horizons that are relatively high in clay content. In such soils, oxidation or reduction of iron has had its effect, depending on natural drainage. Many of the soils have been drained well enough to have a red or dark red subsoil, and they contain highly oxidized iron. A few have impaired drainage and, consequently, have a gray subsoil that contains reduced iron. In addition, leaching of soluble calcium, magnesium, potassium, and other weatherable material has caused an increase in exchangeable hydrogen. Cecil and Hiwassee soils are examples of old soils in Elbert, Franklin, and Madison Counties.

Soils that have essentially the same parent material and drainage sometimes differ in degree of profile development chiefly because of time. Examples are the Wickham soils on stream terraces and the Toccoa soils on flood plains. These soils are similar in texture and occupy similar positions on the landscape. The Wickham soils, however, have been in place long enough to have a distinct, dark colored surface layer and a subsoil with an accumulation of clay. The Toccoa soils, on the other hand, have not been in place long enough for distinct horizons to form or for much clay to accumulate.

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Glossary

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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping 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 60-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	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. 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.

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 (or contour farming). 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 40 or 80 inches (1 or 2 meters).

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.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

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.

Favorable. Favorable soil features for the specified use.

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

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.

Frost action. Freezing and thawing of soil moisture. Frost action can damage 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.

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 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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 A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

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 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.

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.

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.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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 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.

Low strength. Inadequate strength for supporting 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 greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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).

Munsell notation. A designation of color by degrees of the three single 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.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Pitting. Formation of pits as a result of the melting of ground ice after the removal of plant cover.

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 a semisolid to a plastic state.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to 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 outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

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

Reaction, soil. The degree 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

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

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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.

Saprolite (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In a soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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 runoff water.

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.

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.

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.

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.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that 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.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily 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.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

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 that are separated from adjoining 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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, 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 specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a 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.

Illustrations

Figure 1.—Grain sorghum cut for hay on Toccoa fine sandy loam in the Toccoa-Cartecay association in Elbert County.

Figure 2.—Well managed fescue pasture on Madison sandy loam, 6 to 10 percent slopes, in the Madison-Cecil association in Franklin County.

Figure 3.—Beaver pond in Cartecay soils, ponded. These soils provide excellent habitat for wildlife that lives in or near water.

Figure 4.—Profile of Cecil sandy loam, 2 to 6 percent slopes. The soil auger is 60 inches long.

Figure 5.—Contour farming on Cecil sandy loam, 2 to 6 percent slopes.

Figure 6.—Coastal bermudagrass cut for hay on Cecil sandy loam, 6 to 10 percent slopes.

Figure 7.—Profile of Wilkes gravelly loam in an area of Enon-Wilkes complex, 10 to 25 percent slopes. The soil auger is 60 inches long.

Figure 8.—Multipurpose pond in Madison sandy loam, 2 to 6 percent slopes. The pond is used for watering livestock and for recreation.

Figure 9.—Profile of Madison sandy loam, 15 to 25 percent slopes. Weathered mica schist is at a depth of 4 to 5 feet.

Figure 10.—Planted stand of yellow-poplar on Toccoa fine sandy loam.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1951-73 at Athens, Ga.]

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[1]	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----	52.6	32.6	42.7	73	11	25	4.69	2.94	6.26	7	.7
February---	55.8	34.4	45.1	75	13	45	4.37	2.72	5.85	7	.8
March-------	63.0	40.4	51.7	81	22	150	5.71	3.81	7.43	8	.4
April-------	73.4	49.6	61.5	89	32	345	4.28	2.53	5.84	6	0
May---------	81.0	57.7	69.3	94	39	598	4.39	2.01	6.33	6	0
June--------	87.2	65.2	76.2	100	52	786	4.32	1.96	6.23	6	0
July--------	89.4	68.6	79.0	99	60	899	5.27	3.06	7.06	8	0
August------	89.0	67.9	78.4	98	58	880	3.37	1.27	5.06	5	0
September--	83.3	62.5	72.9	96	47	687	3.68	1.56	5.39	4	0
October----	73.9	50.9	62.4	90	31	384	2.52	.68	3.99	4	0
November---	63.2	40.3	51.8	81	22	110	3.21	1.57	4.55	5	.1
December---	54.8	34.8	44.8	75	13	59	4.40	2.46	5.97	7	.4
Year-----	72.2	50.4	61.3	101	8	4,968	50.21	41.79	58.24	73	2.4

[1]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 (50 F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73 at Athens, Ga.]

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 23	April 3	April 12
2 years in 10 later than--	March 14	March 26	April 8
5 years in 10 later than--	February 23	March 10	March 31
First freezing temperature in fall:			
1 year in 10 earlier than--	November 12	October 31	October 26
2 years in 10 earlier than--	November 19	November 4	October 30
5 years in 10 earlier than--	December 4	November 12	November 7

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1951-73 at Athens, Ga.]

Probability	Daily minimum temperature during growing season		
	Higher than 24 F	Higher than 28 F	Higher than 32 F
	Days	Days	Days
9 years in 10	250	222	203
8 years in 10	262	230	209
5 years in 10	283	247	220
2 years in 10	305	264	231
1 year in 10	317	272	237

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Elbert County	Franklin County	Madison County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Pct
AmB	Appling sandy loam, 2 to 6 percent slopes	2,545	1,550	3,955	8,050	1.4
AmC	Appling sandy loam, 6 to 10 percent slopes	2,135	1,895	720	4,750	0.8
AmD	Appling sandy loam, 10 to 15 percent slopes	910	690	180	1,780	0.3
AnC2	Appling sandy clay loam, 6 to 10 percent slopes, eroded	840	345	160	1,345	0.2
AnD2	Appling sandy clay loam, 10 to 15 percent slopes, eroded	285	105	180	570	0.1
AsF	Ashlar complex, 10 to 30 percent slopes	3,345	1,725	540	5,610	1.0
Ca	Cartecay soils	6,155	6,720	5,040	17,915	3.1
Cc	Cartecay soils, ponded	1,260	860	540	2,660	0.5
CeB	Cecil sandy loam, 2 to 6 percent slopes	12,855	11,200	8,455	32,510	5.6
CeC	Cecil sandy loam, 6 to 10 percent slopes	12,300	17,295	6,295	35,890	6.2
CeD	Cecil sandy loam, 10 to 15 percent slopes	4,210	6,545	2,340	13,095	2.3
CfC2	Cecil sandy clay loam, 6 to 10 percent slopes, eroded	23,510	10,855	5,935	40,300	7.0
CfD2	Cecil sandy clay loam, 10 to 15 percent slopes, eroded	23,090	12,465	5,040	40,595	7.0
DgB	Davidson loam, 2 to 6 percent slopes	1,400	0	900	2,300	0.4
DhC2	Davidson clay loam, 6 to 10 percent slopes, eroded	1,955	0	440	2,395	0.4
DhD2	Davidson clay loam, 10 to 15 percent slopes, eroded	1,790	0	180	1,970	0.3
EwE	Enon-Wilkes complex, 10 to 25 percent slopes	9,485	170	55	9,710	1.7
GeB	Grover sandy loam, 2 to 6 percent slopes	300	15	3,780	4,095	0.7
GeC	Grover sandy loam, 6 to 10 percent slopes	595	85	2,950	3,630	0.6
GgB	Gwinnett sandy loam, 2 to 6 percent slopes	0	3,790	2,160	5,950	1.0
GwC2	Gwinnett sandy clay loam, 6 to 10 percent slopes, eroded	30	11,365	3,240	14,635	2.5
GwD2	Gwinnett sandy clay loam, 10 to 15 percent slopes, eroded	0	1,770	180	1,950	0.3
GwE2	Gwinnett sandy clay loam, 15 to 25 percent slopes, eroded	0	2,755	720	3,475	0.6
GwE3	Gwinnett sandy clay loam, 10 to 25 percent slopes, severely eroded	0	9,645	900	10,545	1.8
HsB	Hiwassee loam, 2 to 6 percent slopes	0	1,550	540	2,090	0.4
HsC	Hiwassee loam, 6 to 10 percent slopes	0	1,205	720	1,925	0.3
IrB	Iredell sandy loam, 2 to 6 percent slopes	12,150	0	0	12,150	2.1
IrC	Iredell sandy loam, 6 to 10 percent slopes	13,985	345	35	14,365	2.5
LoE	Louisa gravelly loam, 10 to 30 percent slopes	45	105	900	1,050	0.2
MdB	Madison sandy loam, 2 to 6 percent slopes	8,050	6,030	22,845	36,925	6.4
MdC	Madison sandy loam, 6 to 10 percent slopes	8,380	12,230	29,204	49,814	8.6
MdD	Madison sandy loam, 10 to 15 percent slopes	4,020	6,200	11,155	21,375	3.7
MdE	Madison sandy loam, 15 to 25 percent slopes	7,035	7,580	10,790	25,405	4.4
MfC2	Madison sandy clay loam, 6 to 10 percent slopes, eroded	9,900	3,615	16,550	30,065	5.2
MfD2	Madison sandy clay loam, 10 to 15 percent slopes, eroded	11,470	5,170	13,675	30,315	5.3
MfE2	Madison sandy clay loam, 15 to 25 percent slopes, eroded	1,520	1,895	3,600	7,015	1.2
MkB	Mecklenburg fine sandy loam, 2 to 6 percent slopes	4,240	0	0	4,240	0.8
MnC2	Mecklenburg sandy clay loam, 6 to 10 percent slopes, eroded	6,765	0	0	6,765	1.2
MnD2	Mecklenburg sandy clay loam, 10 to 15 percent slopes, eroded	2,935	50	0	2,985	0.5
PfE	Pacolet sandy loam, 15 to 25 percent slopes	9,100	5,855	2,160	17,115	3.0
PgE2	Pacolet sandy clay loam, 15 to 25 percent slopes, eroded	3,685	4,135	4,680	12,500	2.2
PhC	Pacolet complex, 2 to 10 percent slopes	940	345	70	1,355	0.3
To	Toccoa fine sandy loam	13,755	9,305	7,555	30,615	5.3
WhB	Wickham sandy loam, 2 to 6 percent slopes	1,830	860	540	3,230	0.6
	Total	228,800	168,320	179,904	577,024	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Cotton lint	Soybeans	Wheat	Grain sorghum	Tall fescue and white clover
	Bu	Lb	Bu	Bu	Bu	AUM[1]
Appling:						
AmB	95	650	35	45	65	8.0
AmC, AnC2	80	600	30	40	50	7.5
AmD, AnD2	70	500	25	35	40	7.0
Ashlar:						
[2]AsF	---	---	---	---	---	4.0
Cartecay:						
Ca	85	---	---	---	65	7.0
Cc	---	---	---	---	---	---
Cecil:						
CeB	95	750	35	45	65	6.5
CeC	90	700	30	40	60	6.5
CeD	80	600	25	35	37	6.0
CfC2	60	410	26	36	38	5.0
CfD2	---	---	---	---	---	4.5
Davidson:						
DgB	110	750	45	55	65	8.5
DhC2	75	450	35	45	50	7.0
DhD2	---	---	---	---	---	6.5
Enon:						
[2]EwE	---	---	---	---	---	7.5
Grover:						
GeB	90	700	35	45	55	6.3
GeC	80	600	30	40	50	6.0
Gwinnett:						
GgB	85	700	33	43	65	6.0
GwC2	65	450	28	38	55	5.5
GwD2	---	---	---	---	---	5.0
GwE2, GwE3	---	---	---	---	---	4.5
Hiwassee:						
HsB	95	550	45	55	60	5.8
HsC	85	500	35	45	55	5.6
Iredell:						
IrB	65	900	35	45	55	8.0
IrC	55	700	30	40	50	6.5
Louisa:						
LoE	---	---	---	---	---	---
Madison:						
MdB	90	700	35	45	60	6.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Cotton lint	Soybeans	Wheat	Grain sorghum	Tall fescue and white clover
	Bu	Lb	Bu	Bu	Bu	AUM[1]
Madison:						
MdC, MfC2	80	600	30	40	50	6.0
MdD, MfD2	70	500	25	35	45	5.5
MdE, MfE2	---	---	---	---	---	5.0
Mecklenburg:						
MkB	80	550	35	45	55	5.8
MnC2	75	500	30	40	50	5.0
MnD2	65	450	25	35	45	4.5
Pacolet:						
PfE, PgE2	---	---	---	---	---	---
[2]PhC	75	650	26	40	42	6.5
Toccoa:						
To	90	900	40	50	65	6.5
Wickham:						
WhB	115	750	40	50	65	9.5

[1]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 a period of 30 days.

[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	111,540	80,925	30,615	---
III	149,648	131,733	17,915	---
IV	127,450	127,450	---	---
V	2,660	---	2,660	---
VI	121,266	121,266	---	---
VII	14,702	11,595	---	3,107
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Appling:								
AmB, AmC, AmD, AnC2, AnD2	3o	Slight	Slight	Slight	Slight	Loblolly pine	81	Eastern redcedar, loblolly pine, yellow-poplar.
						Shortleaf pine	65	
						Scarlet oak	68	
						Southern red oak	76	
						Virginia pine	74	
						White oak	71	
						Yellow-poplar	90	
Ashlar:								
[1]AsF	3r	Moderate	Moderate	Slight	Slight	Eastern white pine	85	Loblolly pine, Virginia pine.
						Shortleaf pine	55	
						Virginia pine	65	
						Northern red oak	70	
Cartecay:								
Ca	2w	Slight	Moderate	Slight	Slight	Loblolly pine	---	Loblolly pine, sweetgum, yellow-poplar, water oak, American sycamore, eastern cottonwood.
						Sweetgum	90	
						Yellow-poplar	95	
						Water oak	---	
						Southern red oak	---	
Cc	2w	Slight	Severe	Severe	Slight	Sweetgum	90	Sweetgum, yellow-poplar.
						Yellow-poplar	95	
Cecil:								
CeB, CeC, CeD	3o	Slight	Slight	Slight	Slight	Eastern white pine	80	Loblolly pine, yellow-poplar.
						Loblolly pine	80	
						Shortleaf pine	67	
						Virginia pine	73	
						Black oak	66	
						Northern red oak	82	
						Post oak	65	
						Scarlet oak	80	
CfC2, CfD2	4c	Moderate	Moderate	Moderate	Slight	Loblolly pine	72	Loblolly pine, Virginia pine.
						Shortleaf pine	66	
						Virginia pine	65	
Davidson:								
DgB	3o	Slight	Slight	Slight	Slight	Loblolly pine	81	Loblolly pine, yellow-poplar.
						Shortleaf pine	68	
						Northern red oak	86	
						Southern red oak	72	
						Sweetgum	80	
						White oak	71	
						Yellow-poplar	91	
DhC2, DhD2	3c	Moderate	Slight	Slight	Slight	Loblolly pine	81	Loblolly pine, yellow-poplar.
						Shortleaf pine	68	
						Northern red oak	86	
						Southern red oak	72	
						Sweetgum	80	
						White oak	71	
						Yellow-poplar	91	
Enon:								
[1]EwE:								
Enon part	4c	Severe	Severe	Moderate	Slight	Loblolly pine	71	Eastern redcedar, loblolly pine, Virginia pine.
						Shortleaf pine	60	
						Virginia pine	65	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Enon:								
[1]EwE:								
Wilkes part	4r	Moderate	Moderate	Slight	Slight	Loblolly pine	75	Eastern redcedar, loblolly pine, Virginia pine.
						Post oak	79	
						Shortleaf pine	63	
						Southern red oak	76	
						Sweetgum	82	
Grover:								
GeB, GeC	3o	Slight	Slight	Slight	Slight	Loblolly pine	80	Loblolly pine, Virginia pine, yellow-poplar.
						White oak	---	
						Southern red oak	---	
Gwinnett:								
GgB	3o	Slight	Slight	Slight	Slight	Loblolly pine	81	Loblolly pine, Virginia pine, yellow-poplar.
						Southern red oak	---	
						White oak	---	
GwC2, GwD2, GwE2	4c	Moderate	Moderate	Moderate	Slight	Loblolly pine	75	Loblolly pine, Virginia pine, eastern redcedar.
						Virginia pine	65	
						Shortleaf pine	65	
GwE3	4c	Severe	Severe	Moderate	Slight	Loblolly pine	75	Loblolly pine, Virginia pine, yellow-poplar.
						Virginia pine	65	
						Shortleaf pine	65	
Hiwassee:								
HsB, HsC	3o	Slight	Slight	Slight	Slight	Loblolly pine	75	Loblolly pine, yellow-poplar, slash pine.
						Northern red oak	70	
						Shortleaf pine	70	
						White oak	70	
						Yellow-poplar	85	
Iredell:								
IrB, IrC	4c	Slight	Moderate	Moderate	Slight	Loblolly pine	67	Loblolly pine, eastern redcedar.
						Shortleaf pine	58	
						Post oak	44	
						White oak	47	
Louisa:								
LoE	4r	Moderate	Moderate	Slight	Slight	Loblolly pine	72	Loblolly pine, eastern redcedar.
						Shortleaf pine	67	
						Southern red oak	77	
						Yellow-poplar	89	
Madison:								
MdB, MdC, MdD, MfC2, MfD2	3o	Slight	Slight	Slight	Slight	Loblolly pine	73	Loblolly pine, yellow-poplar.
						Shortleaf pine	66	
						Southern red oak	81	
						Yellow-poplar	96	
MdE, MfE2	3r	Moderate	Moderate	Slight	Slight	Loblolly pine	73	Loblolly pine, slash pine, yellow-poplar.
						Shortleaf pine	63	
						Southern red oak	66	
						Yellow-poplar	81	
							96	
Mecklenburg:								
MkB	4o	Slight	Slight	Slight	Slight	Loblolly pine	75	Loblolly pine, Virginia pine, yellow-poplar, eastern redcedar.
						Shortleaf pine	67	
						Southern red oak	75	
						Sweetgum	82	
						White oak	71	
						Yellow-poplar	89	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Mecklenburg:								
MnC2, MnD2	4c	Moderate	Moderate	Moderate	Slight	Loblolly pine	66	Loblolly pine,
						Shortleaf pine	59	Virginia pine,
								eastern redcedar.
Pacolet:								
PfE	3r	Moderate	Moderate	Slight	Slight	Loblolly pine	72	Loblolly pine,
						Shortleaf pine	70	shortleaf pine,
						Yellow-poplar	86	Virginia pine,
						Northern red oak	79	yellow-poplar.
						Southern red oak	74	
						Sweetgum	82	
						Virginia pine	78	
PgE2	4c	Severe	Severe	Severe	Slight	Loblolly pine	72	Loblolly pine,
						Shortleaf pine	60	shortleaf pine.
[1]PhC	3o	Slight	Slight	Slight	Slight	Loblolly pine	72	Loblolly pine,
						Shortleaf pine	70	yellow-poplar.
						Yellow-poplar	86	
						Northern red oak	79	
						Southern red oak	74	
						Sweetgum	82	
						Virginia pine	78	
Toccoa:								
To	1o	Slight	Slight	Slight	Slight	Loblolly pine	90	Loblolly pine,
						Yellow-poplar	107	yellow-poplar,
						Sweetgum	100	American sycamore,
						Southern red oak	---	cherrybark oak.
Wickham:								
WhB	2o	Slight	Slight	Slight	Slight	Loblolly pine	82	Loblolly pine,
						Shortleaf pine	72	yellow-poplar,
						Yellow-poplar	100	sweetgum.
						Southern red oak	80	

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Appling:					
AmB	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Slight.
AmC, AmD, AnC2, AnD2	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Ashlar:					
[1]AsF	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cartecay:					
Ca, Cc	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Cecil:					
CeB	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Moderate: low strength.
CeC, CeD, CfC2, CfD2	Moderate: too clayey.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
Davidson:					
DgB	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Moderate: low strength.
DhC2, DhD2	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
Enon:					
[1]EwE:					
Enon part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Wilkes part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Grover:					
GeB	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
GeC	Moderate: slope, depth to rock.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.
Gwinnett:					
GgB	Moderate: too clayey, depth to rock.	Slight	Slight	Moderate: slope.	Slight.
GwC2, GwD2	Moderate: too clayey, depth to rock.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
GwE2, GwE3	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hiwassee:					
HsB	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope.	Moderate: low strength.
HsC	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
Iredell:					
IrB, IrC	Severe: too clayey.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
Louisa:					
LoE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Madison:					
MdB	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Moderate: low strength.
MdC, MdD, MfC2, MfD2	Moderate: too clayey.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
MdE, MfE2	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mecklenburg:					
MkB	Severe: too clayey.	Moderate: low strength.	Moderate: low strength.	Severe: slope, low strength.	Severe: low strength.
MnC2, MnD2	Severe: too clayey.	Moderate: low strength.	Moderate: slope, low strength.	Severe: slope, low strength.	Severe: low strength.
Pacolet:					
PfE, PgE2	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]PhC	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Toccoa:					
To	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Wickham:					
WhB	Slight	Slight	Slight	Moderate: slope.	Slight.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.--SANITARY FACILITIES

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Appling:					
AmB	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
AmC, AmD, AnC2, AnD2	Moderate: slope, percs slowly.	Severe: slope, seepage.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Ashlar:					
[1]AsF	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
Cartecay:					
Ca, Cc	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Cecil:					
CeB	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
CeC, CeD, CfC2, CfD2	Moderate: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Fair: too clayey.
Davidson:					
DgB	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
DhC2, DhD2	Moderate: slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Enon:					
[1]EwE:					
Enon part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey.
Wilkes part	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer.
Grover:					
GeB	Moderate: depth to rock.	Moderate: slope, seepage.	Severe: depth to rock.	Slight	Fair: hard to pack.
GeC	Moderate: slope, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope, hard to pack.
Gwinnett:					
GgB	Slight	Moderate: slope, seepage.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
GwC2, GwD2	Moderate: slope.	Severe: slope.	Moderate: too clayey, depth to rock.	Moderate: slope.	Fair: too clayey.

See footnote at end of table.

TABLE 9.--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
Gwinnett:					
GwE2, GwE3	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.	Poor: slope.
Hiwassee:					
HsB	Moderate: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Fair: too clayey.
HsC	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Fair: too clayey.
Iredell:					
IrB	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, depth to rock, wetness.	Severe: wetness.	Poor: too clayey.
IrC	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: too clayey, depth to rock, wetness.	Severe: wetness.	Poor: too clayey.
Louisa:					
LoE	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope.
Madison:					
MdB	Moderate: percs slowly.	Moderate: slope, seepage.	Severe: too clayey.	Slight	Fair: too clayey.
MdC, MdD, MfC2, MfD2	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
MdE, MfE2	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope.
Mecklenburg:					
MkB	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: thin layer.
MnC2, MnD2	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: thin layer.
Pacolet:					
PfE, PgE2	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.	Poor: slope.
[1]PhC	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Good.
Toccoa:					
To	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Wickham:					
WhB	Slight	Moderate: slope, seepage.	Slight	Slight	Good.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Appling: AmB, AmC, AmD, AnC2, AnD2	Fair: low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
Ashlar: [1]AsF	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope.
Cartecay: Ca, Cc	Fair: wetness.	Poor: excess fines.	Poor: excess fines.	Good.
Cecil: CeB, CeC, CeD, CfC2, CfD2	Fair: low strength.	Unsuited	Unsuited	Fair: too clayey.
Davidson: DgB, DhC2, DhD2	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Enon: [1]EwE:				
Enon part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Wilkes part	Fair: slope, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Grover: GeB, GeC	Fair: low strength.	Unsuited	Unsuited	Poor: thin layer.
Gwinnett: GgB, GwC2, GwD2, GwE2, GwE3	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Hiwassee: HsB, HsC	Fair: low strength.	Unsuited	Unsuited	Poor: thin layer, too clayey.
Iredell: IrB, IrC	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Louisa: LoE	Fair: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Madison: MdB, MdC, MdD, MfC2, MfD2	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Madison: MdE, MfE2	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Mecklenburg: MkB, MnC2, MnD2	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Pacolet: PfE, PgE2	Fair: low strength, slope.	Unsuited	Unsuited	Poor: thin layer, slope.
[1]PhC	Fair: low strength.	Unsuited	Unsuited	Poor: thin layer.
Toccoa: To	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
Wickham: WhB	Good	Unsuited	Unsuited	Fair: thin layer.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 11.--WATER MANAGEMENT

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Appling:						
AmB	Moderate: seepage.	Moderate: low strength.	Not needed	Favorable	Favorable	Favorable.
AmC, AmD, AnC2, AnD2	Moderate: seepage.	Moderate: low strength.	Not needed	Slope	Slope	Favorable.
Ashlar:						
[1]AsF	Severe: depth to rock, seepage.	Moderate: thin layer, seepage.	Not needed	Droughty, fast intake, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Cartecay:						
Ca, Cc	Moderate: seepage.	Moderate: piping.	Favorable	Floods	Not needed	Not needed.
Cecil:						
CeB, CeC, CeD, CfC2, CfD2	Moderate: seepage.	Severe: compressible.	Not needed	Complex slope	Complex slope	Complex slope.
Davidson:						
DgB	Moderate: seepage.	Moderate: hard to pack.	Not needed	Favorable	Favorable	Favorable.
DhC2	Moderate: seepage.	Moderate: hard to pack.	Not needed	Slope	Favorable	Favorable.
DhD2	Moderate: seepage.	Moderate: hard to pack.	Not needed	Slope	Slope	Slope.
Enon:						
[1]EwE:						
Enon part	Moderate: depth to rock.	Severe: shrink-swell, hard to pack.	Not needed	Percs slowly	Erodes easily, slope, percs slowly.	Percs slowly, erodes easily.
Wilkes part	Severe: depth to rock.	Severe: thin layer.	Not needed	Complex slope	Depth to rock, complex slope.	Slope.
Grover:						
GeB	Moderate: seepage.	Moderate: hard to pack, piping.	Not needed	Favorable	Favorable	Favorable.
GeC	Moderate: seepage.	Moderate: hard to pack, piping.	Not needed	Slope	Slope	Slope.
Gwinnett:						
GgB, GwC2	Moderate: depth to rock, seepage.	Moderate: compressible.	Not needed	Slope	Favorable	Favorable.
GwD2, GwE2, GwE3	Moderate: depth to rock, seepage.	Moderate: compressible.	Not needed	Slope	Slope	Slope.
Hiwassee:						
HsB	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable	Favorable.
HsC	Moderate: seepage.	Moderate: compressible.	Not needed	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Iredell:						
IrB, IrC	Slight	Moderate: compressible, hard to pack.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, wetness.	Percs slowly, slope.
Louisa:						
LoE	Severe: seepage.	Severe: seepage, piping.	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Madison:						
MdB	Moderate: seepage.	Moderate: hard to pack, piping.	Not needed	Favorable	Favorable	Favorable.
MdC, MdD, MdE, MfC2, MfD2, MfE2	Moderate: seepage.	Moderate: hard to pack, piping.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Slope.
Mecklenburg:						
MkB	Moderate: depth to rock, slope.	Severe: hard to pack, thin layer.	Not needed	Favorable	Favorable	Favorable.
MnC2, MnD2	Moderate: depth to rock, slope.	Severe: hard to pack, thin layer.	Not needed	Slope	Slope	Slope.
Pacolet:						
PfE, PgE2, [1]PhC	Moderate: seepage, slope.	Moderate: low strength, compressible, erodes easily.	Not needed	Complex slope, erodes easily.	Complex slope, erodes easily.	Slope, erodes easily.
Toccoa:						
To	Severe: seepage.	Moderate: piping.	Not needed	Floods, seepage.	Not needed	Not needed.
Wickham:						
WhB	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Appling:				
AmB	Slight	Slight	Moderate: slope.	Slight.
AmC, AmD, AnC2, AnD2	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ashlar:				
[1]AsF	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Cartecay:				
Ca, Cc	Severe: floods.	Moderate: floods, wetness.	Moderate: floods, wetness.	Moderate: wetness.
Cecil:				
CeB	Slight	Slight	Moderate: slope.	Slight.
CeC, CeD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
CfC2, CfD2	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Davidson:				
DgB	Slight	Slight	Moderate: slope.	Slight.
DhC2, DhD2	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: too clayey.
Enon:				
[1]EwE:				
Enon part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Wilkes part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Grover:				
GeB	Slight	Slight	Moderate: slope.	Slight.
GeC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Gwinnett:				
GgB	Slight	Slight	Moderate: slope, depth to rock.	Slight.
GwC2, GwD2	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Moderate: too clayey.
GwE2, GwE3	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.
Hiwassee:				
HsB	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hiwassee:				
HsC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Iredell:				
IrB	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
IrC	Severe: wetness.	Moderate: wetness. slope.	Severe: slope, wetness.	Moderate: wetness.
Louisa:				
LoE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Madison:				
MdB	Slight	Slight	Moderate: slope.	Slight.
MdC, MdD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
MdE, MfE2	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
MfC2, MfD2	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: too clayey.
Mecklenburg:				
MkB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
MnC2, MnD2	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Moderate: too clayey.
Pacolet:				
PfE, PgE2	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
[1]PhC	Slight	Slight	Severe: slope.	Slight.
Toccoa:				
To	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Wickham:				
WhB	Slight	Slight	Moderate: slope.	Slight.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates 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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Appling:												
AmB	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
AmC, AmD	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
AnC2, AnD2	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Ashlar:												
[1]AsF	Poor	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Cartecay:												
Ca	Fair	Good	Good	Good	Good	---	Fair	Poor	Good	Good	Fair	---
Cc	Very poor.	Very poor.	Fair	Fair	Fair	---	Good	Good	Poor	Poor	Good	---
Cecil:												
CeB	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
CeC, CeD	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
CfC2, CfD2	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Davidson:												
DgB	Good	Good	Good	Good	Fair	---	Poor	Very poor.	Good	Good	Poor	---
DhC2, DhD2	Fair	Good	Good	Good	Fair	---	Very poor.	Very poor.	Good	Fair	Very poor.	---
Enon:												
[1]EwE:												
Enon part	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.	---
Wilkes part	Poor	Poor	Fair	Fair	Fair	---	Very poor.	Very poor.	Poor	Fair	Very poor.	---
Grover:												
GeB	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
GeC	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Gwinnett:												
GgB	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
GwC2, GwD2	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
GwE2, GwE3	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.	---

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Hiwassee:												
HsB	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
HsC	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Iredell:												
IrB, IrC	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Louisa:												
LoE	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Madison:												
MdB	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
MdC, MdD, MfC2, MfD2	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
MdE, MfE2	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Mecklenburg:												
MkB	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
MnC2, MnD2	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Pacolet:												
PfE, PgE2	Very poor.	Poor	Poor	Fair	Fair	---	Very poor.	Very poor.	Poor	Fair	Very poor.	---
[1]PhC	Fair	Fair	Fair	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.	---
Toccoa:												
To	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Wickham:												
WhB	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Appling:											
AmB, AmC, AmD-----	0-6	Sandy loam------	SM, SM-SC	A-2	0-5	86-100	80-100	55-75	15-35	<27	NP-5
	6-40	Sandy clay, clay loam, clay.	MH, CL, ML, SC	A-7	0-5	95-100	95-100	70-92	50-75	41-74	15-30
	40-60	Sandy clay loam	CL, ML, SC	A-6	0-5	95-100	90-100	70-95	40-70	20-40	11-20
	60-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
AnC2, AnD2--------	0-6	Sandy clay loam	CL, ML, SC	A-6	0-5	95-100	90-100	70-95	40-70	20-40	11-20
	6-40	Sandy clay, clay loam, clay.	MH, CL, ML, SC	A-7	0-5	95-100	95-100	70-92	50-75	41-74	15-30
	40-60	Sandy clay loam	CL, ML, SC	A-6	0-5	95-100	90-100	70-95	40-70	20-40	11-20
	60-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Ashlar:											
[1]AsF---------------	0-20	Sandy loam------	SC, SM	A-2, A-4, A-1	0-2	70-95	65-95	40-80	20-50	<21	NP-4
	20-29	Sandy loam, coarse sandy loam.	SC, SM	A-1, A-2, A-4	2-8	55-95	50-90	30-75	15-50	14-23	NP-6
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cartecay:											
Ca, Cc-------------	0-7	Fine sandy loam	SM	A-2, A-4	0	90-100	75-100	60-80	20-50	---	NP
	7-70	Sandy loam, fine sandy loam, loam, loamy sand, sand.	SM, SC, SM-SC, SP-SM	A-2, A-4	0	80-100	35-100	25-85	10-50	<30	NP-10
Cecil:											
CeB, CeC, CeD-----	0-7	Sandy loam------	SM, SM-SC	A-2, A-4	0	84-100	80-100	67-90	26-42	<30	NP-6
	7-58	Clay, clay loam, sandy clay loam.	MH, ML	A-7	0	97-100	92-100	72-99	55-95	41-80	9-37
	58-66	Weathered bedrock.	---	---	---	---	---	---	---	---	---
CfC2, CfD2--------	0-7	Sandy clay loam	SM, SC, CL, ML	A-4	0	74-100	72-100	68-95	38-81	21-28	3-10
	7-58	Clay, clay loam	MH, ML	A-7	0	97-100	92-100	72-99	55-95	41-80	9-37
	58-66	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Davidson:											
DgB----------------	0-7	Loam------------	CL, ML, CL-ML, SC	A-4, A-6	0	94-100	84-100	75-95	40-70	20-40	5-18
	7-57	Clay------------	CL, CH, ML, MH	A-7, A-6	0	96-100	95-100	85-100	65-85	35-65	15-35
	57-72	Clay, clay loam, sandy clay loam.	CL, ML	A-4, A-6, A-7	0	95-100	90-100	75-100	50-80	27-50	11-25
DhC2, DhD2--------	0-7	Clay loam-------	CL, ML, CL-ML, SC	A-6	0	94-100	84-100	75-95	40-70	27-40	11-18
	7-57	Clay------------	CL, CH, ML, MH	A-7, A-6	0	96-100	95-100	85-100	65-85	35-65	15-35
	57-72	Clay, clay loam	CL, ML	A-7, A-6	0	95-100	90-100	75-100	50-80	27-50	11-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Enon:											
[1]EwE:											
Enon part	0-10	Gravelly loam, loam.	ML, CL, CL-ML	A-4, A-6	0-5	80-100	80-100	70-90	50-80	20-40	4-20
	10-24	Clay loam, clay	CH	A-7-6	0-5	85-100	80-100	75-95	65-95	51-75	25-50
	24-30	Sandy loam, loam, clay loam.	SC, CL, SM	A-2, A-4, A-6, A-7-6	2-10	75-100	60-100	40-95	30-85	20-50	8-25
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Wilkes part	0-10	Gravelly loam	SM, SM-SC	A-2, A-4	0-10	70-80	60-75	45-75	20-49	<20	NP-7
	10-19	Clay loam, clay, sandy clay loam.	CL, CH, MH, ML	A-6, A-7	0	80-100	80-100	75-95	50-80	30-60	11-32
	19-60	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-2, A-4, A-6	0	94-100	80-100	45-95	25-60	<40	NP-16
Grover:											
GeB, GeC	0-10	Sandy loam	SM, SM-SC	A-4	0-5	95-100	90-100	50-75	36-50	<30	NP-10
	10-36	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0-5	95-100	90-100	70-85	40-70	35-50	12-25
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Gwinnett:											
GgB	0-6	Sandy loam	SM, SC, SM-SC	A-2, A-4	0-3	95-100	85-100	65-90	30-50	<32	NP-10
	6-34	Clay, sandy clay	MH, ML, CL	A-7, A-6	0-4	95-100	90-100	75-95	51-80	38-65	16-28
	34-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
GwC2, GwD2, GwE2, GwE3	0-5	Sandy clay loam	SM, SC, SM-SC	A-6, A-4	0-3	95-100	85-100	65-90	36-50	<32	NP-15
	5-34	Clay, sandy clay	MH, ML, CL	A-7, A-6	0-4	95-100	90-100	75-95	51-80	38-65	16-28
	34-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Hiwassee:											
HsB, HsC	0-6	Loam	ML	A-4	0-2	95-100	90-100	85-95	50-75	25-35	NP-10
	6-72	Clay, clay loam	CL, ML, MH	A-7-5, A-7-6, A-6	0-2	95-100	95-100	80-100	70-95	36-52	12-20
Iredell:											
IrB, IrC	0-7	Sandy loam	SM, SM-SC	A-2-4, A-4	0-1	90-98	80-90	65-80	30-50	<35	NP-9
	7-28	Clay, clay loam	CH	A-7-6	0	99-100	85-100	80-100	65-95	60-115	30-85
	28-34	Loam, sandy clay loam, clay loam.	CL, SM, SC	A-7-6, A-2, A-4, A-6	0-1	98-100	85-100	70-95	33-75	36-55	NP-28
	34-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Louisa:											
LoE	0-6	Gravelly loam, sandy loam.	SM	A-1, A-2, A-4	0-5	75-90	60-75	40-55	20-40	---	NP
	6-19	Gravelly loam, gravelly sandy loam.	SM	A-2, A-4	0-5	80-95	60-80	50-70	20-45	---	NP
	19-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Madison:											
MdB, MdC, MdD, MdE	0-6	Sandy loam	SM	A-2, A-4	0-3	85-100	80-100	60-90	26-49	<35	NP-8
	6-41	Clay, clay loam	MH, ML-CL	A-7	0-3	90-100	85-100	75-97	57-85	43-65	12-30
	41-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
MfC2, MfD2, MfE2	0-6	Sandy clay loam	CL	A-4, A-6	0-3	90-100	85-100	70-95	50-80	20-40	10-20
	6-41	Clay, clay loam	MH, ML-CL	A-7	0-3	90-100	85-100	75-97	57-85	43-65	12-30
	41-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Mecklenburg:											
MkB	0-5	Fine sandy loam	SC, ML, SM	A-4, A-6	0-5	90-100	80-100	70-90	45-75	<45	NP-15
	5-43	Clay, clay loam	MH, CL, ML, CH	A-7	0-5	90-100	85-100	80-100	75-95	45-75	15-35
	43-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
MnC2, MnD2	0-5	Sandy clay loam	CL	A-6	0-5	100	100	80-100	50-80	25-49	11-20
	5-43	Clay, clay loam	MH, CL, ML, CH	A-7	0-5	90-100	85-100	80-100	75-95	45-75	15-35
	43-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Pacolet:											
PfE, [1]PhC	0-6	Sandy loam	SM	A-2	0-2	85-100	80-100	60-80	20-35	<30	NP-6
	6-30	Sandy clay, clay loam, clay.	CL, ML, MH	A-6, A-7	0	98-100	85-100	60-95	51-75	35-60	11-27
	30-60	Fine sandy loam, clay loam.	SM, ML	A-2, A-4, A-6, A-5	0-2	80-100	80-100	60-95	25-70	20-49	3-15
PgE2	0-3	Sandy clay loam	SM, SM-SC, SC	A-4	0-1	95-100	90-100	65-85	36-50	20-40	4-10
	3-30	Sandy clay, clay loam, clay.	CL, ML, MH	A-6, A-7	0	98-100	85-100	60-95	51-75	35-60	11-27
	30-60	Fine sandy loam, clay loam.	SM, ML	A-2, A-4, A-6, A-5	0-2	80-100	80-100	60-95	25-70	20-49	3-15
Toccoa:											
To	0-8	Fine sandy loam	SM	A-2	0	98-100	95-100	85-100	25-36	<30	NP-4
	8-60	Sandy loam, fine sandy loam, loam.	SM, ML	A-2, A-4	0	95-100	90-100	60-100	30-55	<30	NP-4
Wickham:											
WhB	0-7	Sandy loam	SM	A-2	0	95-100	90-100	70-100	25-35	<25	NP-7
	7-51	Sandy clay loam, clay loam, loam.	CL-ML, CL, SC, SM-SC	A-2, A-4, A-6	0	95-100	90-100	75-100	30-70	20-41	5-15
	51-60	Variable	---	---	---	---	---	---	---	---	---

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm				
Appling:									
AmB, AmC, AmD	0-6	2.0-6.0	0.10-0.15	4.5-5.5	<2	Low	Moderate	Moderate	---
	6-60	0.6-2.0	0.15-0.17	4.5-5.5	<2	Moderate	Moderate	Moderate	
	60-65	---	---	---	---	---	---	---	
AnC2, AnD2	0-6	0.6-2.0	0.12-0.15	4.5-5.5	<2	Low	Moderate	Moderate	---
	6-60	0.6-2.0	0.15-0.17	4.5-5.5	<2	Moderate	Moderate	Moderate	
	60-65	---	---	---	---	---	---	---	
Ashlar:									
[1]AsF	0-20	2.0-6.0	0.08-0.15	4.5-6.0	<2	Low	Low	High	---
	20-29	2.0-6.0	0.04-0.14	4.5-5.5	<2	Low	Low	High	
	29	---	---	---	---	---	---	---	
Cartecay:									
Ca, Cc	0-7	6.0-20	0.06-0.10	5.1-6.5	<2	Low	Low	Moderate	---
	7-70	6.0-20	0.06-0.09	5.1-6.5	<2	Low	Low	Moderate	
Cecil:									
CeB, CeC, CeD	0-7	2.0-6.0	0.12-0.14	4.5-6.0	<2	Low	Moderate	Moderate	---
	7-58	0.6-2.0	0.13-0.15	4.5-5.5	<2	Moderate	Moderate	Moderate	
	58-66	---	---	---	---	---	---	---	
CfC2, CfD2	0-7	0.6-2.0	0.13-0.15	4.5-6.0	<2	Low	Moderate	Moderate	---
	7-58	0.6-2.0	0.13-0.15	4.5-5.5	<2	Moderate	Moderate	Moderate	
	58-66	---	---	---	---	---	---	---	
Davidson:									
DgB, DhC2, DhD2	0-7	0.6-2.0	0.14-0.18	4.5-6.5	<2	Low	High	Moderate	---
	7-57	0.6-2.0	0.12-0.16	4.5-6.0	<2	Low	High	Moderate	
	57-72	0.6-2.0	0.12-0.18	4.5-6.0	<2	Low	High	Moderate	
Enon:									
[1]EwE:									
Enon part	0-10	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low	High	Moderate	---
	10-24	0.06-0.2	0.15-0.20	5.1-7.8	<2	High	High	Moderate	
	24-30	0.2-0.6	0.13-0.18	6.1-7.8	<2	Moderate	High	Low	
	30-60	---	---	---	---	---	---	---	
Wilkes part	0-10	2.0-6.0	0.10-0.14	5.1-6.5	<2	Low	Moderate	Moderate	---
	10-19	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	Moderate	Moderate	
	19-60	0.6-2.0	0.08-0.13	6.1-7.8	<2	Low	Moderate	Moderate	
Grover:									
GeB, GeC	0-10	2.0-6.0	0.07-0.10	4.5-6.5	<2	Low	Moderate	Moderate	---
	10-36	0.6-2.0	0.12-0.14	4.5-5.5	<2	Low	Moderate	Moderate	
	36-60	---	---	---	---	---	---	---	
Gwinnett:									
GgB, GwC2, GwD2, GwE2, GwE3	0-5	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low	High	Moderate	---
	5-34	0.6-2.0	0.11-0.16	5.1-6.5	<2	Low	High	Moderate	
	34-60	---	---	---	---	---	---	---	
Hiwassee:									
HsB, HsC	0-6	0.6-2.0	0.12-0.14	4.5-6.5	<2	Low	Moderate	Moderate	---
	6-72	0.6-2.0	0.12-0.15	4.5-6.5	<2	Moderate	Moderate	Moderate	
Iredell:									
IrB, IrC	0-7	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low	Moderate	Low	---
	7-28	0.06-0.2	0.16-0.22	6.1-7.3	<2	Very high	High	Low	
	28-34	0.06-0.6	0.14-0.18	6.1-7.8	<2	High	High	Low	
	34-50	---	---	---	---	---	---	---	
Louisa:									
LoE	0-6	2.0-6.0	0.10-0.14	4.5-6.0	<2	Low	Low	Moderate	---
	6-19	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low	Low	Moderate	
	19-60	---	---	---	---	---	---	---	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm				
Madison:									
MdB, MdC, MdD, MdE	0-6	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low	High	Moderate	---
	6-41	0.6-2.0	0.13-0.18	4.5-5.5	<2	Moderate	High	Moderate	
	41-60	---	---	---	---	---	---	---	
MfC2, MfD2, MfE2	0-6	0.6-2.0	0.12-0.16	4.5-6.0	<2	Low	High	Moderate	---
	6-41	0.6-2.0	0.13-0.18	4.5-5.5	<2	Moderate	High	Moderate	
	41-60	---	---	---	---	---	---	---	
Mecklenburg:									
MkB	0-5	0.6-2.0	0.14-0.19	5.5-6.0	<2	Low	High	Moderate	---
	5-43	0.06-0.2	0.12-0.14	5.5-6.0	<2	Moderate	High	Moderate	
	43-60	---	---	---	---	---	---	---	
MnC2, MnD2	0-5	0.6-2.0	0.12-0.14	5.5-6.0	<2	Low	High	Moderate	---
	5-43	0.06-0.2	0.12-0.14	5.5-6.0	<2	Moderate	High	Moderate	
	43-60	---	---	---	---	---	---	---	
Pacolet:									
PfE, [1]PhC	0-6	2.0-6.0	0.08-0.12	4.5-6.0	<2	Low	Moderate	High	---
	6-30	0.6-2.0	0.12-0.15	4.5-6.0	<2	Low	High	High	
	30-60	0.6-6.0	0.09-0.12	4.5-6.0	<2	Low	Moderate	High	
PgE2	0-6	0.6-2.0	0.10-0.14	4.5-6.0	<2	Low	Moderate	High	---
	6-30	0.6-2.0	0.12-0.15	4.5-6.0	<2	Low	High	High	
	30-60	0.6-6.0	0.09-0.12	4.5-6.0	<2	Low	Moderate	High	
Toccoa:									
To	0-10	2.0-6.0	0.09-0.12	5.1-6.5	<2	Low	Low	Moderate	---
	10-60	2.0-6.0	0.06-0.12	5.1-6.5	<2	Low	Low	Moderate	
Wickham:									
WhB	0-7	2.0-6.0	0.11-0.16	4.5-6.0	<2	Low	Moderate	Moderate	---
	7-51	0.6-2.0	0.12-0.17	4.5-6.0	<2	Low	Moderate	Moderate	
	51-60	---	---	---	---	---	---	---	

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	
					Ft			In		In		
Appling: AmB, AmC, AmD, AnC2, AnD2	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Ashlar: [1]AsF	B	None	---	---	4.0-6.0	Apparent	---	22-40	Hard	---	---	---
Cartecay: Ca, Cc	C	Common	Brief	Dec-Mar	0.5-1.5	Apparent	Jan-Apr	>60	---	---	---	---
Cecil: CeB, CeC, CeD, CfC2, CfD2	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Davidson: DgB, DhC2, DhD2	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Enon: [1]EwE: Enon part	C	None	---	---	1.0-2.0	Perched	Dec-Mar	>60	---	---	---	---
Wilkes part	C	None	---	---	>6.0	---	---	40-80	Hard	---	---	---
Grover: GeB, GeC	B	None	---	---	>6.0	---	---	>48	Hard	---	---	---
Gwinnett: GgB, GwC2, GwD2, GwE2, GwE3	B	None	---	---	>6.0	---	---	20-40	Rip-pable	---	---	---
Hiwassee: HsB, HsC	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Iredell: IrB, IrC	D	None	---	---	1.0-2.0	Perched	Nov-Mar	40-72	Rip-pable	---	---	---
Louisa: LoE	B	None	---	---	>6.0	---	---	16-20	Rip-pable	---	---	---
Madison: MdB, MdC, MdD, MdE, MfC2, MfD2, MfE2	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Mecklenburg: MkB, MnC2, MnD2	C	None	---	---	>6.0	---	---	48-96	Hard	---	---	---
Pacolet: PfE, PgE2, [1]PhC	B	None	---	---	>6.0	---	---	>60	---	---	---	---
Toccoa: To	B	Common	Brief	Jan-Dec	2.5-5.0	Apparent	Dec-Apr	>60	---	---	---	---
Wickham: WhB	B	None to rare	---	---	>6.0	---	---	>60	---	---	---	---

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 17.—ENGINEERING TEST DATA

[Tests were performed by the State Highway Department of Georgia. The tests, except those for volume change, were performed in accordance with standard test procedures of the American Association of State Highway and Transportation Officials. (AASHTO). NP means nonplastic]

Soil name and location	Parent material	Report No.	Depth from surface	Moisture density[1]: Maximum dry density	Moisture density[1]: Optimum moisture	Volume change: Shrinkage	Volume change: Swell	Volume change: Total	Mechanical analysis[2] — Percentage passing sieve: No. 4	No. 10	No. 40	No. 200	Percentage smaller than—: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO[3]	Classification: Unified[4]
			In	Lbs/ft[3]	Pct	Pct	Pct	Pct									Pct			
Cecil sandy loam (Elbert County): 8.5 miles north on Ga. Hwy. 77 from Elberton city limits and 200 yards due west on dirt road, south roadbank.	Granite gneiss.	5-1	0-8	106	16	3.5	14.1	17.6	98	95	67	37	33	29	20	14	—	NP	A-4(0)	SM
		5-4	14-30	85	33	12.6	3.6	16.2	100	100	88	80	80	78	71	68	69	21	A-7-5(23)	MH
		5-6	60-80+	93	23	6.6	10.0	16.6	100	100	82	50	49	47	29	22	—	NP	A-4(0)	ML
Gwinnett sandy clay loam (Franklin County): 1.1 miles south along county road from Stephens County line and 0.2 mile west of Clarks Creek and about 7 miles north-northeast from Carnesville.	Dark colored gneisses and schists containing mafic minerals.	2-1	0-5	109	16	5.9	5.4	11.3	97	96	89	47	43	38	29	24	29	12	A-6(3)	SC
		2-2	5-17	88	30	10.7	6.7	17.4	100	100	90	69	64	59	54	51	58	16	A-7-5(13)	MH
		2-4	32-70+	93	24	4.7	16.3	21.0	99	97	87	42	39	29	20	19	—	NP	A-4(0)	SM
Iredell sandy loam (Elbert County): East on Ga. Hwy. 72 from Elberton city limits for 9.9 miles and south at Rome Hill Baptist Church 0.6 mile, west roadbank.	Weathered diorite and gabbro and dark colored ferromagnesium rocks.	2-1	0-7	115	13	2.6	8.1	10.7	99	92	70	36	31	24	18	15	—	NP	A-2-4(0)	SM
		2-3	13-25	91	22	22.1	12.9	39.0	100	100	99	90	89	85	71	65	68	41	A-7-6(42)	CH
		2-5	28-42+	108	17	3.4	10.1	13.5	97	93	73	33	27	17	10	7	—	NP	A-2-4(0)	SM

See footnotes at end of table.

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Report No.	Depth from surface	Moisture density[1]: Maximum dry density	Moisture density[1]: Optimum moisture	Volume change: Shrinkage	Volume change: Swell	Volume change: Total	Mechanical analysis[2], Percentage passing sieve: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO[3]	Classification: Unified[4]
			In	Lbs/ft3	Pct	Pct	Pct	Pct									Pct			
Madison sandy loam (Madison County): 2.6 miles west of Colnert on Ga. Hwy. 72 and north on dirt road for 2.6 miles and 200 yards west in field.	Residuum from gneiss and mica schist.	4-1	0-6	119	11	1.3	8.2	9.5	95	89	60	29	24	21	15	12	---	NP	A-2-4(0)	SM
		4-3	9-29	96	25	9.4	3.1	12.5	100	95	77	64	56	51	48	44	56	12	A-7-6(9)	MH
		4-5	50-57+	102	19	3.5	10.8	14.3	98	89	47	37	36	33	27	24	---	NP	A-4(0)	SM
Toccoa fine sandy loam (Madison (County): North from Paoli for 1.2 miles on Vineyard Baptist Church Road and 300 yards on Holly Creek flood plain.	Alluvial soil materials.	3-3	14-32	106	16	1.8	9.1	10.9	100	100	97	43	39	31	20	14	---	NP	A-4(0)	SM
		3-4	32-74	105	17	2.1	11.7	13.8	100	100	98	51	47	36	22	15	---	NP	A-4(0)	ML

[1]Based on the Moisture-density Relations of Soils Using 5.5-lb. Rammer and 12-in Drop, AASHTO Designation T 99, Method A (2).

[2]Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 mm in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[3]Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt 1, Ed 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

[4]Based on the Unified Soil Classification System (3).

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Appling	Clayey, kaolinitic, thermic Typic Hapludults
Ashlar	Coarse-loamy, mixed, thermic Typic Dystrochrepts
Cartecay	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Cecil	Clayey, kaolinitic, thermic Typic Hapludults
Davidson	Clayey, kaolinitic, thermic Rhodic Paleudults
Enon	Fine, mixed, thermic Ultic Hapludalfs
Grover	Fine-loamy, micaceous, thermic Typic Hapludults
Gwinnett	Clayey, kaolinitic, thermic Typic Rhodudults
Hiwassee	Clayey, kaolinitic, thermic Typic Rhodudults
*Iredell	Fine, montmorillonitic, thermic Typic Hapludalfs
Louisa	Loamy, micaceous, thermic, shallow Ruptic-Ultic Dystrochrepts
Madison	Clayey, kaolinitic, thermic Typic Hapludults
Mecklenburg	Fine, mixed, thermic Ultic Hapludalfs
Pacolet	Clayey, kaolinitic, thermic Typic Hapludults
Toccoa	Coarse-loamy, mixed, nonacid, thermic Typic Udifluvents
Wickham	Fine-loamy, mixed, thermic Typic Hapludults
Wilkes	Loamy, mixed, thermic, shallow Typic Hapludalfs

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