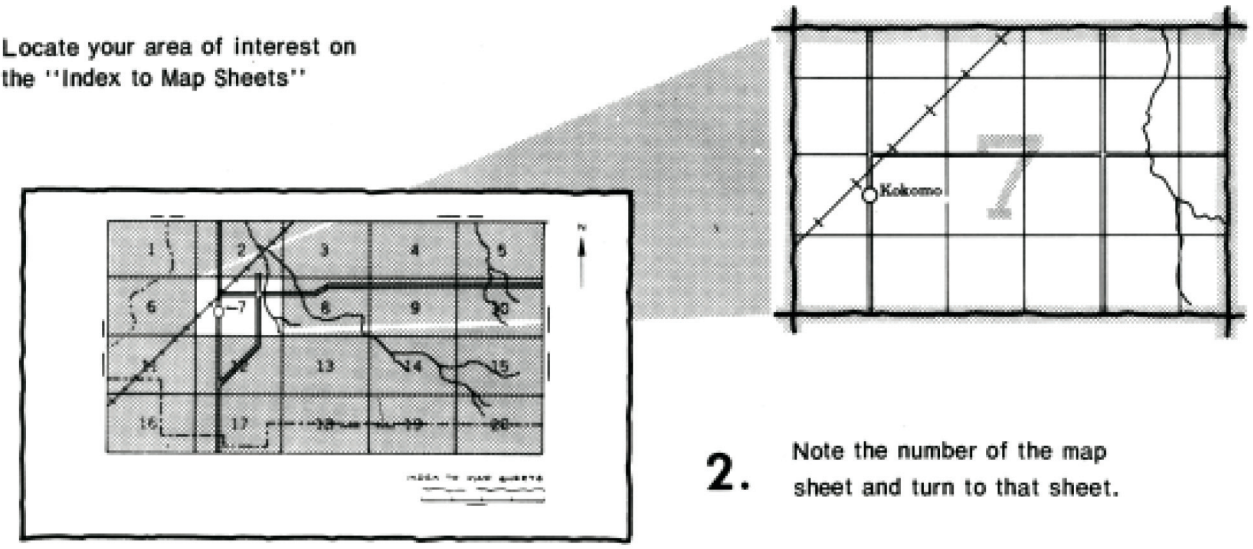
SOIL SURVEY OF

NACOGDOCHES COUNTY, TEXAS

United States Department of Agriculture
Soil Conservation Service and
Forest Service
in cooperation with
Texas Agricultural Experiment Station

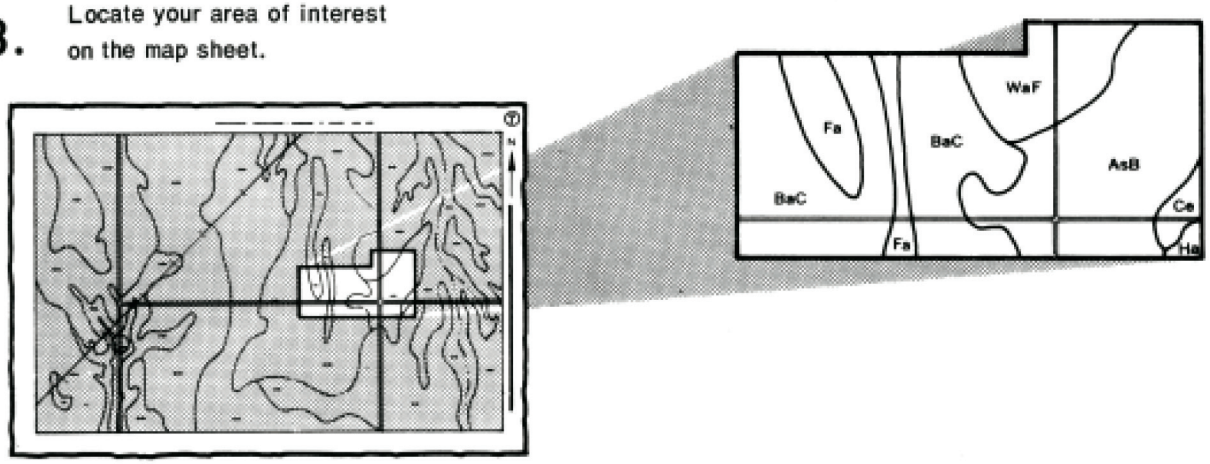
HOW TO USE

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

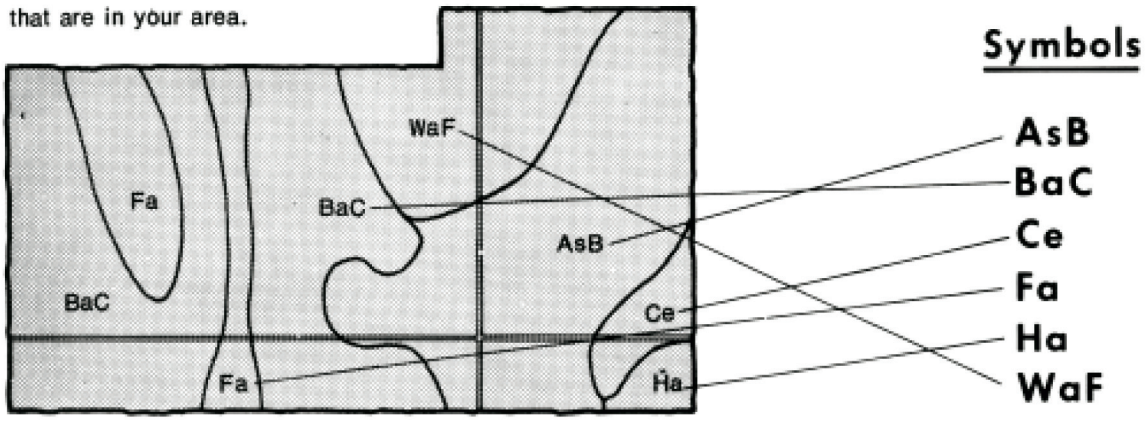


2. Note the number of the map sheet and turn to that sheet.

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

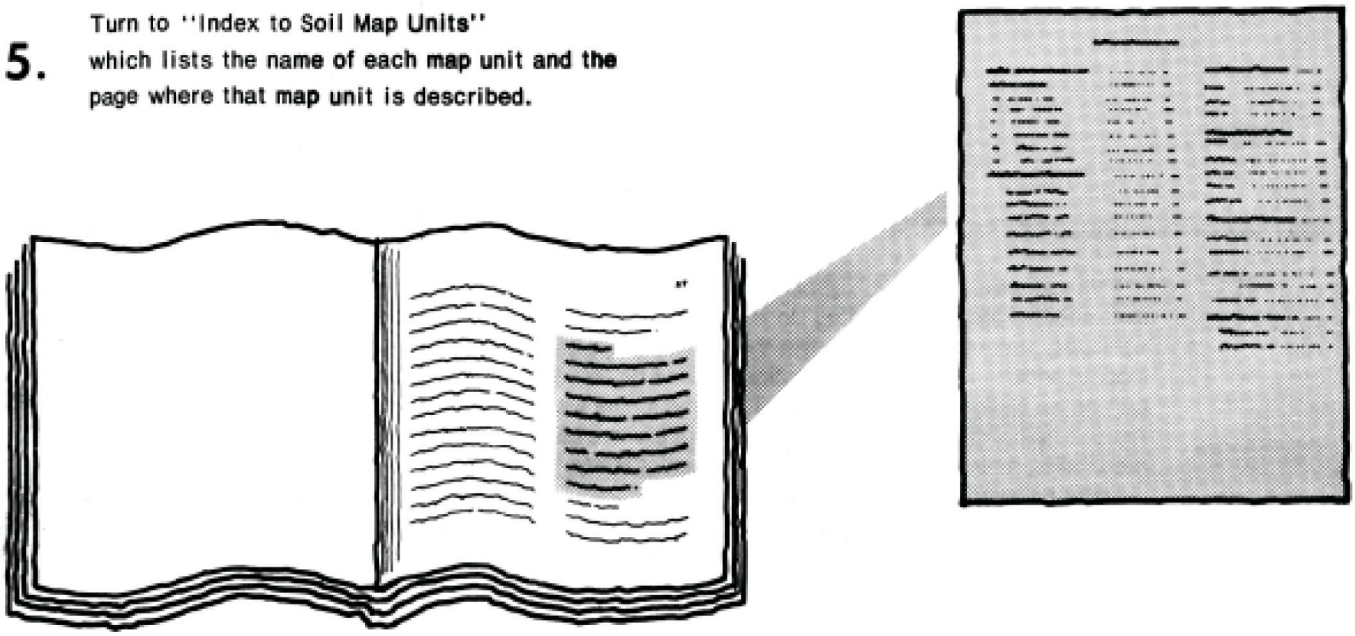


4. List the map unit symbols that are in your area.

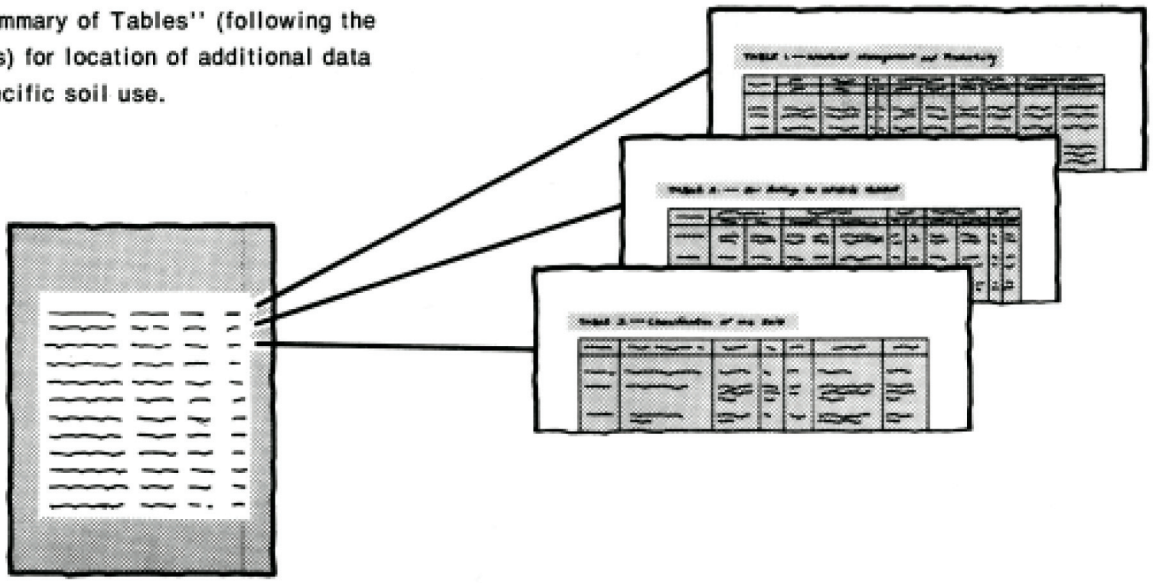


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1968-75. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and the Forest Service, in cooperation with the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Nacogdoches Soil and Water Conservation District.

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

Cover: Pasture in the foreground is on Sacul soil, and the well managed pine timber is on Lilbert soil.

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Issued February 1980

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Foreword

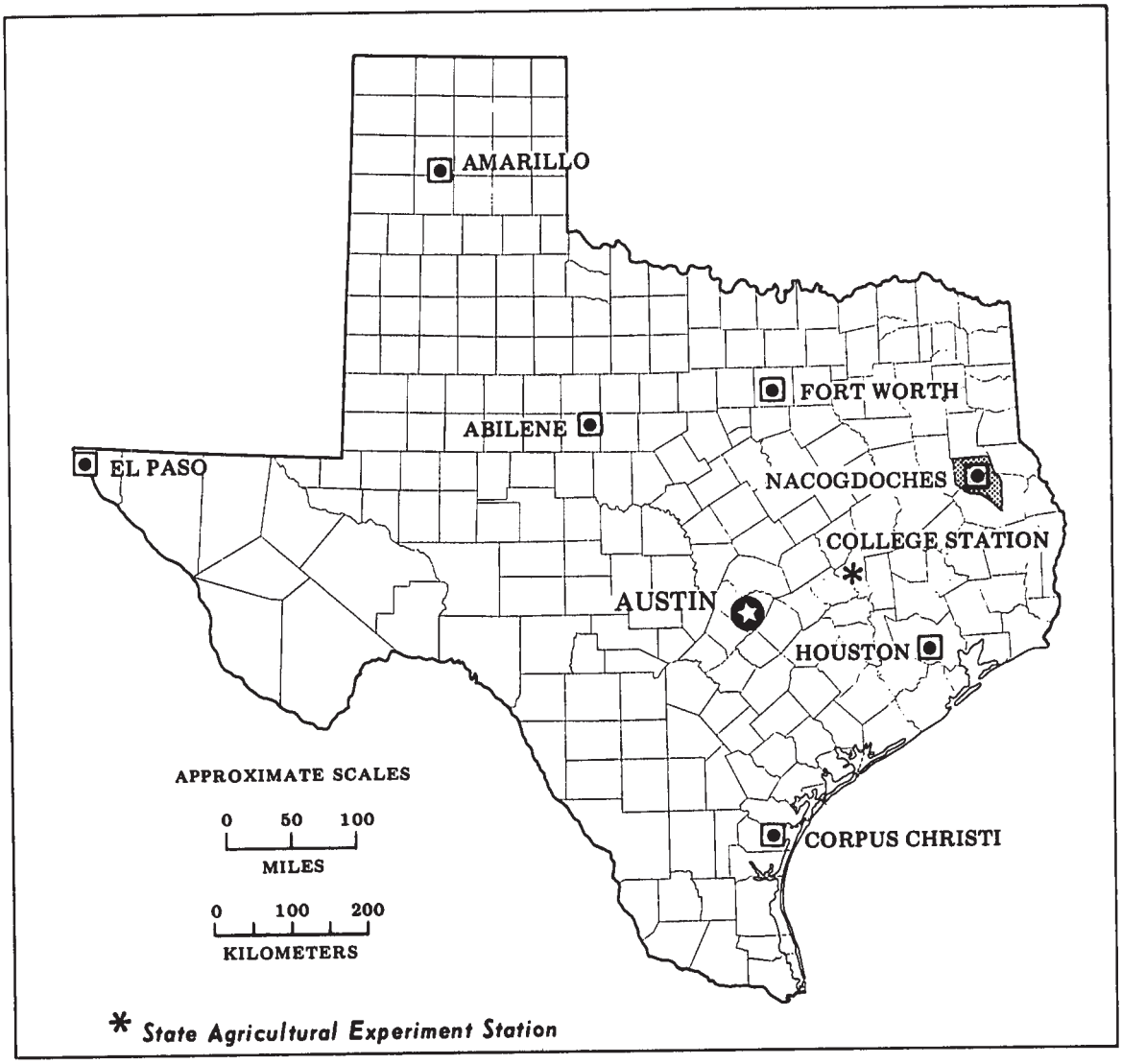
This soil survey contains information that can be used in land-planning programs in Nacogdoches County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Nacogdoches County in Texas.

SOIL SURVEY OF
NACOGDOCHES COUNTY, TEXAS

By Raymond Dolezel, Soil Conservation Service

Soils surveyed by Raymond Dolezel and Charles Fuchs,
soil scientists, Soil Conservation Service

United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
Texas Agricultural Experiment Station

NACOGDOCHES COUNTY is in the central part of east Texas. The county is roughly triangular and measures about 50 miles from northwest to southeast. It becomes narrower in the southeast at the confluence of the Angelina River and the Attoyac Bayou. The land surface is nearly level to steep. Elevation ranges from about 130 feet above sea level in the southeastern part of the county to more than 725 feet in the northwestern part near Cushing. The county is made up of 617,600 acres, including 17,816 acres of water.

Nacogdoches County is in the East Texas Timberlands Land Resource Area. The main soils formed under forest vegetation in a humid environment. Most soils are light colored and low in natural fertility. Nearly level areas are often wet, and steep sloping areas tend to erode easily.

The entire county has a dendritic drainage system with many large streams. In many sandy areas large springs flow continuously.

This is the third soil survey made in Nacogdoches County. The first was published in 1903. It covered an area of about 5 miles around the city of Nacogdoches and listed 5 map units. The second report was published in 1925 and included the entire county. It listed 36 map units and 17 soil series. Today, the need for information about agricultural and nonagricultural soils requires more detailed interpretations.

General nature of the survey area

The settlement, population, farming, natural resources, and climate of the county are described in this section.

Settlement and population

The city of Nacogdoches is one of the oldest settlements in Texas. It was named for a Caddo Indian chieftain. The earliest records indicate that in 1690 a Catholic mission was established near Nacogdoches under Spanish rule. The oldest land grants date from 1792. Between 1825 and 1830 an influx of settlers arrived. They were from various parts of the United States but mostly from the southeastern states. By 1833 there were 36 new settlers. Nacogdoches County was formed in 1836 and included the territory extending from the Sabine River to beyond the present site of the city of Dallas.

Initial settlement of the area was slow. However, by 1920 the population of the county had grown to about 28,457. In 1973 the estimated population was 41,600.

Farming

Most of the original settlers were farmers. They cleared the trees from the land and planted corn, cotton, and sugar cane. These crops grew well because of the high amount of rainfall.

The early settlers lived primitively. There were no grist mills or cotton gins and no accessible markets. Until 1840, little thought was given to surplus produce. At that time about 50 bushels of corn and 1 to 3 bales of cotton were produced on each acre of virgin soil.

By 1900 the principal crops were cotton, corn, oats, tomatoes, and potatoes. In addition, peaches were being produced. The peak year for acreages of cultivated crops was 1920, when there were 58,589 acres in cotton and 55,925 acres in corn. About 10,000 acres of such other crops as peanuts, oats, and cowpeas were also grown.

By 1976, less than 100 acres of cotton and less than 3,000 acres of corn were grown.

Natural resources

Woodland is the greatest natural resource of Nacogdoches County. The products of several sawmills range from finished lumber to cross ties. A large amount of wood is used for studs, fiberboard, and plywood.

Iron ore is another natural resource. Several areas of Trawick and Trawick-Bub soils on Flower Mountain and Button Mountain, near Cushing, have been surface mined. Sand for masonry, clay for bricks, and gravel for roads are also surface mined.

Water may be a resource of great importance in the future. Nacogdoches County has an abundance of water because of the high rainfall. In addition, many springs and streams, Lake Sam Rayburn, and other smaller lakes supply water.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Center, Texas in the period 1951 to 1975. 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 48 degrees F, and the average daily minimum temperature is 36 degrees. The lowest temperature on record, which occurred at Center on February 2, 1951, is 0 degrees. In summer the average temperature is 81 degrees, and the average daily maximum temperature is 93 degrees. The highest recorded temperature, which occurred on July 26, 1954, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

About 25 inches of rainfall, or approximately 50 percent of the total annual precipitation, generally occurs in April through September. This is the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 7.4 inches at Center on April 29, 1953. Thunderstorms occur on about 55 days each year, and most occur in summer.

Snowfall is rare. In 65 percent of the winters, there is no measurable snowfall. In 30 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 5 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in March.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. 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; and the kinds of rock. They dug many holes to study 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 plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management 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 can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map 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 can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

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

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, woodland, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Pasture includes areas in introduced grasses used for grazing. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, ballfields, and areas used for nature study and as wilderness.

Soil descriptions

The eleven general soil areas in Nacogdoches County are described on the following pages. About 97 percent of the county is in these units. The remaining 3 percent is water areas, mainly in the Sam Rayburn Reservoir.

Dominantly loamy upland soils

This group of map units makes up about 46 percent of the county. The major soils are in the Nacogdoches, Sacul, Cuthbert, Trawick, Kirvin, Woodtell, and Lacerda series. They have a loamy surface layer and a clayey subsoil. These soils are mainly well drained and moderately well drained. They have moderately slow and slow permeability and high or medium available water capacity. The Lacerda soils, however, are somewhat poorly drained and have very slow permeability.

Most of these soils are used for improved pastureland and woodland. Many areas of Nacogdoches soils were formerly used as cropland. Some soils are used as a local source of gravel.

Improved pasture consists of bahiagrass or bermudagrass and, on some soils, an early spring legume, for example, crimson clover. Most of these soils are best suited to pine trees for commercial use.

1. Nacogdoches-Trawick

Loamy, well drained, gently sloping to moderately steep soils that have moderately slow permeability; on uplands

The soils in this map unit are on broad, gently sloping to sloping convex ridges above strongly sloping and moderately steep side slopes. Locally, this unit is called the Redland Belt.

This map unit makes up about 21 percent of the county (fig. 1). About 48 percent of the unit is Nacogdoches soils and about 27 percent is Trawick soils. The rest is mainly Alto, Bub, and Chireno soils.

The Nacogdoches soils are gently sloping and sloping. They are on broad interstream divides. Slope is 1 to 8 percent. Typically, the surface layer is dark reddish brown fine sandy loam about 6 inches thick. Some soils have a gravelly surface layer. The subsoil, which extends to a depth of about 70 inches, is dark red clay. The underlying material is partially weathered glauconite. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

The Trawick soils are strongly sloping and moderately steep. They are on hills and side slopes. Slope is 8 to 20 percent. Typically, the surface layer is dark red fine sandy loam about 6 inches thick. Some soils have a gravelly surface layer. The subsoil, which extends to a depth of 46 inches, is dark red clay in the upper part and red clay that has bits of yellowish glauconite in the lower part. The underlying material is partially weathered greensand marl. Reaction is neutral in the surface layer and medium acid to strongly acid in the subsoil.

These soils have medium available water capacity.

The soils of minor extent are the Alto, Chireno, and Bub soils. The loamy Alto soils and the clayey, nearly level to gently sloping Chireno soils are moderately well drained. They are on saddles and colluvial foot slopes. The gravelly, clayey, sloping to steep Bub soils are well drained. They are on side slopes of hills and ridges.

Most of the soils in this map unit are used for pasture. A smaller area is used for woodland. At one time almost all of these soils were cultivated, but probably less than 5 percent is now used as cropland.

The less sloping soils have medium potential for cultivated crops. Low fertility and the hazard of erosion limit the area that is usable for cultivation. If slope is more than 8 percent, the hazard of erosion is so severe that cultivation is not practical.

These soils have medium potential for pastureland. Low fertility and the clayey texture are the main limitations.

The soils have medium potential for woodland. Although both pine and hardwood trees grow on these soils, most plantations are in loblolly pine. The clayey subsoil and high content of gravel of these soils and the shallow depth of the Bub soils in places are limitations to growth.

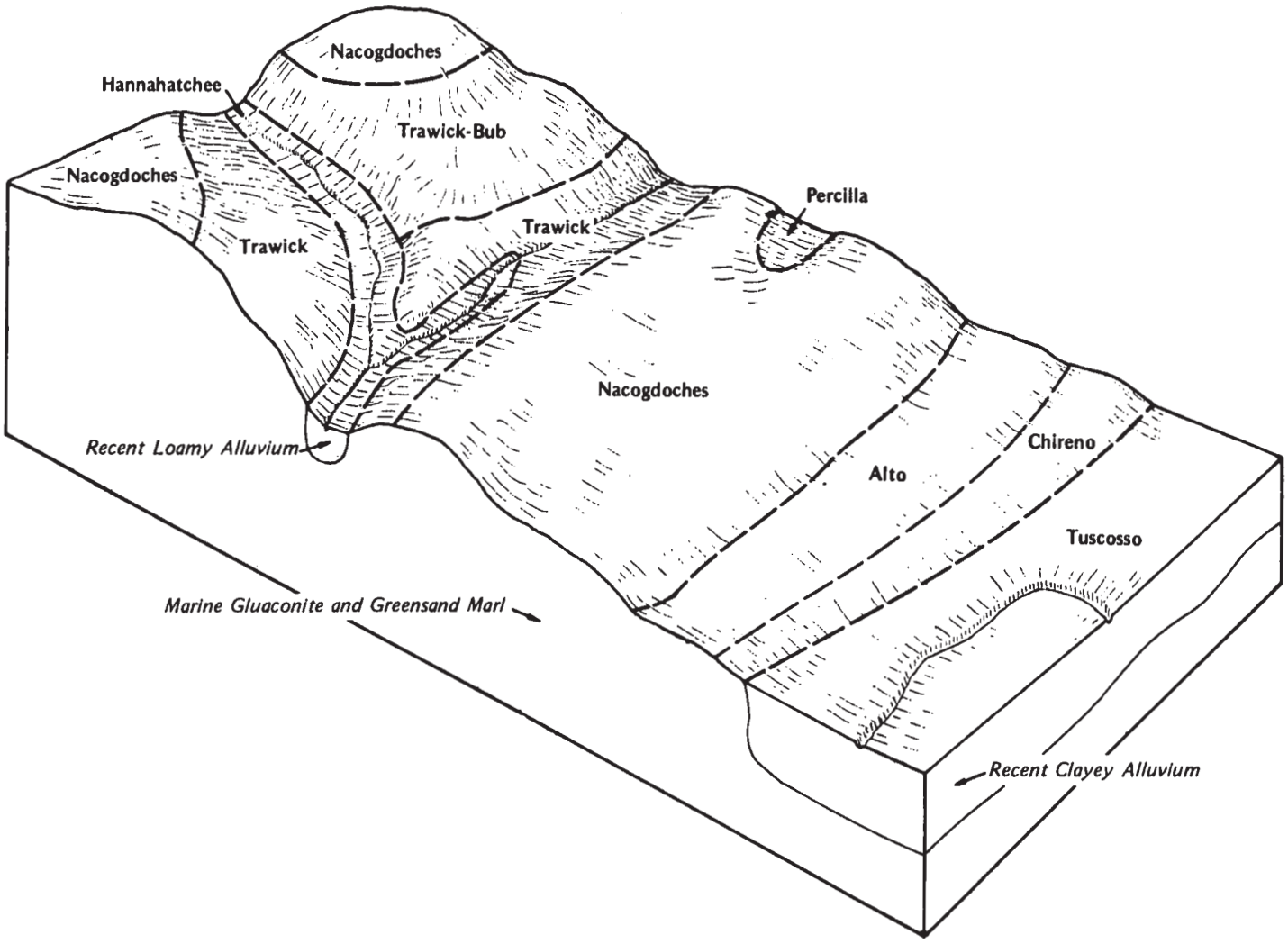


Figure 1.—Typical cross section of Nacogdoches-Trawick soils.

These soils have medium potential for urban uses. Low strength and steepness of slope are the most limiting factors. In places, the gravelly Nacogdoches and Trawick soils are good sources of gravel for construction. Moderately slow permeability and slope limit recreation uses.

2. Sacul-Cuthbert

Loamy, moderately well drained and well drained, gently sloping to moderately steep soils that have slow and moderately slow permeability; on uplands

The soils in this map unit are on broad, gently sloping concave heads of drainageways and on sloping to moderately steep side slopes above drainageways.

This map unit makes up about 18 percent of the county (fig. 2). About 36 percent of the unit is Sacul soils and about 34 percent is Cuthbert soils. The rest is mainly Bowie, Kirvin, and Ruston soils.

The Sacul soils are gently sloping to moderately steep. They are at the heads of drainageways. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 53 inches. From 7 to 21 inches it is red clay that has gray mottles in the lower part; from 21 to 53 inches it is mottled red, light brownish gray, strong brown, and yellowish red clay. The underlying material is made up of alternate layers of shale and sandstone. Reaction is strongly acid and very strongly acid in the surface layer and very strongly acid in the subsoil.

The Cuthbert soils are strongly sloping and moderately steep. They are on side slopes adjoining drainageways. Typically, the surface layer is fine sandy loam about 8 inches thick. It is very dark gray in the upper 4 inches and brown in the lower 4 inches. The subsoil, which extends to a depth of 29 inches, is red clay that has strong brown and light brownish gray mottles in the

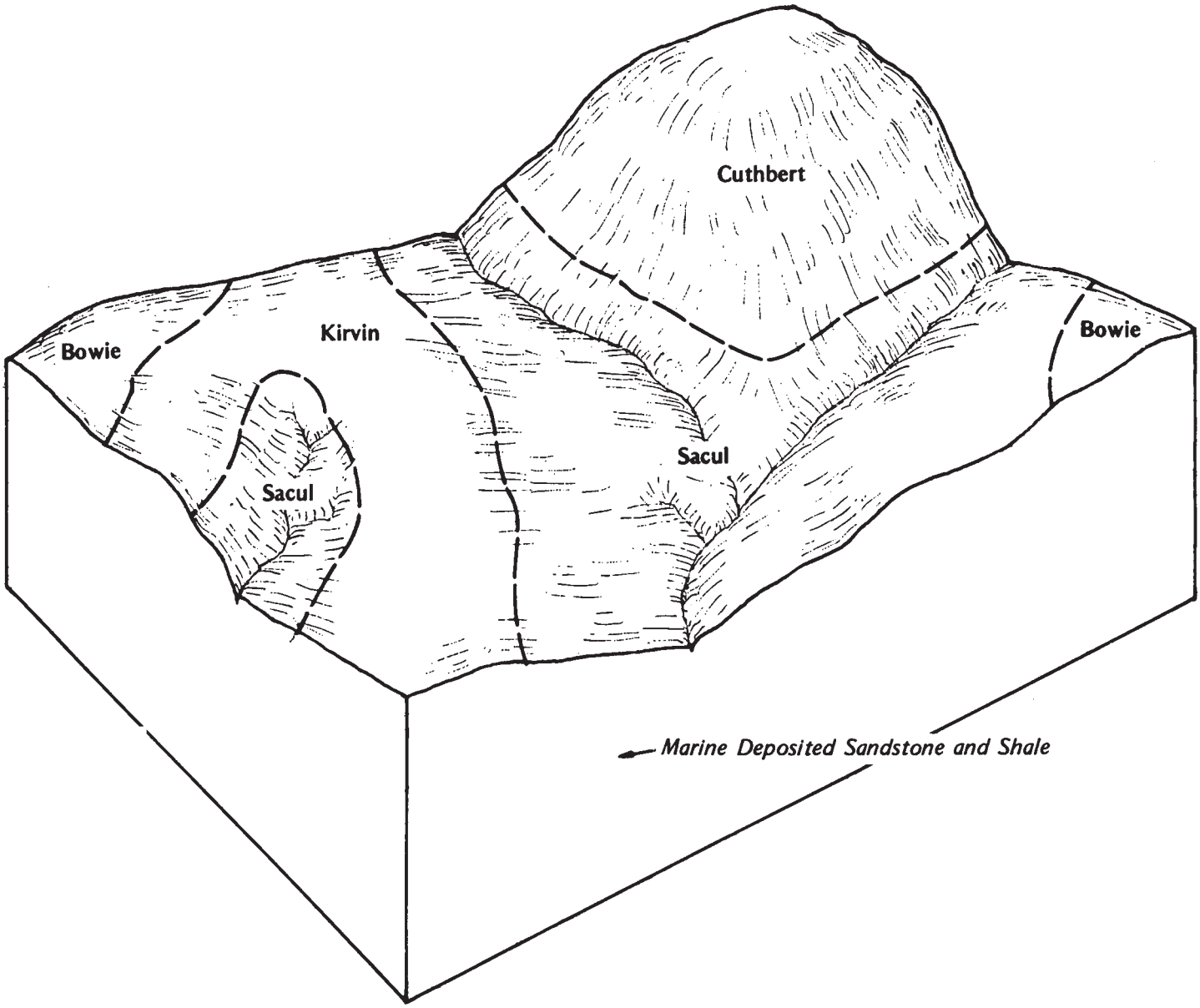


Figure 2.—Typical cross section of Sacul-Cuthbert soils.

lower part. The underlying material, to a depth of 34 inches, is red, strong brown, and grayish brown sandy loam and partially weathered alternate layers of soft sandstone and shale. Below this layer is sandstone interbedded with thin layers of shale.

The Sacul soils are moderately well drained and have slow permeability. The Cuthbert soils are well drained and have moderately slow permeability.

Of minor extent are the loamy, well drained Kirvin soils and Ruston soils and the moderately well drained Bowie soils. They are on broad, convex interstream divides.

Most of the soils in this map unit are used for woodland. A small area is used as pastureland.

These soils have low potential for cultivated crops. Low fertility and the hazard of erosion limit the area that is usable for cultivation. If slope is more than 5 percent,

the hazard of erosion is so severe that cultivation is not feasible.

The potential is medium for pasture. Low fertility and the clayey subsoil are the main limitations.

These soils have medium potential for woodland. Pine is predominant. Most old fields have reverted to stands of loblolly and shortleaf pine and a few hardwoods. The clayey subsoil is a limitation to growth.

Shrink-swell potential and steepness of slope are the most limiting factors for urban uses. Areas of the gravelly Cuthbert soils are potential sources of gravel for construction. Slow and moderately slow permeability and slope are the main limitations for most recreation uses.

3. Woodtell-Lacerda

Loamy and clayey, moderately well drained and somewhat poorly drained, nearly level to moderately steep soils that have very slow permeability; on uplands

The soils in this map unit are on broad interstream divides and on side slopes above drainageways.

This map unit makes up about 4 percent of the county (fig. 3). About 42 percent is Woodtell soils and about 30 percent is Lacerda soils. The rest is mainly Etoile and Naclina soils.

The Woodtell soils are gently sloping to moderately steep. Typically, the surface layer is dark brown and brown very fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of 56 inches, is dense clay. It is red with grayish mottles in the upper part and light brownish gray with reddish mottles in the lower part. The underlying material is shale. Reaction is strongly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

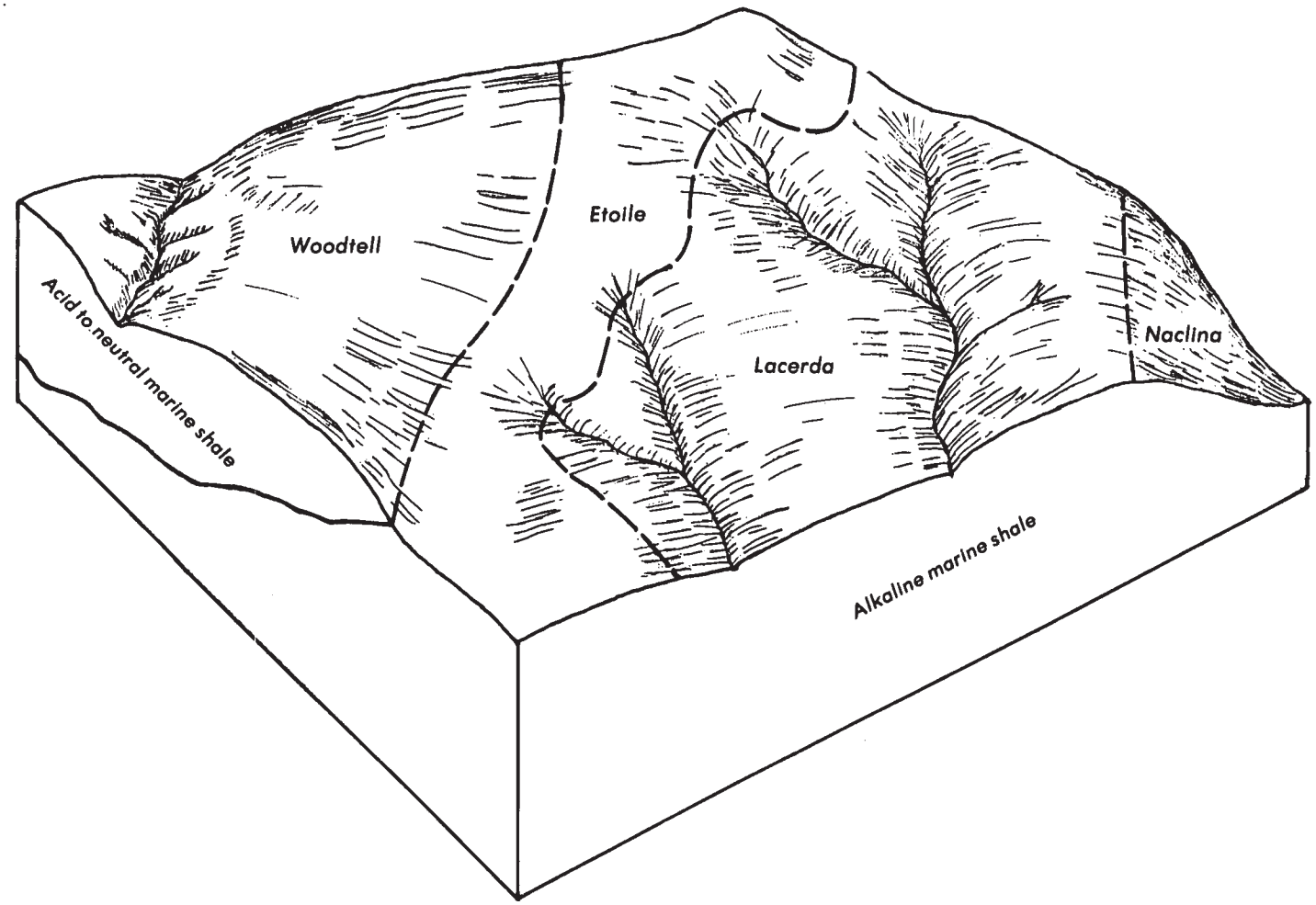


Figure 3.—Typical cross section of Woodtell-Lacerda soils.

The Lacerda soils are nearly level to moderately steep. Typically, the surface layer is dark grayish brown clay loam about 2 inches thick. The subsoil extends to a depth of 72 inches. From 2 to 8 inches it is yellowish brown silty clay loam mottled with light brownish gray. From 8 to 72 inches it is dense clay that is grayish brown in the upper part, gray in the middle part, and brownish to yellowish in the lower part. It is mottled throughout with strong brown, yellowish red, red, and grayish brown. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

The Woodtell soils are moderately well drained, and the Lacerda soils are somewhat poorly drained. Both soils have medium available water capacity.

Of minor extent are the loamy, somewhat poorly drained Etoile soils on landscapes that are similar to the Woodtell and Lacerda soils and the clayey Naclina soils which are sloping to moderately steep on side slopes.

The soils in this map unit are used almost entirely for woodland.

These soils have low potential for cultivated crops. Low fertility, the hazard of erosion, and the dense clayey subsoil are management concerns.

The potential is medium for pastureland. Low fertility and the dense clayey subsoil are the main limitations.

These soils have low potential for woodland mainly because of the dense clayey subsoil. Hardwoods and pine trees grow in these soils; however, they produce low yields.

These soils have low potential for most urban and recreation uses. The dense clayey subsoil, shrink-swell potential, wetness, and very slow permeability are the main limitations.

4. Sacul-Kirvin

Loamy, moderately well drained and well drained, gently sloping and sloping soils that have slow and moderately slow permeability; on uplands

The soils in this map unit are at the heads of drainageways and on broad convex ridges and interstream divides.

This map unit makes up about 3 percent of the county. About 44 percent of the unit is Sacul soils and about 36 percent is Kirvin soils. The rest is mainly Bowie and Ruston soils.

The Sacul soils are gently sloping. They are at the heads of drainageways. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 53 inches. From 7 to 21 inches it is red clay that is mottled with light brownish gray in the lower part; from 21 to 53 inches it is mottled red, light brownish gray, strong brown, and reddish yellow clay. The underlying material is interbedded shale and sandstone. Reaction is strongly acid and very strongly acid in the surface layer and very strongly acid in the subsoil.

The Kirvin soils are gently sloping and sloping. They are on broad convex ridges and interstream divides. Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 52 inches. From 12 to 38 inches it is red clay; from 38 to 52 inches it is mottled red and strong brown clay that has bits of gray shale. Reaction is medium acid and strongly acid in the surface layer and strongly acid in the subsoil.

The Sacul soils are moderately well drained. They have slow permeability and high available water capacity. The Kirvin soils are well drained. They have moderately slow permeability and medium available capacity.

Of minor extent are the loamy, gently sloping to sloping Bowie soils that are moderately well drained and the Ruston soils that are well drained. They are on broad interstream divides.

Most of the soils in this unit are used for pasture. At one time most of these soils were used for cultivated crops.

These soils have low potential for cultivated crops. Low fertility and the hazard of erosion limit the area that is usable for cultivation.

The potential is medium for pastureland. Low fertility and the clayey subsoil are the main limitations.

These soils have medium potential for woodland. Loblolly pine is dominant. There are some shortleaf pine and various hardwoods; however, the clayey subsoil limits growth.

These soils have low potential for urban uses. Shrink-swell potential of the clayey subsoil and low strength are the main limitations. In some places, the gravelly Kirvin soils are a good source of gravel for construction. Slow and moderately slow permeability are the main limitations for recreation uses. The soils, however, are well suited to recreation uses in other ways.

Dominantly sandy upland soils

This group of map units make up about 31 percent of the county. The major soils are in the Darco, Lilbert, Cuthbert, Tonkawa, and Tenaha series. Most of these soils have a thick sandy surface layer and a loamy or sandy subsoil. The Cuthbert soils, however, have a loamy surface layer and clayey subsoil. These soils are well drained to excessively drained. They have moderately slow to rapid permeability and low or medium available water capacity.

These soils are used mainly for improved pastureland and woodland. Some areas are used for cropland. Watermelons are one of the main specialty crops. Some areas are excavated and are a source of sand for construction or fill material.

Improved pasture consists mainly of bermudagrass and lovegrass. Most of the formerly idle cropland has been planted to slash pine or loblolly pine. Watermelons

and, to a lesser extent, peanuts and some truck crops are the main cultivated crops.

5. Lilbert-Darco

Sandy, well drained, gently sloping to sloping soils that have moderately slow and moderate permeability; on uplands

The soils in this map unit are on ridges, in low convex areas, and on interstream divides.

This map unit makes up about 15 percent of the county (fig. 4). About 40 percent of the unit is Lilbert soils and 35 percent is Darco soils. The rest is soils of minor extent.

The Lilbert soils are on low convex areas and ridges. Typically, the surface layer is loamy fine sand about 28 inches thick. It is dark grayish brown in the upper part and pale brown in the lower part. The subsoil, which extends to a depth of 72 inches, is strong brown sandy clay loam that has yellowish red mottles in the upper part and yellowish red and light brownish gray mottles in the lower part. Reaction is medium acid to very strongly acid in the surface layer and very strongly acid in the subsoil.

The Darco soils are on interstream divides. Typically, the surface layer is brown and pale brown loamy fine sand about 48 inches thick. The subsoil, which extends to a depth of 72 inches or more, is yellowish red sandy clay loam that has brown mottles in the lower part. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

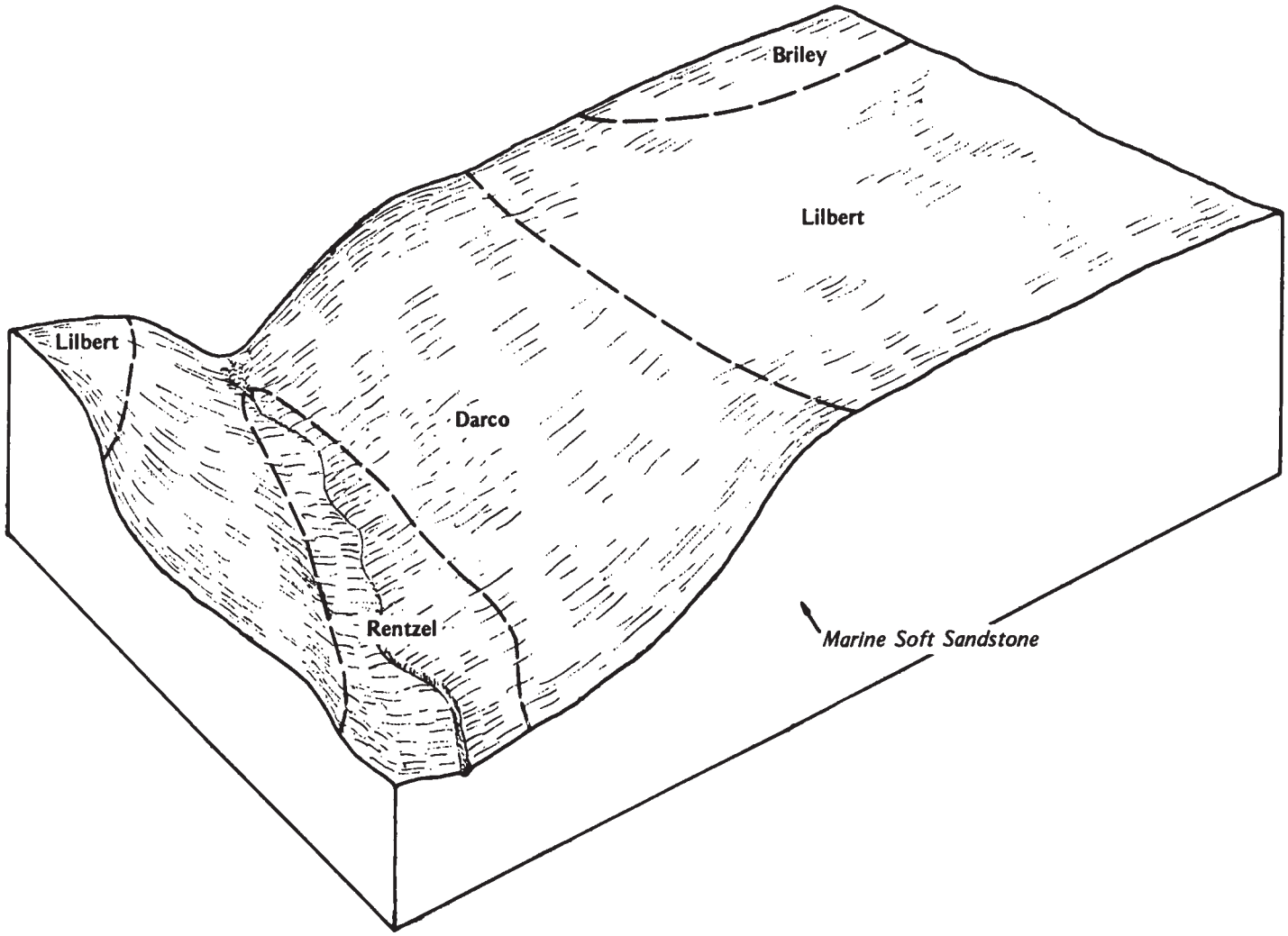


Figure 4.—Typical cross section of Lilbert-Darco soils.

The Lilbert soils have moderately slow permeability and medium available water capacity. The Darco soils have moderate permeability and low available water capacity.

Of minor extent are mainly the Briley, Betis, and Rentzel soils. The sandy, well drained Briley soils are gently sloping to sloping. They are on slightly convex areas. The sandy, somewhat excessively drained Betis soils are nearly level to sloping. They are on broad interstream divides. The sandy, somewhat poorly drained Rentzel soils are in concave areas near small drainageways.

Most of the soils in this map unit are used for pasture. A small area is used for cultivated crops and timber.

The less sloping soils have medium potential for cultivated crops; however, the potential is high for watermelons. Low fertility and the droughty, sandy surface layer are limitations. If slope is more than 8 percent, the hazard of erosion is so severe that cultivation is not feasible.

These soils have medium potential for pastureland. Low fertility and droughtiness caused by medium to low available water capacity are the main limitations.

The potential is medium for woodland. Loblolly pine and shortleaf pine are dominant; however, slash pine has been planted in many old fields. Low available water capacity limits growth.

These soils have high potential for urban uses and medium potential for recreation uses. The sandy surface layer is the main limitation.

6. Cuthbert-Tenaha

Loamy and sandy, well drained, sloping to moderately steep soils that have moderately slow and moderate permeability; on uplands

The soils of this map unit are on broad hills, side slopes on hillsides, and above drainageways.

This map unit makes up about 10 percent of the county. About 40 percent of the unit is Cuthbert soils, and about 35 percent is Tenaha soils. The rest is mainly Briley, Kirvin, and Ruston soils.

The Cuthbert soils are on side slopes adjoining drainageways. Typically, the surface layer is fine sandy loam about 8 inches thick. It is very dark gray in the upper 4 inches and brown in the lower 4 inches. The subsoil, which extends to a depth of 29 inches, is red clay that has strong brown and light brownish gray mottles in the lower part. The underlying material, to a depth of 34 inches, is red, strong brown, and grayish brown sandy loam and partially weathered alternate layers of soft sandstone and shale. Below this is sandstone interbedded with thin layers of shale. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

The Tenaha soils are on hills and side slopes. Typically, the surface layer is loamy fine sand about 22 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil, which extends to a depth of 46 inches, is yellowish red sandy clay loam that has strong brown mottles in the upper part and red mottles in the lower part. The underlying material is soft sandstone. Reaction is slightly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

Both of these soils are well drained and have medium available water capacity. The Cuthbert soils have moderately slow permeability, and the Tenaha soils have moderate permeability.

Of minor extent are the sandy Briley soils and the loamy Ruston soils on interstream divides and the Kirvin soils on convex areas. These soils are well drained.

The soils in this map unit are used almost entirely for woodland. Steepness of slope limits use as pastureland and prohibits use as cropland.

These soils have low potential for cultivated crops. Low fertility and the hazard of erosion are limitations to cultivation.

These soils have medium potential for pasture. Low fertility and slope are the main limitations.

The potential is low for woodland. Shortleaf pine and loblolly pine are dominant. Steepness of slope and medium available water capacity limit the growth of trees.

These soils have low potential for urban uses. Slope is the main limiting factor. The soils are suitable for most recreation uses; however, steepness of slope and the sandy surface layer of the Tenaha soils are limitations.

7. Tonkawa

Sandy, excessively drained, gently sloping to moderately steep soils that have rapid permeability; on uplands

The soils in this map unit are on broad, slightly convex interstream divides and on long narrow side slopes. Slope is 1 to 20 percent.

This map unit makes up about 3 percent of the county. About 50 percent of the unit is Tonkawa soils. The rest is mainly Betis, Darco, and Osier soils.

Typically, the Tonkawa soils are fine sand to a depth of 80 inches or more. The surface layer is dark grayish brown and yellowish brown. The underlying material is brownish yellow and yellow in the upper part and very pale brown in the lower part. Reaction is extremely acid.

These soils have low available water capacity.

Of minor extent are the sandy Betis, Darco, and Tenaha soils which are somewhat excessively drained. The Betis soils are on smooth to convex interstream divides, and the sloping to moderately steep Darco and Tenaha soils are on side slopes. Also included are the wet, sandy, nearly level to gently sloping Osier soils which are poorly drained. They are on foot slopes or in colluvial areas.

The soils in this map unit are used mainly for woodland, although they produce mostly shortleaf trees of low growth. A few areas are used for pastureland and cropland.

The less sloping soils have low potential for cultivated crops. Watermelons, however, are well suited. Low fertility, low available water capacity, and excessive slope limit the area usable for cultivation.

The potential is low for pastureland. Low fertility and low available water capacity are the main limitations.

These soils are poorly suited to woodland. Shortleaf pine and sandjack oak are dominant (fig. 5). A few old fields have been planted to loblolly pine and slash pine. Low available water capacity limits the growth of trees.

These soils have high potential for most urban uses. Some areas are a good source of sand for construction. Because of the loose sandy surface layer, the potential is low for recreation sites.

8. Darco-Tenaha

Sandy, well drained, gently sloping to moderately steep soils that have moderate permeability; on uplands

Figure 5.—Shortleaf pine and sandjack oak in an area of Tonkawa fine sand.

The soils in this map unit are on broad, slightly convex interstream divides and on side slopes above drainageways.

This map unit makes up about 3 percent of the county. About 40 percent of the unit is Darco soils and about 30 percent is Tenaha soils. The rest is mainly Briley, Lilbert, and Rentzel soils.

The Darco soils are gently sloping to moderately steep. They are on broad interstream divides and side slopes. Slope is 5 to 20 percent. Typically, the surface layer is brown and pale brown loamy fine sand about 48 inches thick. The subsoil is yellowish red sandy clay loam that has brown mottles in the lower part. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

The Tenaha soils are sloping to moderately steep. They are on side slopes. Slope is 5 to 20 percent. Typically, these soils have a surface layer of loamy fine sand about 22 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil, which extends to a depth of 46 inches, is yellowish red sandy clay loam that has strong brown mottles in the upper part and red mottles in the lower part. The underlying material is soft sandstone. Reaction is slightly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

The Darco soils have low available water capacity, and the Tenaha soils have medium available water capacity.

Of minor extent are the sandy, gently sloping to sloping Briley and Lilbert soils which are well drained. They are on broad interstream divides. Also included are the sandy Rentzel soils. They are on foot slopes near small streams.

The soils in this map unit are used mainly for woodland and pastureland.

These soils have medium potential for cultivated crops. The potential is high for watermelons. Low fertility and low to medium available water capacity limit the area that is usable for cultivation. In the more sloping areas, the hazard of erosion is so severe that cultivation is not feasible.

The potential is medium for pasture. Low fertility and low to medium available water capacity are the main limitations.

These soils have low potential for woodland. Shortleaf pine and loblolly pine are dominant. A few old fields of Darco soils have been planted to slash pine. Low available water capacity limits the growth of trees.

These soils have medium potential for most urban uses. Steepness of slope is the most limiting factor. Potential is medium for recreation uses. The sandy surface layer is the main limitation.

Dominantly loamy bottomland soils

This group of map units makes up about 14 percent of the county. The major soils are in the Mantachie, Mariet-

ta, Tuscosso, and Hannahatchee series. They have a loamy surface layer and a loamy or clayey subsoil. These soils are moderately well drained to somewhat poorly drained. They have moderate and moderately slow permeability and high available water capacity. Flooding is frequent.

These soils are used for woodland and pastureland. They are rarely used for cultivated crops because of the hazard of flooding. Improved pasture mainly consists of bahiagrass and white clover. Most of these soils are best suited to hardwoods, but some soils produce large quantities of commercial pine trees.

9. Mantachie-Marietta

Loamy, somewhat poorly drained and moderately well drained, frequently flooded soils that have moderate permeability; on bottom lands

The soils in this map unit are on nearly level flood plains that are frequently flooded.

This map unit makes up about 9 percent of the county. About 38 percent of the unit is Mantachie soils and about 33 percent is Marietta soils. The rest is mainly luka soils.

The Mantachie soils are on flood plains of the Attoyac and Angelina Rivers and other smaller streams. Typically, the surface layer is about 3 inches thick. It is dark grayish brown clay loam that has gray and strong brown mottles. The subsoil extends to a depth of 60 inches. From 3 to 15 inches it is mottled, yellowish brown, brown, light brownish gray, and strong brown sandy clay loam; from 15 to 60 inches it is gray clay loam that has brownish mottles. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

The Marietta soils are on flood plains of many small streams in the county. A few areas are on the Attoyac and Angelina River flood plains. Typically, the surface layer is brown and dark brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 36 inches. From 12 to 16 inches it is dark brown sandy clay loam that has light brownish gray mottles; from 16 to 37 inches it is mottled, light brownish gray, brown, and dark grayish brown sandy clay loam. The underlying material is mottled, light brownish gray, dark yellowish brown, and strong brown sandy clay loam. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

The Mantachie soils are somewhat poorly drained, and the Marietta soils are moderately well drained. Both soils have high available water capacity.

Of minor extent are the loamy luka soils. They are mainly on the bottom lands of small streams.

The Mantachie soils in this map unit are used almost entirely for woodland. The Marietta soils are used mainly for improved pastureland.

Because of flooding, these soils have low potential for most cultivated crops.

These soils have high potential for pastureland.

The potential is high for woodland. Water willow, red oak, sweetgum, and hickory are dominant; however, pine trees grow well on the Marietta and luka soils. Under natural conditions the Mantachie soils are suited only to hardwood trees.

These soils have low potential for most urban and recreation uses. Flooding is the main limitation.

10. Tuscosso-Hannahatchee

Loamy, moderately well drained, frequently flooded soils that have moderately slow and moderate permeability; on bottom lands

The soils in this map unit are on flood plains that drain the Redland Belt.

This map unit makes up about 5 percent of the county. About 50 percent of the unit is Tuscosso soils and about 40 percent is Hannahatchee soils. The rest is mainly luka soils.

The Tuscosso soils are on the flood plains of the major creeks draining the Redland Belt. Typically, the surface layer is dark reddish brown clay loam about 8 inches thick. The subsoil extends to a depth of 53 inches. From 8 to 15 inches it is yellowish red silty clay, and from 15 to 53 inches it is yellowish red clay that has grayish brown mottles in the upper part and gray mottles in the lower part. The underlying material is red clay that has dark gray mottles.

The Hannahatchee soils are on the flood plains of smaller streams which drain the Redland Belt. Typically, the surface layer is reddish brown loam about 9 inches thick. The subsoil extends to a depth of 45 inches. From 9 to 21 inches it is yellowish red loam, and from 21 to 45 inches it is yellowish red sandy clay loam. The underlying material is yellowish red sandy clay loam. Reaction is medium acid throughout.

The Tuscosso soils have moderately slow permeability, and the Hannahatchee soils have moderate permeability. Both soils have high available water capacity.

Of minor extent are the loamy luka soils. They are mainly on the bottom lands of small streams.

The soils in this unit are used almost entirely for pastureland.

These soils have low potential for cultivated crops because of flooding.

The potential is high for pasture.

These soils have high potential for woodland. Hardwoods are dominant; however, good stands of loblolly pine and shortleaf pine occur.

These soils have low potential for urban and recreation uses because of flooding.

Dominantly loamy terrace soils

This group of soils has one map unit and makes up about 6 percent of the county. The major soils are in the Attoyac, Bernaldo, and Besner series. They have a

loamy surface layer and a loamy subsoil. These soils are well drained. They have moderate permeability and high available water capacity.

These soils are used mainly for pastureland. Some areas are used for woodland and cropland.

Pasture consists of improved grasses and clovers. The main cultivated crops are corn and truck crops. These soils produce excellent commercial timber.

11. Attoyac-Bernaldo-Besner

Loamy, well drained, nearly level to gently sloping soils that have moderate permeability; on terraces

The soils in this map unit are on broad terraces mainly along the Angelina River.

This map unit makes up about 6 percent of the county (fig. 6). About 30 percent of the unit is Attoyac soils, about 27 percent is Bernaldo soils, and about 23 percent is Besner soils. The rest is mainly Mollville, Bienville, and Woden soils.

The Attoyac soils are on convex areas. Typically, the surface layer is reddish brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 75 inches. From 9 to 17 inches it is red fine sandy loam, and from 17 to 75 inches it is dark red and red sandy clay loam. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

The Bernaldo soils are in concave lows and are intricately mixed with the Besner soils on mounds. Typically, the surface layer is fine sandy loam about 14 inches thick. It is brown in the upper 6 inches and pale brown in the lower 8 inches. The subsoil extends to a depth of 80 inches. From 14 to 47 inches it is strong brown sandy clay loam, and from 47 to 80 inches it is yellowish brown loam that has strong brown and light gray mottles. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

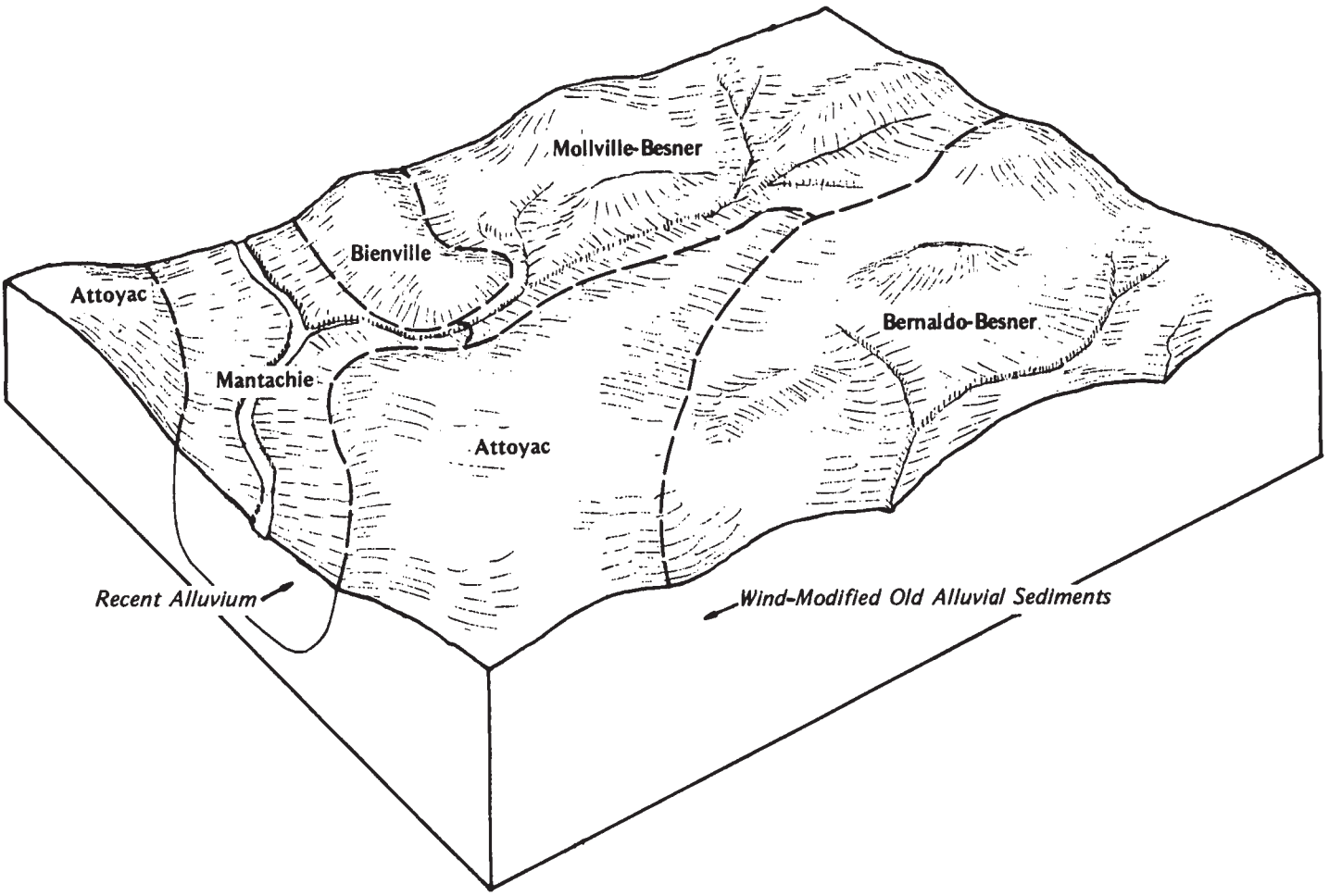


Figure 6.—Typical cross section of Attoyac-Bernaldo-Besner soils.

The Besner soils are in a complex with Bernaldo soils on mounds or with Mollville soils in concave low areas. Typically, the surface layer is loam about 38 inches thick. It is dark grayish brown in the upper 2 inches, brown in the next 7 inches, and pale brown in the lower 29 inches. The subsoil extends to a depth of 80 inches. From 38 to 55 inches it is strong brown loam that has pale brown mottles, and from 55 to 80 inches it is reddish yellow loam that has red, very pale brown, and yellowish brown mottles. Reaction is slightly acid to strongly acid in the surface layer and strongly acid in the subsoil.

Of minor extent are the well drained, loamy Woden soils on smooth, slightly convex terraces; the somewhat excessively drained, sandy Bienville soils on natural levees; and the poorly drained Mollville soils in depressional areas.

The soils in this map unit are used mainly for pastureland. Some areas are used for woodland and cropland.

These soils have high potential for cropland, pastureland, woodland, and for urban and recreation uses. Some areas of this map unit are good sources of topsoil.

Broad land use considerations

In general, the kinds of soils, the steepness of slope, the wetness, and the flood hazard are the most important factors that influence land use in Nacogdoches County.

About 62 percent of the county is used as woodland, about 22 percent is used for pasture, and about 6 percent is used as cropland. About 80 percent of the county has a medium to high potential for woodland.

In the past few years the acreage used for cropland, woodland, and recreation has remained fairly constant. However, there has been an appreciable increase for urban uses.

The general soils information in this section and the more detailed information in the following sections can be used as a guide in planning orderly growth and development of the county. This information is especially helpful in determining which lands are best suited to the desired use.

Soil maps for detailed planning

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Nacogdoches clay loam, 1 to 8 percent slopes, is one of several phases in the Nacogdoches series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Mollville-Besner complex 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 similar interpretations can be made for use and management. The pattern and portion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Angelina soils, frequently flooded, is an undifferentiated group in this survey area.

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

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

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables")

give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

2—Alto fine sandy loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, upland soil is on saddles between higher areas and on colluvial areas above bottom lands. Slope is mainly 1 to 2 percent but ranges to 4 percent. Areas are mostly 10 to 50 acres.

Typically, the surface layer of this Alto soil is reddish brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 72 inches. From 9 to 15 inches it is brown clay loam that has yellowish red mottles; from 15 to 24 inches it is strong brown clay that has yellowish red mottles; and from 24 to 44 inches it is yellowish brown clay that has strong brown and yellowish red mottles. From 44 to 72 inches the subsoil is yellowish red clay loam that has strong brown mottles. Reaction is slightly acid in the surface layer and medium acid and slightly acid in the subsoil.

This soil is moderately well drained. It has moderately slow permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of lower lying Chireno soils which have a black surface layer and small areas of Nacogdoches soils on convex slopes which have a dark red subsoil. The included soils make up less than 10 percent of any mapped area.

Most areas of this Alto soil are used as pasture.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production.

The potential is high for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

The potential is medium for pine and hardwood trees. Loblolly pine and red oak are dominant. The clayey subsoil is the main limitation to growth. Longleaf uniola, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses and medium for recreation uses. Wetness of the soil during the cool season is the main limitation.

This soil is in capability subclass IIIe, and woodland suitability group 3o7.

3—Alto clay loam, 0 to 1 percent slopes. This deep, nearly level, upland soil is on low saddles between higher lying areas. Some areas are adjacent to bottom lands. Areas are generally less than 30 acres but range from 5 to 70 acres.

Typically, the surface layer of this Alto soil is dark brown clay loam about 8 inches thick. The subsoil extends to a depth of 60 inches. From 8 to 30 inches it is yellowish brown clay that has red mottles, and from 30 to 60 inches it is strong brown clay that has red mottles. Reaction is slightly acid.

This soil is moderately well drained. It has moderately slow permeability and high available water capacity. The soil is slightly wet early in spring, and wetness hampers seedbed preparation. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Chireno soils that have a black surface layer. These soils are on lower spots in the landscape. Also included are areas of Nacogdoches soils on slight elevations. These soils have a dark red subsoil. The included soils make up less than 10 percent of any mapped area.

This Alto soil is used almost entirely for pasture.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

The potential is low for pine and hardwood trees. Loblolly pine and red oak are dominant. The clayey subsoil is the main limitation to growth. Longleaf uniola, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses and medium for recreation uses. Wetness during the cool season is the main limitation.

This soil is in capability class I and woodland suitability group 4c2.

4—Alto clay loam, 1 to 3 percent slopes. This deep, gently sloping, upland soil is on saddles between higher areas, and in colluvial areas above bottom lands. Slope is mainly less than 2 percent but ranges to 3 percent. Areas are generally 10 to 60 acres.

Typically, the surface layer of this Alto soil is reddish brown clay loam 8 inches thick. The subsoil extends to a depth of 73 inches. From 8 to 34 inches it is yellowish red clay loam that has red mottles in the lower part, and from 34 to 48 inches it is strong brown clay that has red mottles. From 48 to 73 inches the subsoil is yellowish brown clay that has yellowish red and olive mottles in the lower part. Reaction is slightly acid to a depth of 48 inches.

This soil is moderately well drained. It has moderately slow permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Chireno soils which have a black surface layer and small areas of Nacogdoches soils which have a red subsoil. The included soils make up less than 10 percent of any mapped area.

This Alto soil is used mainly for pasture.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

The potential is low for pine and hardwood trees. Loblolly pine and red oak are dominant. The clayey subsoil is the main limitation to growth. Longleaf uniola, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses and medium for recreation uses. Wetness during the cool season is the main limitation.

This soil is in capability subclass IIe and woodland suitability group 4c2.

5—Angelina soils, frequently flooded. These nearly level, wet, bottom land soils are in large concave areas in the Angelina River flood plain. They are covered with water except during the summer months. These soils are not uniform and do not occur in a regular pattern. The texture of the surface layer is variable. It is sandy clay loam, loam, and fine sandy loam. Areas of these soils are generally 50 to 300 acres.

Typically, these Angelina soils are light gray sandy clay loam that have yellowish brown, strong brown, and red mottles to a depth of 32 inches. Below that, to a depth of 60 inches, is mottled, light gray, red, and strong brown clay loam. A 3-inch layer of decomposing organic matter covers the surface. Reaction is very strongly acid throughout the profile.

These soils are very poorly drained and are ponded. They have slow permeability and high available water capacity. Water stands on or flows across the surface of these soils for 8 to 10 months in most years. Periodically, these soils become a flooded marsh.

Included with these soils in mapping are small narrow areas along old stream channels that are covered with recent deposits of coarse sand.

These Angelina soils are used only for wildlife habitat. They are not suitable for commercial timber or useful pasture. Giant sawgrass and buttonbush are the main vegetation.

These soils are not suitable for urban or recreation uses.

These soils are in capability subclass VIw. They are not assigned to a woodland suitability group.

6—Attoyac fine sandy loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, upland soil is on broad terraces near most of the major streams throughout the county. It formed in old alluvial deposits that have been modified by wind.

Typically, the surface layer of this Attoyac soil is fine sandy loam about 9 inches thick. The subsoil extends to a depth of 75 inches. From 9 to 17 inches it is dark red fine sandy loam, and from 17 to 75 inches it is sandy clay loam that is dark red in the upper part and red in the lower part.

This soil is well drained. It has moderate permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Bernaldo soils in slightly concave spots, areas of Woden soils, and a few areas of Attoyac soils with 4 to 8 percent slopes. The included soils make up about 20 percent of any mapped area.

This Attoyac soil is used mainly for pastureland and woodland.

This soil has high potential for cropland. Use of crop residue (fig. 7) and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production. Terracing and contouring are needed if extensive cultivation is planned.

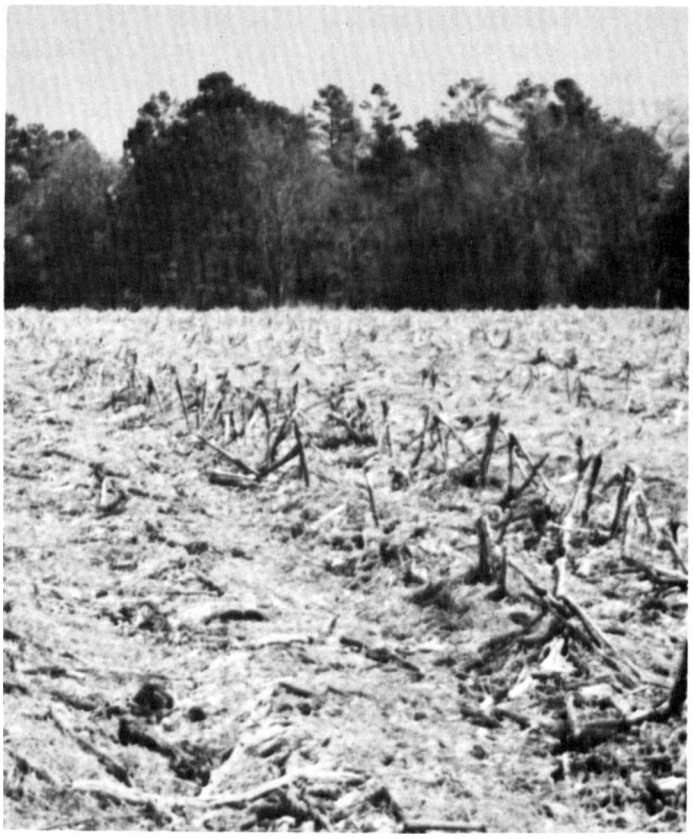


Figure 7.—Crop residue in a field of Attoyac fine sandy loam, 0 to 4 percent slopes.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine, sweetgum, and red oak are dominant. Longleaf uniola, purpletop, pinehill bluestem, beaked panicum, and diverse shrubs and sedges are the main understory vegetation.

The potential of this soil is high for urban and recreation uses.

This soil is in capability subclass IIe and woodland suitability group 2o7.

7—Attoyac fine sandy loam, 8 to 15 percent slopes. This deep, sloping to moderately steep, upland soil is on side slopes of terraces above some areas of bottom land. It formed in old alluvial deposits that have been modified by wind. Areas are long and narrow.

Typically, the surface layer of this Attoyac soil is reddish brown fine sandy loam about 5 inches thick overlying a subsoil of red sandy clay loam that extends to a depth of 72 inches. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

This soil is well drained. It has moderate permeability and high available water capacity. Runoff is medium to rapid, and the hazard of erosion is severe.

Included with this soil in mapping are areas of Sacul soils and areas of Attoyac soils from which the surface layer has eroded. The included soils make up less than 15 percent of any mapped area.

Most areas of this Attoyac soil are used as improved pastureland and woodland.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production. Terracing and contouring are needed if extensive cultivation is planned.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass.

The potential is high for pine and hardwood trees. Loblolly pine, sweetgum, and red oak are dominant. Longleaf uniola, purpletop, pinehill bluestem, beaked panicum, and diverse shrubs and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Steepness of slope is the main limitation.

This soil is in capability subclass IVe and woodland suitability group 2o7.

8—Attoyac-Urban land complex, 0 to 4 percent slopes. This complex of nearly level to gently sloping soils and Urban land is on terraces along creeks. Attoyac soils make up about 40 percent of the complex; Urban land, 40 percent; and other soils, 20 percent. Attoyac soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of these Attoyac soils is fine sandy loam about 9 inches thick. It is brown in the upper 5 inches and reddish brown in the lower 4 inches. The subsoil extends to a depth of 72 inches. From 9 to 40 inches it is dark red sandy clay loam, and from 40 to 70 inches it is red sandy clay loam. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Much of the downtown area of the city of Nacogdoches is in this complex. Near the South Loop, many large industrial plants have been constructed.

Included with these soils in mapping are small concave areas of Bernaldo soils.

The Attoyac soils have high potential for urban uses. In some areas of Urban land, the surface layer of the soil was removed during cut and fill operations and structures were built on the red sandy clay loam subsoil. The soil from the surface layer was used as topsoil for adjoining lots. The more sloping areas spread with this topsoil have a moderate hazard of erosion.

This complex is not placed in a capability subclass or woodland suitability group.

9—Bernaldo fine sandy loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping, upland soil is on broad terraces near the major streams. It formed in old alluvial deposits that have been modified by wind. Some areas have low mounds, especially those in virgin forested areas.

Typically, the surface layer of this Bernaldo soil is fine sandy loam about 14 inches thick. It is brown in the upper few inches and pale brown in the lower part. The subsoil extends to a depth of 80 inches. From 14 to 47 inches it is strong brown sandy clay loam, and from 47 to 80 inches it is yellowish brown sandy clay loam that has strong brown and light gray mottles. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

This soil is well drained. It has moderate permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this Bernaldo soil in mapping are slightly concave areas of a soil similar to Bernaldo soils that is slightly wetter. Also included are mounds of Besner soils that have a surface layer more than 20 inches thick. The included soils make up about 25 percent of any mapped area.

Most areas of this soil are used for pastureland and woodland.

This soil has high potential for cropland. Use of crop residue and cover crops help to maintain soil tilth. Applications of fertilizer and lime are needed for high produc-

tion. Terracing and contouring are needed if extensive cultivation is planned.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine, sweetgum, and red oak are dominant. Longleaf uniola, pinehill bluestem, beaked panicum, and diverse shrubs and sedges are the main understory vegetation.

The potential of this soil is medium for urban uses and high for most recreation uses. Low strength is the main limitation for urban uses.

This soil is in capability subclass IIe and woodland suitability group 2o7.

10—Bernaldo-Besner complex. These deep, nearly level upland soils are on broad terraces. These terraces are old alluvial deposits that have been modified by wind. Areas of these soils are generally less than 200 acres.

Bernaldo soils make up from 40 to 65 percent of the unit, Besner soils make up from 30 to 55 percent, and other soils make up less than 20 percent.

The Besner soils are on mounds, and the Bernaldo soils are in lows that are interconnected and continuous. Mounds range from 2 to 4 feet above the lows. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, Bernaldo soils have a fine sandy loam surface layer 14 inches thick that is brown in the upper part and pale brown in the lower part. The upper part of the subsoil, to a depth of 47 inches, is strong brown sandy clay loam. The lower part, to a depth of 80 inches, is yellowish brown loam mottled with strong brown and light gray. Reaction is slightly acid in the surface layer and medium acid in the subsoil.

Typically, the Besner soils have a brownish fine sandy loam surface layer 30 inches thick that is brown to a depth of 5 inches, pale brown to 12 inches, and very pale brown to 30 inches. Below this, to a depth of 80 inches, is strong brown loam that is mottled with gray in the lower part. Reaction is slightly acid in the upper part of the surface layer and strongly acid below.

Bernaldo and Besner soils are well drained. These soils have moderate permeability and high available water capacity. Runoff is slow. The hazard of water erosion is slight.

Included with these soils in mapping are areas of grayish Mollville soils on microdepressions in the lows and areas of Woden soils on the crests of broader mounds. The Woden soils have a reddish subsoil. The included soils make up less than 20 percent of the complex.

Most areas of this Bernaldo-Besner complex are used for pastureland and woodland.

The soils in this complex have high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production.

The potential is high for pastureland and hayland. Grazing management and proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

These soils have high potential for pine and hardwood trees. Loblolly pine, sweetgum, and red oak are dominant. Longleaf uniola, pinehill bluestem, diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of these soils is medium for urban uses and high for most recreation uses. Low strength is the main limitation for urban uses.

This complex is in capability subclass IIe and woodland suitability group 2o7.

11—Betis loamy fine sand, 0 to 8 percent slopes. This deep, nearly level to sloping soil is on broad interstream divides. Slope ranges from 0 to 8 percent but is mainly 2 to 4 percent. Areas of this soil range from 5 to about 1,100 acres but are mainly 80 to 150 acres.

Typically, the surface layer of this Betis soil is about 37 inches thick. It is brown loamy fine sand that has areas of pale brown mottles. The subsoil extends to a depth of 80 inches. From 37 to 57 inches it is strong brown loamy fine sand that has very pale brown mottles, and from 57 to 80 inches it is very pale brown loamy fine sand that has thin bands of yellowish brown fine sandy loam. Reaction is slightly acid and medium acid in the surface layer.

This soil is somewhat excessively drained. It has rapid permeability and low available water capacity. Runoff is very slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Tonkawa soils and Darco soils. Tonkawa soils, which occur in a pattern similar to that of the Betis soils, are fine sand to a depth of more than 80 inches. Darco soils, which are generally on slightly convex areas, have a loamy subsoil between the depth of 40 and 72 inches. The included soils make up less than 20 percent of any mapped area.

Areas of this Betis soil are used mainly for woodland and pastureland.

This soil has low potential for most cropland. However, the potential for watermelons is high. Use of crop residue and cover crops helps to maintain soil tilth and increase available water capacity. Applications of fertilizers and lime are needed for high production. Lack of water is the main limitation.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and lovegrass. The droughty sand is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The droughty sand, which causes high seedling mortality and slow growth, is the main limitation. Longleaf uniola, pinehill bluestem, arrowfeather threeawn, and diverse shrubs are the main understory vegetation.

The potential of this soil is high for most urban uses. The sandy surface layer mainly limits recreation uses.

This soil is in capability subclass IIIs and woodland suitability group 4s3

12—Bienville loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping, upland soil is on terraces that are mainly adjacent to the bottom lands of the Angelina and Attoyac Rivers. Other areas are adjacent to large creeks. Areas of this soil are oblong and are generally less than 50 acres.

Typically, this Bienville soil is loamy fine sand to a depth of 72 inches (fig. 8). It ranges from brown in the upper part of the profile to strong brown in the lower part. Yellowish red thin layers are in the lower part. Reaction is slightly acid to medium acid.

This soil is somewhat excessively drained. It has moderately rapid permeability and medium available water capacity. Runoff is slow, and the hazard of erosion is slight. This soil has a fluctuating water table at a depth of 4 to 8 feet. The soil receives subsurface moisture from the higher lying, more sloping areas. Some areas of Bienville soils may flood about once in 50 years.

Included with this soil in mapping are small areas of a soil which is similar to Bienville soils. This soil has a more clayey subsoil between the depth of 40 and 80 inches and is slightly wetter. Also included are soils in old stream channels that vary in texture and are wetter than Bienville soils. The included soils make up less than 15 percent of any mapped area.

This Bienville soil is used mainly for pastureland and timberland.

This soil has high potential for cropland, and is especially suited to watermelons. Use of crop residue and cover crops help to maintain soil tilth and to increase available water capacity. Applications of fertilizers and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass.

The potential is medium for pine trees. Loblolly pine is dominant; however, many old fields have been planted to slash pine. The droughty, sandy surface layer is the main limitation to growth. Longleaf uniola, pinehill bluestem, little bluestem, and diverse panicums and shrubs are the main understory vegetation.

The potential of this soil is high for urban uses. The sandy surface layer is the main limitation for recreation uses.

This soil is in capability subclass IIIs and woodland suitability group 3s2.

13—Bowie fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping to sloping soil is on broad, slightly convex interstream divides. It occurs in nearly all upland parts of the county. Areas of this soil average about 50 acres.

Typically, the surface layer of this Bowie soil is fine sandy loam about 7 inches thick. It is brown in the upper 3 inches and pale brown in the lower 4 inches. The subsoil extends to a depth of 72 inches. It is sandy clay loam that is strong brown in the upper part and yellowish brown in the lower part. Red and gray mottles are

Figure 8.—Profile of Bienville loamy fine sand. Many thin bands, called lamellae, are prominent in this soil.

common in the lower part. Reaction is strongly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is moderately well drained. It has moderate permeability and high available water capacity. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Ruston soils on ridges and knobs that have a reddish subsoil. Also included, on a few knobs or ridges, are areas of Kirvin soils which have a red clayey subsoil and a few areas of Lilbert soils which have a surface layer of loamy fine sand 20 to 40 inches thick. The included soils make up about 20 percent of any mapped area.

Most areas of this Bowie soil are used for pastureland and woodland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

The potential is medium for pine trees. Loblolly pine is dominant; however, many old fields have been planted to slash pine. Longleaf uniola, little bluestem, diverse panicums, and shrubs and sedges are the main understory vegetation.

The potential of this soil is medium for urban uses and high for recreation uses. Moderate permeability is the main limitation for urban uses.

This soil is in capability subclass IVe and woodland suitability group 3o1.

14—Briley loamy fine sand, 1 to 8 percent slopes. This deep, nearly level to sloping soil is on uplands. Areas are generally on convex interstream divides, and are less than 30 acres.

The surface layer of this Briley soil is loamy fine sand about 23 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of 72 inches. It is yellowish red sandy clay loam that has mottles of strong brown and red in the lower part. Reaction is medium acid in the surface layer and very strongly acid in the subsoil.

This soil is well drained. It has moderate permeability and medium available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Lilbert soils which are lower in the landscape than Briley soil. Also included are a few spots of a soil similar to Briley soil that has a surface layer less than 20 inches thick. The included soils make up less than 10 percent of any mapped area.

This Briley soil is used mainly for pastureland and woodland.

This soil has high potential for cropland. It is especially suited to the production of watermelons. Use of crop residue and cover crops helps to maintain soil tilth and to increase the available water capacity. Grasses and legumes should be used in the crop rotation if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and proper use of fertilizers and lime are needed for high production of improved bermudagrass. The sandy surface layer is the main limitation.

The potential is medium for pine trees. Loblolly pine and shortleaf pine are dominant; however, many fields have been planted to slash pine. The droughty, sandy surface layer, which causes seedling mortality and slow growth, is the main limitation. Longleaf uniola, pinehill bluestem, broomsedge bluestem, and diverse panicums and shrubs are the main understory vegetation.

The potential of this soil is high for most urban uses and medium for recreation uses. The sandy surface layer is the main limitation for recreation uses.

This soil is in capability subclass IIIe and woodland suitability group 3s2.

15—Chireno clay loam, 0 to 2 percent slopes. This deep, nearly level to gently sloping upland soil is in colluvial areas on lower slopes in the Redland Belt.

Typically, the surface layer of this Chireno soil is about 18 inches thick. It is black clay loam in the upper 7 inches; mottled very dark gray and very dark grayish brown clay in the next 5 inches; and very dark grayish brown clay that has brown and very dark gray mottles in the lower 6 inches. The subsoil extends to a depth of 62 inches. From 18 to 31 inches it is brown clay that has strong brown mottles; from 31 to 47 inches it is yellowish brown clay that has dark grayish brown mottles; from 47 inches to a depth of 62 inches it is faintly mottled, olive brown and dark grayish brown clay. Reaction is mildly alkaline in the surface layer and mildly alkaline and moderately alkaline in the subsoil.

This soil is moderately well drained. It has slow permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Alto soils which are on the higher parts of the landscape. These areas are 5 acres or less. The included soils make up less than 5 percent of any mapped area.

Most areas of this Chireno soil are used for pastureland; however, a small acreage is used for cropland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertiliz-

ers and lime are needed for high production of crimson clover and bahiagrass.

The potential is low for pine trees. Loblolly and shortleaf pine are dominant. The clayey texture of the soil is the main limitation. Longleaf uniola, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses and medium for recreation uses. The high shrink-swell potential is the main limitation for urban uses. The clayey surface layer mainly limits recreation use.

This soil is in capability subclass IIs and woodland suitability group 4c2.

16—Cuthbert fine sandy loam, 8 to 20 percent slopes. This moderately deep, strongly sloping to moderately steep soil is on higher areas that lead down to the major drainageways. Areas are long and narrow and are parallel to the bottomland for several miles.

Typically, the surface layer of this Cuthbert soil is fine sandy loam that is very dark gray in the upper 4 inches and brown in the lower 4 inches. The subsoil is dark red clay to a depth of 29 inches and red clay that has light brownish gray and pale brown mottles in the lower part. The underlying material extends to a depth of 34 inches. It is red, strong brown, and grayish brown sandy loam and partially weathered sandstone and grayish brown and light brownish gray partially weathered shale. Below this layer are alternate layers of soft sandstone and shale (fig. 9). Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are areas of gently sloping Kirvin soils that are deeper than Cuthbert soils and have a subsoil of redder hue and areas of Tenaha soils that have a sandy surface layer more than 20 inches thick. The Tenaha soils are near the base of slopes. Also included are areas of Sacul soils at the heads of drainageways that are deeper than Cuthbert soils and have a subsoil that has red and gray mottles. These included soils make up less than 20 percent of any mapped area.

This Cuthbert soil is used mainly for woodland. It is not suitable for cultivated crops because of slope and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass. Steepness of slope and medium available water capacity are the main limitations.

The potential is low for pine trees. Shortleaf pine and loblolly pine are the main species; the clayey subsoil, however, is a limitation to growth. Longleaf uniola, pinehill bluestem, and diverse panicums, shrubs, and sedges are the most common understory vegetation.

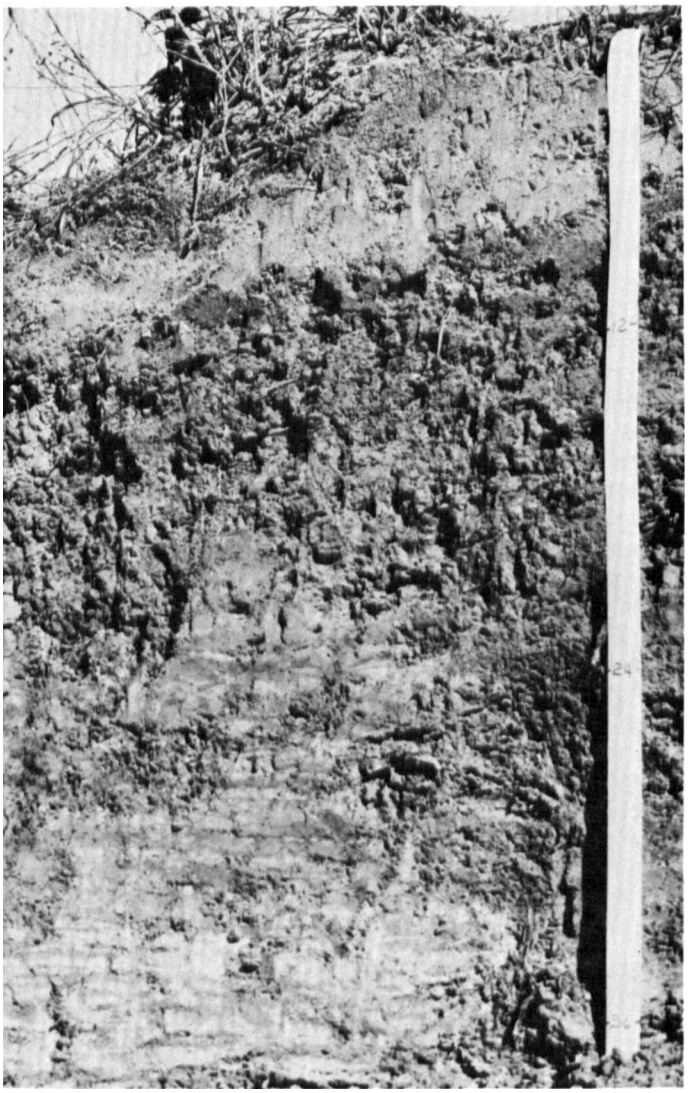


Figure 9.—Cuthbert fine sandy loam, 8 to 20 percent slopes, showing moderately deep development over alternate layers of sandstone and shale.

The potential of the soil is low for most urban uses and medium for recreation uses. Slope is the main limitation. Many areas of this soil are suited to wildlife habitat (fig. 10).

This soil is in capability subclass VIe and woodland suitability group 4c2.

17—Cuthbert gravelly fine sandy loam, 8 to 20 percent slopes. This moderately deep, strongly sloping to moderately steep upland soil is in areas that lead down to the major drainageways and in areas on convex hills. These areas are long and narrow and are generally less than 100 acres.

Figure 10.—Many areas of Cuthbert fine sandy loam, 8 to 20 percent slopes, provide good woodland wildlife habitat.

Typically, the surface layer of this Cuthbert soil is brown gravelly fine sandy loam about 6 inches thick. The subsoil to a depth of 20 inches is yellowish red clay. From 20 to 31 inches it is yellowish red clay that has red mottles and some spots of gray unweathered shale in the lower part. The underlying material is reddish sandstone that is stratified with thin layers of gray shale. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe (fig. 11).

Included with this soil in mapping are small areas of Kirvin soils on the tops of some ridges. Also included are areas of Sacul soils and areas of Cuthbert soils that have slopes of 20 to 35 percent. The included soils make up less than 20 percent of any mapped area.

Most areas of this Cuthbert soil are used for woodland. The soil is not suitable for cultivated crops because of steepness of slope and the hazard of erosion.

The soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, clover, and bahiagrass. Steepness of slope and medium available water capacity are the main limitations.

The potential is low for pine trees. Loblolly pine and shortleaf pine are dominant; however, the clayey subsoil and the gravelly surface layer are limitations to growth. Longleaf uniola, pinehill bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

Figure 11.—Severe erosion on Cuthbert gravelly fine sandy loam, 8 to 20 percent slopes.

The potential of this soil is low for most urban uses and medium for recreation uses. Steepness of slope is the main limitation.

This soil is in capability subclass VIe and woodland suitability group 4r2.

18—Cuthbert stony fine sandy loam, 5 to 30 percent slopes. This moderately deep, sloping to steep, upland soil is in areas that lead down to major drainageways. The areas are long and narrow and are generally less than 80 acres. In about 30 to 35 percent of this map unit, large stones are on the surface or are part of the surface layer. These stones range from 3 inches to 6 or 7 feet in diameter.

Typically, the surface layer of this Cuthbert soil is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red clay to a depth of 28 inches and contains pieces of gray shale in the lower part. The underlying material is made up of alternate layers of gray shale and reddish sandstone. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is severe.

Included with this soil in mapping are areas of Cuthbert gravelly fine sandy loam and Cuthbert fine sandy loam that do not have stones on the surface or in the surface layer.

Most areas of this Cuthbert soil are used for woodland. The soil is not suitable for cultivated crops because of the strong to steep slopes, the stoniness, and the hazard of erosion.

This soil has low potential for pastureland and hayland. Intensive management is required. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant; however, slope, the clayey subsoil, and the gravelly and stony surface layer are limitations. Longleaf uniola, pinehill bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses and medium for recreation uses. Steepness of slope and stoniness are the main limitations.

This soil is in capability subclass VIe and woodland suitability group 4r2.

19—Darco loamy fine sand, 1 to 8 percent slopes. This deep, gently sloping to sloping, upland soil is on the highest lying landscapes in the county. Areas, which are generally on slightly convex interstream divides, are about 45 acres. Drains are very few because of the absence of runoff.

Typically, the surface layer of this Darco soil is loamy fine sand about 48 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil, to a depth of 80 inches, is yellowish red sandy clay loam that has brown mottles in the lower part. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

This soil is well drained. It has moderate permeability and low available water capacity. Runoff is slow because of the moderate permeability of the surface layer. The hazard of erosion is slight.

Included with this soil in mapping are areas of Lilbert soils and Briley soils that each have a sandy surface layer less than 40 inches thick. These soils are on convex knobs or ridges. The included soils make up less than 15 percent of any mapped area.

In the past, most areas of this Darco soil were cultivated. Watermelons, which are the main tilled crop in the county, are still produced. At the present time, however,

this soil is mostly planted to pine or improved pasture (fig. 12).

This soil has medium potential for cropland, and it is especially suited to watermelons. Use of crop residue and cover crops helps to maintain soil tilth and to increase the available water capacity. Grasses and legumes should be used in the crop rotation if extensive cultivation is planned. Applications of fertilizer and lime are also needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass or lovegrass. The droughty, sandy surface layer is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant; however, many old fields have been planted to slash pine. The sandy surface layer, which causes seedling mortality and slow growth, is the main limitation. Longleaf uniola, pinehill bluestem, purpletop, and diverse shrubs are the main understory vegetation.

The potential of this soil is high for urban uses. There are no major limitations. The sandy surface layer is the main limitation for recreation uses.

This soil is in capability subclass IIIe and woodland suitability group 4s3.

20—Darco loamy fine sand, 8 to 20 percent slopes. This deep, strongly sloping and moderately steep soil is in areas that are parallel to drainageways. Springs occur at the base of some of the slopes in this soil. Areas are long and narrow and are about 50 acres.

Typically, the surface layer of this Darco soil is loamy fine sand about 50 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil, to a depth of 72 inches, is strong brown sandy clay loam.

Figure 12.—A well-managed field of Coastal bermudagrass for pasture and hay on Darco loamy fine sand, 1 to 8 percent slopes.

Reaction is medium acid in the surface layer and strongly acid in the subsoil.

This soil is well drained. It has moderate permeability and low available water capacity. Runoff is slow because of the moderate permeability of the surface layer. The hazard of erosion is severe.

Included with this soil in mapping are areas of Tenaha soils that have a sandy surface layer less than 40 inches thick. These soils are on ridges. Also included are areas of Rentzel soils which are slightly wet. They are on the lowest part of slopes. Many of the springs in this map unit arise in areas of the Rentzel soils. The included soils make up less than 20 percent of any mapped area.

Most areas of this Darco soil are used for woodland. Very little acreage has been cleared for pasture. This soil is not suitable for cultivated crops because of slopes and the hazard of erosion.

This soil has low potential for pastureland and hayland. Intensive management is required. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass or lovegrass. The droughty, sandy surface layer is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant; however, many old fields have been planted to slash pine. The sandy surface layer, which causes seedling mortality and slow growth, is the main limitation. Longleaf uniola, pinehill bluestem, purpletop, and diverse shrubs are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Slope is the main limitation for urban uses, and the sandy surface layer mainly limits recreation uses.

This soil is in capability subclass VIe and woodland suitability group 4s3.

21—Darco-Urban land complex, 1 to 8 percent slopes. This complex of gently sloping to sloping soils and Urban land is on broad interstream divides. It is about 50 percent Darco soils, 35 percent Urban land, and 15 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of these Darco soils is loamy fine sand about 60 inches thick. It is dark brown in the upper 4 inches and pale brown in the lower 56 inches. The subsoil, to a depth of 72 inches, is yellowish red sandy clay loam. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with this complex in mapping are small areas of Briley soils and Lilbert soils on convex areas.

The Darco soils have medium potential for urban uses. Slope and the sandy surface layer are the main limitations. Some areas have been excavated to a depth of several feet and the sandy surface layer used as fill material for other lots. This sandy material is droughty to ornamental plants. The hazard of erosion is severe in sloping areas.

This complex is not placed in a capability subclass or woodland suitability group.

22—Darco-Urban land complex, 8 to 25 percent slopes. This complex of strongly sloping to steep soils and Urban land is above drainageways. It is about 60 percent Darco soils, 30 percent Urban land, and 10 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of these Darco soils is loamy fine sand about 55 inches thick. It is dark brown in the upper 6 inches and very pale brown in the lower 49 inches. The subsoil, to a depth of 72 inches, is strong brown sandy clay loam. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with these soils in mapping are small areas of Tenaha soils on steep slopes and in broken areas.

The Darco soils have medium potential for urban uses. Slope and the sandy surface layer are the main limitations. Because of the strong and steep slopes, drastic cut and fill operations are often needed where areas are leveled for residences and other buildings. In a few areas the subsoil is exposed. The sandy surface layer is droughty to ornamental plants. The hazard of erosion is severe.

This complex is not placed in a capability subclass or woodland suitability group.

23—Etoile loam, 1 to 5 percent slopes. This deep, gently sloping, upland soil is on broad ridges. In some places the surface has a weak gilgai microrelief which consists of microdepressions and microknolls. Areas of the soil range to 550 acres.

Typically, the surface layer of this Etoile soil is loam about 8 inches thick. It is dark grayish brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of 53 inches. From 8 to 41 inches it is yellowish red dense clay that has pale brown mottles in the upper part and light brownish gray mottles in the lower part; from 41 to 53 inches it is olive dense clay. The underlying material is brown and gray platy clay. Reaction is medium acid in the surface layer and strongly acid to moderately alkaline in the subsoil. This soil is calcareous below a depth of 41 inches.

This soil is somewhat poorly drained. It has very slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is severe.

Included with this soil in mapping are small areas of Woodtell soils and areas of sloping Etoile soils. Also included are small areas of Naclina soils which have a clayey surface layer. The included soils make up less than 20 percent of any mapped area.

Most areas of this Etoile soil are used as woodland.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive farming is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers are needed for high production of improved bermudagrass and bahiagrass. The dense clayey subsoil is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clayed subsoil is the main limitation. Longleaf uniola, little bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. The high shrink-swell potential of the clayey subsoil is the main limitation for urban uses, and wetness mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4c2.

24—Etoile loam, 5 to 20 percent slopes. This deep, sloping to moderately steep soil is on side slopes above drainageways. Areas are long and narrow and are mostly more than 100 acres.

Typically, the surface layer of this Etoile soil is very dark grayish brown loam about 4 inches thick. The subsoil, to a depth of 43 inches, is yellowish red clay that has light brownish gray mottles in the lower part. The underlying material is olive brown and light brownish gray calcareous marl. Reaction is medium acid in the surface layer and medium acid to neutral in the subsoil.

This soil is somewhat poorly drained. It has very slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are small areas of Lacerda soils. They make up less than 15 percent of any mapped area.

This Etoile soil is used almost entirely for woodland. It is not suitable for cultivated crops because of steepness of slope and the hazard of erosion.

This soil has low potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass. The dense clayey subsoil is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clayey subsoil is the main limitation. Longleaf uniola, little bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. The high shrink-swell potential of the clayey subsoil is the main limitation for urban uses, and special construction measures are needed to offset this limitation. Wetness is the main limitation for recreation uses.

This soil is in capability subclass VIe and woodland suitability group 4c2.

25—Hannahatchee loam, frequently flooded. This deep, nearly level soil is on bottomlands that formed in sediment from soils of the Redland Belt. Areas are long and narrow. Slope is 0 to 1 percent.

Typically, the surface layer of this Hannahatchee soil is reddish brown loam about 9 inches thick. The subsoil extends to a depth of 45 inches. From 8 to 21 inches it is yellowish red loam, and from 21 to 45 inches it is yellowish red sandy clay loam. The underlying material, to a depth of 65 inches, is also yellowish red sandy clay loam. Reaction is medium acid throughout the profile.

This soil is moderately well drained. It has moderate permeability and high available water capacity. Runoff is slow. This soil floods nearly every year; however, most floods last less than 2 days.

Included with this soil in mapping are areas of Marietta soils and Iuka soils on lower and wetter parts of the map unit. Also included are small areas of Tuscosso soils which have a clayey subsoil. The included soils make up less than 25 percent of any mapped area.

Most areas of this Hannahatchee soil have been cleared and are used for improved pasture. This soil is not suitable for cultivated crops because of the hazard of flooding.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, white clover, and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine, sweetgum, and red oak are dominant. Longleaf uniola, beaked panicum, giant cane, and diverse shrubs and sedges are the main understory vegetation.

The potential of this soil is low for urban uses and medium for recreation uses. Flooding is the main limitation. If flooding is controlled, this soil is well suited to these uses.

This soil is in capability subclass Vw and woodland suitability group 1o7.

26—Hannahatchee-Urban land complex, frequently flooded. This complex of nearly level soils and Urban

land is on bottomlands. It is about 50 percent Hannahatchee soils, 35 percent Urban land, and 15 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Hannahatchee soils is reddish brown loam about 6 inches thick. The subsoil extends to a depth of 43 inches. From 6 to 15 inches it is yellowish red sandy clay loam, and from 15 to 43 inches it is brown loam. The underlying material, to a depth of 65 inches, is yellowish red sandy clay loam. Reaction is medium acid throughout the profile.

The Urban land part of this complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Many of the water, gas, and sewer lines of the city are placed in this soil.

Included with this complex in mapping are small areas of Tuscosso soils in old drainageways.

This Hannahatchee-Urban land complex has low potential for urban uses. Flooding is the main hazard. In most areas flooding occurs every year; however, in the combined areas of the complex the flooding average is every 5 to 20 years.

This complex is not placed in a capability subclass or woodland suitability group.

27—Iuka fine sandy loam, occasionally flooded. This deep, nearly level soil is mainly on bottomlands of small streams and creeks throughout the county. Some small areas are on the edge of flood plains of larger streams near the upland escarpment. Slope is less than 1 percent.

Typically, the surface layer of this Iuka soil is fine sandy loam about 12 inches thick. It is grayish brown in the upper 4 inches and brown in the lower 8 inches. The underlying material, to a depth of 26 inches, is brown fine sandy loam that has grayish brown mottles. The next layer, from 26 to 33 inches, is dark grayish brown fine sandy loam. Below this layer, to a depth of 60 inches, the underlying material is mottled brown, strong brown, and light brownish gray fine sandy loam. Reaction is strongly acid throughout the profile.

This soil is moderately well drained. It has moderate permeability and high available water capacity. Runoff is slow. This soil is subject to flooding about once every 2 to 5 years; however, flooding is generally of brief duration. The water table is at a depth of 1 foot to 3 feet during the cool season.

Included with this soil in mapping are small spots of a soil similar to Iuka soil which is well drained and free of gray mottling in the upper 24 inches. Also included are small areas of Mantachie soils which are more poorly drained and are grayer than the Iuka soil.

Most areas of this Iuka soil are used for pastureland and woodland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Drainage may be needed in some areas. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, white clover, and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine, sweetgum, and water oak are dominant. Longleaf uniola, beaked panicum, giant cane, and diverse shrubs and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses. Flooding is a major hazard. In other ways, this soil is well suited to urban uses and to most recreation uses.

This soil is in capability subclass IIw and woodland suitability group 1w8.

28—Kirvin fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping to sloping soil is on broad and narrow ridges, interstream divides, and round knobs. On most knobs and ridges the surface layer is 5 to 15 percent gravel. Areas of this soil average less than 40 acres.

Typically, the surface layer of this Kirvin soil is brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 52 inches. From 12 to 38 inches it is red clay, and from 38 to 52 inches it is mottled, red and strong brown clay loam that contains bits of gray shale. The underlying material, to a depth of 62 inches, is yellowish red soft sandstone that has strong brown mottles and thin layers of light gray shale. Reaction is medium acid and strongly acid in the surface layer and strongly acid in the subsoil. The underlying material is very strongly acid.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are areas of Bowie soils in lower concave areas. They have a yellowish brown subsoil that is less clayey than the Kirvin soil. Also included are areas of strongly sloping Cuthbert soils. These soils are less than 40 inches thick over parent material that is similar to the Kirvin parent material. Small areas of a soil that is similar to the Kirvin soil are also included. This soil has a surface layer of loamy fine sand 20 to 25 inches thick. The included soils make up less than 25 percent of any mapped area.

Most areas of this Kirvin soil are used for pastureland and woodland.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive cultivation is planned. Applications of fertilizers and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed to produce high yields of improved bermudagrass and bahiagrass.

The potential is medium for pine trees. Loblolly pine and shortleaf pine are dominant (fig. 13). The medium available water capacity is the main limitation. Longleaf uniola, pinehill bluestem, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength of the soil is the main limitation for urban uses. Moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 3o1.

29—Kirvin gravelly fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping to sloping soil is on knobs and ridges and is commonly on high points in the landscape. Areas of this soil are generally less than 30 acres.

Typically, the surface layer of this Kirvin soil is brown gravelly fine sandy loam about 13 inches thick. The subsoil, to a depth of 47 inches, is clay loam. From 13 to 35 inches it is red; from 35 to 41 inches it is yellowish red; and from 41 to 47 inches it is mottled yellowish red, strong brown, and light brownish gray. The underlying material, to a depth of 60 inches, is reddish sandstone stratified with thin layers of grayish shale. Reaction is strongly acid throughout the profile.

Figure 13.—A dense stand of loblolly pine and shortleaf pine on Kirvin fine sandy loam, 1 to 8 percent slopes. Area in the foreground is prepared for planting seedlings.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is medium, and the hazard of water erosion is severe.

Included with this soil in mapping are areas of Cuthbert soils on the tops of knobs and ridges. The included soils make up less than 10 percent of any mapped area.

This Kirvin soil has low potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass. The medium available water capacity caused by the gravelly surface layer and the clayey subsoil is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The gravelly surface layer and the clayey subsoil are the main limitations. Longleaf uniola, pinehill bluestem, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses. Moderately slow permeability and small stones mainly limit recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4f2.

30—Kirvin-Urban land complex, 1 to 5 percent slopes. This complex of deep, gently sloping soils and Urban land is on broad convex ridges. It is about 55 percent Kirvin soils, 35 percent Urban land, and 10 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Kirvin soils is fine sandy loam 7 inches thick. It is brown in the upper part and very pale brown in the lower part. The subsoil extends to a depth of 50 inches. From 7 to 33 inches it is red clay, and from 33 to 50 inches it is yellowish red clay loam. The underlying material is soft sandstone. Reaction is medium acid in the surface layer and strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with these soils in mapping are small areas of Bowie soils and Sacul soils at the heads of drainageways.

This Kirvin-Urban land complex has medium potential for urban uses. Low strength and moderately slow permeability are the main limitations.

This complex is not placed in a capability subclass or a woodland suitability group.

31—Kirvin soils, graded, 2 to 8 percent slopes. These deep, gently sloping to sloping soils are on uplands. Because most of the surface layer of these soils has been removed for gravel, the surface layer now varies in thickness. The areas are generally convex, but they are not in a regular pattern, and they are not uniform. Piles of gravel are scattered over the surface, and there are bare spots of clay (fig. 14). Many areas are eroded and gullied.

Figure 14.—Bare clay spots exposed on Kirvin soils, graded, 2 to 8 percent slopes.

Typically, the surface layer of these Kirvin soils is gravelly fine sandy loam about 3 inches thick. The subsoil extends to a depth of 47 inches. From 3 to 35 inches it is red clay, and from 35 to 47 inches it is red clay loam that has spots of gray partially weathered shale. The underlying material, to a depth of 60 inches, is made up of alternate layers of gray shale and strong brown sandstone. Reaction is medium acid in the surface layer and strongly acid in the subsoil and underlying material.

These soils are well drained. They have moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with these soils is mapping are small areas of Cuthbert gravelly fine sandy loam which have been desurfaced. These areas make up less than 15 percent of any mapped area.

These soils are not suitable for cultivated crops because of the hazard of erosion.

These soils have low potential for pastureland and hayland unless intensive reclamation measures are used. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass, lovegrass, and bahiagrass. The gravelly, rough surface and low fertility are limitations.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The exposed clayey subsoil is the main limitation. Longleaf uniola is the main understory vegetation.

The potential of these soils is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

These soils are in capability subclass VIe and woodland suitability group 4c2.

32—Kullit fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands and terrace divides. It is mainly on concave areas and at the heads of drainageways. Areas are irregular in shape and average about 50 acres.

Typically, the surface layer of the Kullit soil is brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 65 inches. From 7 to 15 inches it is yellowish brown sandy clay loam, from 15 to 21 inches it is strong brown clay loam, and from 21 to 28 inches it is red clay. Below this layer, to a depth of 65 inches, it is coarsely mottled red and gray clay. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is moderately well drained. It has moderately slow permeability and high available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Bowie soils that are not clayey in the lower part of the subsoil. These soils are on knobs and ridges. Also included are a few low, slightly wet areas of a soil that is

similar to the Kulit soil that is of grayer hue; a few mounds of Besner soils which have a surface layer more than 20 inches thick; and areas of Sacul soils which have a red clayey subsoil below the fine sandy loam surface layer. The included soils make up less than 15 percent of any mapped area.

Most areas of this Kullit soil are used for pasture. A few old fields have been planted to pine trees.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are required if extensive farming is planned. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine, red oak, and sweetgum are dominant. Longleaf uniola and diverse panicums, shrubs, and sedges are the main understory vegetation.

This soil has medium potential for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IIe and woodland suitability group 2w8.

33—Lacerda clay loam, 0 to 5 percent slopes. This deep, nearly level to gently sloping soil is on uplands. It is mainly in the southern half of Nacogdoches County, but isolated spots of this soil are throughout the Redland Belt. The surface is a microrelief of microknolls and microdepressions. The microknolls are about 4 inches higher than the microdepressions, and the uneven surface causes small pockets of water to stand in the depressions during wet weather.

Typically, the surface layer of the Lacerda soil is dark grayish brown clay loam about 2 inches thick. The subsoil extends to a depth of 57 inches. From 2 to 8 inches it is yellowish brown silty clay that has light brownish gray mottles; from 8 to 28 inches it is mottled grayish brown, strong brown, and yellowish red clay; and from 28 to 48 inches it is dense gray clay that has red and yellowish brown mottles. From 48 to 57 inches the subsoil is light olive brown clay that has grayish brown mottles. The underlying material, to a depth of 72 inches, is brownish yellow and light olive brown layered clay. Reaction is strongly acid in the surface layer. The subsoil is strongly acid and very strongly acid to a depth of 48 inches and neutral to a depth of 57 inches. The underlying material is moderately alkaline.

This soil is somewhat poorly drained. It has very slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is severe. The shrink-swell potential is high. Shrinking and swelling of the clayey soil during tree growth has caused many trees to have crooked trunks.

Included with this soil in mapping are small areas of Woodtell soils and Etoile soils. They make up less than 15 percent of any mapped area.

This Lacerda soil is used almost entirely for woodland.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive farming is planned. Applications of fertilizer are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass. The dense clayey subsoil is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clayey subsoil is the main limitation to growth. Longleaf uniola, pinehill bluestem, various haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for urban and recreation uses. The high shrink-swell potential of the clayey subsoil is the main limitation for urban uses, and wetness mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4c2.

34—Lacerda clay loam, 5 to 20 percent slopes. This deep soil is sloping to moderately steep. It is mainly in the southern half of Nacogdoches County, but isolated spots of this soil occur throughout the Redland Belt. The surface is a microrelief of microknolls and microdepressions. The microknolls are about 2 inches higher than the microdepressions.

Typically, the surface layer of this Lacerda soil is grayish brown clay loam about 2 inches thick. The subsoil is clay or dense clay to a depth of 57 inches. From 2 to 5 inches it is strong brown; from 5 to 26 inches it is mottled grayish brown and yellowish red; from 26 to 43 inches it is gray mottled with red and yellowish brown; and from 43 to 47 inches it is light olive brown. The underlying material extends to a depth of 70 inches. It is brownish yellow, grayish brown, light olive brown, and olive gray layered clay. Reaction is strongly acid in the surface layer and subsoil and neutral to moderately alkaline in the underlying material.

This soil is somewhat poorly drained. It has very slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe. This soil has high shrink-swell potential, and the shifting of the soil during tree growth has caused many trees to have crooked trunks.

Included with this soil in mapping are small areas of Naclina soils. These soils make up less than 15 percent of any mapped area.

This Lacerda soil is used almost entirely for woodland. It is not suitable for cultivated crops because of steepness of slope and the hazard of erosion.

This soil has low potential for pastureland and hayland. Grazing management and the proper use and fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass. The dense clay is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clay is the main limitation. Longleaf uniola, pinehill bluestem, various haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for urban and recreation uses. The high shrink-swell potential is the main limitation for urban uses, and wetness limits most recreation uses.

This soil is in capability subclass VIe and woodland suitability group 4c2.

35—Lilbert loamy fine sand, 1 to 8 percent slopes. This deep, gently sloping to sloping soil is on broad interstream divides and in other upland areas. Areas are irregular in shape and are generally less than 40 acres. Slope is mainly 2 to 4 percent.

Typically, the surface layer of this Lilbert soil is loamy fine sand 28 inches thick. It is dark grayish brown in the upper part, brown in the middle part, and pale brown in the lower part. The subsoil, to a depth of 72 inches, is sandy clay loam. From 28 to 39 inches it is strong brown, and from 39 to 72 inches it is strong brown mottled with yellowish red and light brownish gray. Reaction is medium acid to very strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small convex areas of Briley soils which have a subsoil of yellowish red sandy clay loam and areas of Darco soils which have a sandy surface layer more than 40 inches thick. Also included are areas of Bowie soils on ridges. The included soils make up less than 20 percent of any mapped area.

This Lilbert soil is used mainly for woodland and pastureland.

This soil has medium potential for cropland. It is especially suited to the production of watermelons. Use of crop residue and cover crops helps to maintain soil tilth and to increase the available water capacity. Grasses and legumes should be used in the crop rotation if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass. The droughty sandy surface layer is the main limitation.

The potential is medium for pine trees. Loblolly pine and shortleaf pine are dominant; however, many old fields have been planted to slash pine. The sandy surface layer, which causes seedling mortality and slow growth, is the main limitation. Longleaf uniola, pinehill bluestem, broomsedge bluestem, and diverse panicums and shrubs are the main understory vegetation.

The potential of this soil is high for urban and recreation uses. There are few limitations to development. The sandy surface layer is the main limitation for recreation uses.

This soil is in capability subclass IIIs and woodland suitability group 3s2.

36—Lilbert-Urban land complex, 1 to 8 percent slopes. This complex of gently sloping and sloping soils and Urban land is on convex ridges. It is about 45 percent Lilbert soils, 35 percent Urban land, and 20 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Lilbert soils is loamy fine sand about 33 inches thick. It is dark grayish brown in the upper part, brown in the middle part, and pale brown in the lower part. The subsoil, to a depth of 72 inches, is strong brown sandy clay loam that has red and yellowish mottles in the lower 22 inches. Reaction is medium acid to very strongly acid in the surface layer and very strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Most structures are single unit dwellings, schools, or churches. There are service stations and small commercial buildings in a few places.

Included with these soils in mapping are small areas of Darco soils and Bowie soils on ridges.

The Lilbert soils have high potential for urban uses. The sandy surface layer, which is droughty to ornamental plants, is the main limitation.

This complex is not placed in a capability subclass or woodland suitability group.

37—Mantachie soils, frequently flooded. These deep, nearly level soils are in old stream channels that occur in an irregular pattern on broad flood plains. The soils have a surface texture of loam or clay loam and do not occur in a regular pattern. Slope is less than 1 percent.

Typically, the surface layer of these Mantachie soils is about 3 inches thick. It is dark grayish brown clay loam that has gray and strong brown mottles. The subsoil extends to a depth of 60 inches. From 3 to 15 inches it is mottled yellowish brown, brown, light brownish gray, and strong brown sandy clay loam; from 15 to 60 inches

it is gray clay loam mottled with shades of brown. Reaction is strongly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

These soils are somewhat poorly drained. They have moderate permeability and high available water capacity. Runoff is slow. These soils overflow 2 to 3 times a year in most years, and the flooding lasts from 2 days to 2 to 4 weeks. The water table is at or near the surface during the cool season.

Included with these soils in mapping are areas of a clayey soil similar to Mantachie soils that has more than 35 percent clay. Also included are areas of higher lying Marietta soils which have more sand than Mantachie soils. The included soils make up less than 15 percent of any mapped area.

These Mantachie soils are used almost entirely for woodland. Because of the hazard of overflow and wetness, they are not suitable for cultivated crops.

These soils have medium potential for pastureland and hayland. Grazing management, good drainage, and the proper use of fertilizers and lime are needed for high production of improved white clover and bahiagrass. Wetness is the main limitation.

The potential is high for hardwood trees (fig. 15). Water oak is dominant. Wetness is the main limitation. Longleaf uniola, pinehill bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of these soils is low for most urban and recreation uses. Flooding is the main limitation.

These soils are in capability subclass Vw and woodland suitability group 1w6.

Figure 15.—Mantachie soil has high potential for water-tolerant trees.

38—Marietta soils, frequently flooded. These deep, nearly level soils formed in loamy alluvial sediment on the bottom lands of streams. Areas are long and narrow and are generally more than 100 acres. These soils are not uniform and do not occur in a regular pattern. Variable textures of loam and fine sandy loam make up the surface layer. Slope is less than 1 percent.

Typically, the surface layer of these Marietta soils is about 12 inches thick. It is fine sandy loam that is brown in the upper part and dark brown in the lower part. The subsoil, which extends to a depth of 36 inches, is sandy clay loam. It is dark brown mottled with light brownish gray to a depth of 16 inches, and it is mottled light brownish gray, brown, and dark grayish brown below this layer. The underlying material, to a depth of 60 inches, is mottled light brownish gray, dark yellowish brown, and strong brown sandy clay loam. Reaction is slightly acid in the surface layer and medium acid in the subsoil. The underlying material is medium acid.

These soils are moderately well drained. They have moderate permeability and high available water capacity. Runoff is slow. These soils flood at least once every two years; however, flooding is of brief duration.

Included with these soils in mapping are small areas of luka soils which are fine sandy loam throughout, areas of grayish brown Mantachie soils, and areas of luka soils on ridges that have more sand than the Marietta soils. Also included are areas of Mantachie soils in wetter, lower lying concave areas, and a soil similar to Marietta soils that is strongly acid in some horizons. The included soils make up about 35 percent of any mapped area.

These Marietta soils are not suitable for cultivated crops because of the hazard of overflow.

These soils have high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, white clover, and bahiagrass.

The potential is high for pine and hardwood trees. Loblolly pine and water oak are dominant. Wetness, which restricts equipment use, is the main limitation. Longleaf uniola, broomsedge bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

These soils are not suitable for urban or recreation uses unless the hazard of flooding is eliminated.

These soils are in capability subclass Vw and woodland suitability group 1w8.

39—Mollville loam. This deep, nearly level soil is in depressional, concave areas on moundy terraces near most major creeks and adjacent to the Angelina River. Areas are mostly less than 50 acres. They are mostly long, narrow, sinuous, and low lying; however, some areas are in rounded depressions.

Typically, the surface layer of the Mollville soil is about 14 inches thick. It is dark gray to a depth of 5 inches and light gray from 5 to 14 inches. The subsoil extends to a depth of 65 inches. From 14 to 23 inches is light gray loam that has spots of grayish brown clay loam mottled with strong brown; from 23 to 40 inches it is gray clay loam mottled with strong brown and penetrated with tongues of light gray loam; from 40 to 65 inches it is light gray clay loam that has strong brown and yellowish brown mottles. Reaction is very strongly acid in the surface layer and strongly acid in the rest of the profile.

This soil is poorly drained. It has slow permeability and high available water capacity. Runoff is very slow, and the hazard of water erosion is slight. This soil has a water table at or near the surface, and water stands on the surface for several weeks each year during the cool season.

Included with this soil in mapping are small spots of a soil similar to Mollville soil that is less gray in hue and is yellowish brown in the upper part. The included soil makes up less than 5 percent of any mapped area.

This Mollville soil is used almost entirely for woodland.

This soil has low potential for cropland unless drainage is provided. Use of crop residue and cover crops helps to maintain soil tilth. Drainage is essential in most areas. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management, good drainage, and the proper use of fertilizers and lime are needed for good production of bahiagrass. Wetness is the main limitation.

The potential is medium for pine and hardwood trees. Water oak, willow oak, and sweetgum are dominant. Wetness, which causes shallow rooting and in some cases results in windthrow, is the main limitation. Pinehill bluestem, Florida paspalum, and diverse panicums, shrubs, and sedges are the main understory vegetation.

This soil is not suited to urban and recreation uses unless flooding is controlled and drainage is provided.

This soil is in capability subclass IVw and woodland suitability group 3w9.

40—Mollville-Besner complex. This complex of nearly level soils is on stream terraces which are near most major streams throughout the county, but are mainly along the Angelina River. Areas are about 100 acres and are made up of alternating mounds and low places. The lows of Mollville soils, which make up 40 to 70 percent of an area, are sinuous and vary greatly in length. They are generally 30 to 130 feet wide. Water stands on the surface during much of the cool season (fig. 16). The mounds of Besner soils, which make up 30 to 50 percent of an area, are generally 1.5 to 5 feet higher than the lows. They are generally rounded and are 40 to 300 feet wide.

In a typical area, Mollville soils make up 45 percent of the complex; Besner soils, 35 percent; and other soils, 20 percent. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Mollville soils is loam about 12 inches thick. It is dark gray in the upper 4 inches and light gray in the lower 8 inches. The subsoil

Figure 16.—Water standing in a low area of Mollville soil. A mound of well drained Besner soil is in the background.

extends to a depth of 65 inches. From 12 to 19 inches it is light gray loam tonguing into strong brown and grayish brown clay loam; from 19 to 39 inches it is light gray clay loam mottled with strong brown and penetrated by tongues of light gray loam; from 39 to 65 inches it is light gray clay loam mottled with strong brown and yellowish brown. Reaction is very strongly acid in the surface layer and strongly acid in the subsoil.

Typically, the surface layer of the Besner soils is fine sandy loam 38 inches thick. It is dark grayish brown in the upper 2 inches, brown in the next 7 inches, and pale brown in the lower 29 inches. The subsoil is loam to a depth of 80 inches or more. From 38 to 55 inches it is strong brown mottled with pale brown; from 55 to 80 inches it is reddish and yellowish mottled with very pale brown, red, and yellowish brown. Reaction is slightly acid to strongly acid in the surface layer and strongly acid in the subsoil.

The lows of Mollville soils are poorly drained. They have poor permeability, and water stands on the surface for several weeks each year. The mounds of Besner soils are well drained. They have moderate permeability, and runoff is slow. Both soils have high available water capacity.

Included with these soils in mapping are areas of Bernaldo soils which make up 5 to 15 percent of the mounds. They are on the lower one-fourth of the mounds, and have a surface layer less than 20 inches thick. Also included, in the low lying areas, are small areas of a soil similar to the Mollville soils which are slightly better drained. The included soils make up about 20 percent of any mapped area.

Areas of this Mollville-Besner complex are used mainly for woodland. Distinctly different types of vegetation grow on these soils. Water-loving hardwood trees grow on the low lying areas, and pine trees grow on the mounds. All types of improved grasses grow on the mounds; however, mainly water-loving plants grow on the lows.

The soils in this complex have low potential for cropland unless adequate drainage is provided. Use of crop residue and cover crops help to maintain soil tilth. Applications of fertilizer and lime are needed for high production. The low lying Mollville soils need drainage.

The potential is medium for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production. Drainage is needed on the lows of Mollville soils. These areas are best suited to white clover and bahiagrass. The mounds of Besner soils are suitable for high production of improved bermudagrass and bahiagrass.

The Mollville soils have medium potential for hardwood and pine trees. The Besner soils have high potential for pine trees. Loblolly pine is dominant on the mounds, and water oak is dominant on the low lying areas. Wetness is the main limitation of the lows. Longleaf uniola, broomsedge bluestem, Florida paspalum, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The Mollville soils are not suitable for urban uses or for most recreation uses unless flooding is controlled and drainage is provided. The Besner soils are mainly limited by wetness and low strength. Otherwise, the soils of this complex are suitable for urban and recreation uses.

Mollville soils are in capability subclass IVw and woodland suitability group 3w9. Besner soils are in capability subclass IIe and woodland suitability group 2o7.

41—Naclina clay, 5 to 20 percent slopes. This deep, sloping to moderately steep, upland soil is on side slopes above drainageways. Areas are long and narrow and are generally more than 80 acres.

Typically, the surface layer of this Naclina soil is clay about 9 inches thick. It is very dark grayish brown in the upper 5 inches and reddish brown in the lower 4 inches. The subsoil extends to a depth of 46 inches. From 9 to 14 inches it is reddish brown clay, and from 14 to 46 inches it is clay that is light olive brown in the upper part and light yellowish brown in the lower part. The underlying material is laminated strong brown and light brownish gray clay. Reaction is neutral in the surface layer and neutral to moderately alkaline in the subsoil.

This soil is somewhat poorly drained. It has very slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is severe.

Included with this soil in mapping are small areas of Lacerda soil which make up less than 15 percent of any mapped area.

Most areas of this Naclina soil are used for woodland. The soil is not suitable for cultivated crops because of slope and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers are needed for high production of improved bermudagrass and bahiagrass. The dense clay is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The clayey, calcareous subsoil is the main limitation. Longleaf uniola, little bluestem, various haws, and diverse panicums, shrubs, and sedges are the main understory vegetation. The shrinking and swelling of the clayey soil during tree growth has caused many trees to have crooked trunks.

The potential of this soil is low for most urban and recreation uses. The high shrink-swell potential is the main limitation for urban uses, and the clayey surface layer is the main limitation for recreation uses.

This soil is in capability subclass VIe and woodland suitability group 4c2.

42—Nacogdoches fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping, upland soil is on broad interstream divides and is commonly on the high-

est parts of the landscape. Areas are convex and irregular in shape and are generally more than 30 acres. Some of the soil on knobs contains 5 to 10 percent gravel.

Typically, the surface layer of this Nacogdoches soil is dark reddish brown fine sandy loam about 6 inches thick. The subsoil is dark red clay that extends to a depth of about 70 inches. The underlying material, to a depth of 80 inches, is red stratified clay and olive yellow partially weathered glauconite. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is medium, and the hazard of water erosion is moderate.

Included with this soil in mapping are small bodies of Nacogdoches gravelly fine sandy loam that are less than 5 acres and small areas of Nacogdoches clay loam. Also included are spots of Alto soils in concave areas that are 1 to 2 acres. The included soils make up less than 15 percent of any mapped area.

This Nacogdoches soil is used almost entirely for pastureland. At one time, however, it was used mainly for cropland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

The potential is medium for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

This soil has medium potential for pine and hardwood trees. Loblolly pine, shortleaf pine, and sweetgum are dominant. The medium available water capacity is the main limitation. Longleaf uniola, pinehill bluestem, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 3o7.

43—Nacogdoches gravelly fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping to sloping, upland soil is on broad convex areas that are mainly in the Redland Belt. Areas are generally less than 50 acres.

Typically, the surface layer of this Nacogdoches soil is dark reddish brown gravelly fine sandy loam about 5 inches thick. The subsoil extends to a depth of 72 inches. From 5 to 25 inches it is red clay that contains 10 to 15 percent gravel, and from 25 to 72 inches it is red clay that contains a few ironstone fragments and a few spots of yellowish red limonite. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small spots of Nacogdoches gravelly clay loam. Also included are small areas of strongly sloping Trawick gravelly fine sandy loam.

This Nacogdoches soil is used mainly for woodland and pastureland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The medium available water capacity is the main limitation. Longleaf uniola, pinehill bluestem, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4f2.

44—Nacogdoches clay loam, 1 to 8 percent slopes. This deep, gently sloping to sloping, upland soil is on broad, convex interstream divides. Areas are generally less than 100 acres. The soil contains up to 15 percent ironstone gravel.

Typically, the surface layer of this Nacogdoches soil is reddish brown clay loam about 5 inches thick. The subsoil, to a depth of about 72 inches, is red clay. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are areas of Nacogdoches fine sandy loam and Nacogdoches gravelly clay loam. The included soils make up less than 15 percent of any mapped area.

This Nacogdoches soil is used mainly for pastureland. Some areas are used for woodland.

This soil has high potential for cropland. Use of crop residue and cover crops helps maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

The potential is medium for pine trees. Shortleaf pine and loblolly pine are dominant. The medium available water capacity is the main limitation. Longleaf uniola, pinehill bluestem, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 3c2.

45—Nacogdoches clay loam, 2 to 5 percent slopes, eroded. This deep, gently sloping, upland soil is on broad, convex areas of interstream divides. Some areas of this soil have natural geologic erosion, and other areas have accelerated manmade erosion. If areas of Nacogdoches gravelly fine sandy loam and gravelly clay loam have had the surface layer removed to mine gravel, there are many ditches, areas of bare clay, and piles of gravelly and stony soil material in places.

Typically, the surface layer of this Nacogdoches soil is reddish brown clay loam about 1 inch thick overlying a red clay subsoil which extends to a depth of 72 inches. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are small spots of Nacogdoches clay loam that are not eroded between some of the eroded areas. The included soil makes up less than 15 percent of any mapped area.

Most areas of this Nacogdoches soil are reverting to pasture. Some areas have been planted to trees.

This soil has medium potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass, lovegrass, crimson clover, and bahiagrass. The clayey surface layer is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The clayey surface layer, which causes seedling mortality and slow growth, is the main limitation. Planted stands of broomsedge bluestem are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IIIe and woodland suitability group 4c2.

46—Nacogdoches gravelly clay loam, 1 to 8 percent slopes. This gently sloping to sloping soil is on convex ridges. Areas are generally less than 50 acres. This soil contains 15 to 45 percent gravel in the surface layer and up to 30 percent in the subsoil.

Typically, the surface layer of this Nacogdoches soil is dark reddish brown gravelly clay loam about 4 inches thick. The subsoil, to a depth of 72 inches, is red clay that contains about 10 percent gravel in the upper 11 inches. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. The runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Nacogdoches clay loam, Trawick clay loam, and Nacogdoches fine sandy loam. The included soils make up less than 20 percent of any mapped area.

Most areas of this Nacogdoches soil are used for woodland.

This soil has high potential for cropland. Use of residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimson clover, and bahiagrass.

This soil has low potential for pine trees. Shortleaf pine and loblolly pine are dominant. The gravelly surface layer and clayey subsoil are the main limitations. Longleaf uniola, pinehill bluestem, indiangrass, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Low strength is the main limitation for urban uses, and moderately slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4f2.

47—Nacogdoches-Urban land complex, 1 to 5 percent slopes. This complex of deep, gently sloping soils and Urban land is on broad, convex interstream divides. It is about 45 percent Nacogdoches soils, 35 percent Urban land, and 20 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Nacogdoches soils is dark reddish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 80 inches, is dark red

clay that contains a few ironstone fragments in the lower part. Reaction is medium acid in the surface layer and strongly acid and very strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Most structures are single unit dwellings, streets, driveways, and service stations. There are a few large buildings.

Included with these soils in mapping are small areas of Trawick soils on the more sloping areas and Alto soils at the base of slopes and in concave areas.

The soils in Nacogdoches-Urban land complex have medium potential for urban uses. Low strength and moderately slow permeability are the main limitations. Runoff from these soils carries reddish iron minerals that stain clothes or painted surfaces on contact. The hazard of erosion is moderate.

This complex is not placed in a capability subclass or woodland suitability group.

48—Osier fine sand, 0 to 2 percent slopes. This deep, nearly level to gently sloping, upland soil is on concave areas. Springs begin in areas of this soil and parallel the spring-flow stream channels.

Typically, the surface layer of this Osier soil is fine sand 11 inches thick. It is dark gray in the upper 4 inches and grayish brown in the lower 7 inches. The underlying material, to a depth of 80 inches, is light gray fine sand. Reaction is strongly acid throughout the profile.

This soil is poorly drained. It has rapid permeability and is seldom dry below a depth of 6 to 10 inches. During the cool season, water stands on or moves over the surface. Many continuous flowing springs originate in this soil. The hazard of erosion is slight.

Included with this soil in mapping is a soil similar to Osier soil that has a sandy loam subsoil at a depth of about 50 to 60 inches. Also included are areas of soils that are very poorly drained and are extremely acid.

This Osier soil is used only for woodland. Because of continuous wetness, it is not suitable for cultivation.

This soil has low potential for pastureland and hayland. Grazing management, good drainage, and the proper use of fertilizers and lime are needed to produce pasture or hay. Constant wetness is the main limitation.

The potential is medium for pine and hardwood trees. Loblolly pine and, in a few areas, longleaf pine are dominant. Wetness is the main limitation. Longleaf uniola, small bay trees, and shrubs and sedges are the main understory vegetation.

This soil is not suited to most urban and recreation uses unless drainage is provided.

This soil is in capability subclass VIw and woodland suitability group 3w9.

49—Osier-Urban land complex, 0 to 2 percent slopes. This complex of nearly level to gently sloping sandy soils and Urban land is on concave, wet toe slopes. It is about 70 percent Osier soils, 25 percent Urban land, and 5 percent other soils. These soils and Urban land are so intricately mixed that separation is not possible at the scale used in mapping.

Typically, the surface layer of the Osier soils is fine sand about 12 inches thick. It is black in the upper 6 inches and grayish brown in the lower 6 inches. The underlying material, to a depth of 80 inches, is light gray sand. Reaction is strongly acid throughout the profile.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Many water mains and sewer lines cross this complex.

Included with these soils in mapping are small areas of Rentzel soil and a soil similar to the Osier soils that has a thick, dark surface layer.

The soils in this Osier-Urban land complex have low potential for urban uses because of the sandy texture and wetness. They are seldom dry below a depth of 6 inches.

This complex is not placed in a capability subclass or woodland suitability group.

50—Percilla clay loam, 0 to 1 percent slopes. This deep, nearly level soil is in concave depressional areas on uplands. Areas are round and are generally less than 40 acres. These areas are generally 1.5 to 4 feet lower than the surrounding soils.

Typically, the surface layer of this Percilla soil is dark grayish brown clay loam about 4 inches thick. The subsoil, to a depth of 65 inches, is clay that is dark gray in the upper 4 inches and gray in the lower 57 inches. Mottles of strong brown, yellowish red, red, and dark red are throughout the subsoil. Reaction is very strongly acid throughout the profile.

This soil is poorly drained. It has very slow permeability and high available water capacity. Water stands on the surface for several days after most rains. Much of the time from January through March, the water table is at or above the surface. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small spots of Alto soil which make up less than 10 percent of any mapped area.

This Percilla soil is used almost entirely for woodland.

This soil has low potential for cropland. Drainage is essential. Use of crop residue and cover crops helps to maintain soil tilth. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management, good drainage, and the proper use of fertilizers and lime are needed for good

production of white clover and bahiagrass. Wetness is the main limitation.

The potential is high for pine and hardwood trees. Water oak, willow oak, and loblolly pine are dominant. Wetness, which causes seedling mortality and restricts use of equipment, is the main limitation. Rustyseed paspalum, Virginia wildrye, and diverse panicums, shrubs, and sedges are the main understory vegetation.

This soil is not suitable for most urban and recreation uses. Wetness is the main limitation.

This soil is in capability subclass IVw and woodland suitability group 2w9.

51—Pits. This map unit consists of areas from which iron ore, sand, or other construction material has been removed. Pits have resulted from these excavations. They vary in depth from several feet to many feet and have walls that are slightly inclined to almost vertical. The iron pits are generally deep and have nearly vertical walls; the sand pits are commonly less than 10 feet deep; and the borrow pits and borrow areas are mostly less than 4 feet deep.

Little or no vegetation grows in the Pits. The hazard of erosion is severe on most areas.

This map unit is not placed in a capability unit or woodland suitability group.

52—Rentzel loamy fine sand, 0 to 4 percent slopes. This soil formed in colluvial material on foot slopes, and it is in most sandy parts of the county. Most areas are parallel to spring-fed flowing streams. These areas are generally long and narrow and range from 5 to 80 acres. Continuous flowing springs emerge from some areas of this soil.

Typically, the surface layer of this Rentzel soil is loamy fine sand about 29 inches thick. It is grayish brown and brown in the upper 12 inches, pale brown in the next 9 inches, and very pale brown and light gray in the lower 8 inches. The subsoil is sandy clay loam to a depth of 75 inches. From 29 to 41 inches it is mottled strong brown, light brownish gray, and red; from 41 to 50 inches it is mottled yellowish brown, light brownish gray, and red; and from 50 to 75 inches it is light gray, mottled yellowish brown, and red. Reaction is medium acid and slightly acid in the surface layer and very strongly acid in the subsoil.

This soil is somewhat poorly drained. It has moderately slow permeability and high available water capacity. A water table is at a depth of 1.5 to 2.5 feet during the cool season. The hazard of erosion is slight.

Included with this soil in mapping are areas of Lilbert soil on slightly higher knolls, a soil similar to Rentzel soil that has a surface layer less than 20 inches thick, and a soil similar to Rentzel soil that is more poorly drained and has a black sandy surface layer.

Most areas of this Rentzel soil are used for woodland.

This soil has low potential for cropland. Use of crop residue and cover crops help to maintain soil tilth. If extensive cultivation is planned, grasses and legumes should be used in the crop rotation. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass. Drainage is needed in some areas.

The potential is high for pine and hardwood trees. Loblolly pine and sweetgum are dominant. Longleaf uniola, pinehill bluestem, broomsedge bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. Wetness is the main limitation.

This soil is in capability subclass IIIw and woodland suitability group 2w8.

53—Rentzel-Urban land complex, 0 to 4 percent slopes. This complex of sloping soils and Urban land is on concave, colluvial foot slopes. It is about 55 percent Rentzel soils, 30 percent Urban land, and 15 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Rentzel soils is loamy fine sand about 29 inches thick. It is dark grayish brown in the upper part and very pale brown in the lower part. The subsoil extends to a depth of 75 inches. It is strong brown sandy clay loam that has grayish, brownish, and reddish mottles. Reaction is medium acid and slightly acid in the surface layer and very strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. Many sewer lines and main water lines are laid in areas of this complex.

Included with these soils in mapping are small areas of Lilbert soils.

The soils in this Rentzel-Urban land complex have low potential for urban uses. Wetness and flooding are the main limitations. A water table is at a depth of 1.5 to 2.5 feet during the cool season.

This complex is not placed in a capability subclass or woodland suitability group.

54—Ruston fine sandy loam, 1 to 8 percent slopes. This deep, gently sloping to sloping, upland soil is on broad interstream divides. Areas are irregular in shape and slightly convex and average about 30 acres.

Typically, the surface layer of this Ruston soil is brown fine sandy loam about 10 inches thick. The subsoil, to a depth of 72 inches, is sandy clay loam. It is yellowish red to a depth of 55 inches and red with areas of very pale

brown below this layer. Reaction is medium acid to strongly acid in the surface layer and strongly acid in the subsoil.

This soil is well drained. It has moderate permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping are small spots of Bowie soils which have a yellowish subsoil. Also included are areas of Briley soils which have a sandy surface layer more than 20 inches thick. The Briley soils are about 1 to 2 acres. The included soils make up less than 10 percent of any mapped area.

Most areas of this Ruston soil are used for pasture. A few small fields are used for corn and truck crops.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring can be needed if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and proper use of fertilizers and lime are needed for high production of improved bermudagrass, crimsom clover, and bahiagrass.

The potential is medium for pine trees. Loblolly pine and shortleaf pine are dominant. Longleaf uniola, pinehill bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is high for most urban and recreation uses.

This soil is in capability subclass IIe and woodland suitability group 3o1.

55—Sacul fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands and at the heads of many drainageways. Areas are slightly convex to slightly concave and irregular and are generally less than 50 acres.

Typically, the surface layer of this Sacul soil is fine sandy loam about 7 inches thick. It is very dark grayish brown in the upper 2 inches and brown in the lower 5 inches. The subsoil, to a depth of 53 inches, is clay. From 7 to 21 inches it is red mottled with light brownish gray in the lower part; and from 21 to 53 inches it is mottled red, light brownish gray, strong brown, and reddish yellow. The underlying material is made up of alternate layers of light brownish gray shale and strong brown or red sandstone. Reaction is strongly acid and very strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is moderately well drained. It has slow permeability and high available water capacity. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small concave areas of Kullit soils and small areas of Kirvin soils on knolls. Also included are areas of eroded Sacul soil from which the surface layer has been removed. The included soils make up less than 20 percent of any mapped area.

Most areas of this Sacul soil are used for timber. The soil is poorly suited to most cultivated crops because of the very strongly acid, clayey subsoil.

This soil has low potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are essential if extensive cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass. The clayey subsoil is the main limitation.

The potential is medium for pine trees. Loblolly pine and shortleaf pine are dominant. The clayey subsoil is the main limitation. Longleaf uniola, pinehill bluestem and little bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses. The high shrink-swell potential of the clayey subsoil is the main limitation. Slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 3c2.

56—Sacul fine sandy loam, 5 to 20 percent slopes. This deep, sloping to moderately steep soil is on rolling hills and long narrow breaks above drainageways. It is one of the most extensive soils and is in most parts of the county. Areas are about 80 acres.

Typically, the surface layer of this Sacul soil is fine sandy loam about 8 inches thick. It is dark grayish brown in the upper 2 inches and pale brown in the lower 6 inches. The subsoil, to a depth of 52 inches, is clay. From 8 to 20 inches it is red, mottled with light brownish gray and yellowish brown; from 20 to 45 inches it is mottled red and light brownish gray; and from 45 to 52 inches it is mottled light brownish gray, red, and yellowish brown. The underlying material is light brownish gray shale that has layers of soft, strong brown sandstone. Reaction is very strongly acid throughout the profile.

This soil is moderately well drained. It has slow permeability and high available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are areas of Cuthbert soils which overlie sandstone and shale and are less than 40 inches thick. Cuthbert soils make up 10 to 15 percent of most areas. Also included are areas of Kirvin soils that have a red clayey subsoil and areas of Sacul soils that have less than 5 percent slopes. The included soils make up less than 20 percent of any mapped area.

This Sacul soil is used almost entirely for woodland.

This soil is not suitable for cultivated crops because of slope and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of

fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass. Slope and the clayey subsoil are limitations.

The potential is low for pine trees. Loblolly pine and shortleaf pine are dominant. The clayey subsoil is the main limitation. Longleaf uniola, pinehill bluestem, little bluestem, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban uses. The high shrink-swell potential of the clayey subsoil and slope are the main limitations. This soil is suited to most recreation uses.

This soil is in capability subclass VIe and woodland suitability group 3c2.

57—Tenaha loamy fine sand, 5 to 20 percent slopes. This deep, sloping to moderately steep, upland soil is on broad hills and side slopes above drainageways. Most areas are long and narrow and are about 60 acres. On narrow ridges and knobs this soil generally has 5 to 10 percent gravel in the surface layer.

Typically, the surface layer of this Tenaha soil is loamy fine sand about 22 inches thick. It is very dark grayish brown in the upper 5 inches and pale brown in the lower 17 inches. The subsoil, to a depth of 46 inches, is yellowish red sandy clay loam that has strong brown mottles in the upper part and red mottles in the lower part. The underlying material is soft reddish sandstone. Reaction is slightly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is well drained. It has moderate permeability and medium available water capacity. Runoff is medium, and the hazard of erosion is severe.

Included with this soil in mapping are areas of a soil similar to the Tenaha soils that contain 15 to 25 percent ironstone-manganese gravel. It is on knobs and ridges. Also included are areas of Darco soils which have a sandy surface layer more than 40 inches thick. These areas make up less than 10 percent of any mapped area.

Most areas of this Tenaha soil are used for pastureland and woodland. This soil is not suitable for cultivated crops because of slope and the hazard of erosion.

This soil has low potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for fair production of improved bermudagrass or lovegrass. The sandy surface layer and steepness of slope are the main limitations.

The potential is medium for pine trees. Shortleaf pine and loblolly pine are dominant. The sandy surface layer is the main limitation. Longleaf uniola, various bluestems, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban and recreation uses. Steepness of slope is the limitation for urban uses, and the sandy surface layer mainly limits recreation uses.

This soil is in capability subclass VIe and woodland suitability group 3s2.

58—Tenaha-Urban land complex, 5 to 20 percent slopes. This complex of sloping to moderately steep soils and Urban land is on side slopes above drainageways. It is about 45 percent Tenaha soils, 35 percent Urban land, and 20 percent other soils. These soils and Urban land are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Tenaha soils is loamy fine sand about 30 inches thick. It is brown in the upper 6 inches and pale brown in the lower 24 inches. The subsoil, to a depth of 45 inches, is yellowish red sandy clay loam. The underlying material is soft reddish sandstone. Reaction is slightly acid in the surface layer and very strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with these soils in mapping are small areas of Darco soils.

The soils in this Tenaha-Urban land complex have medium potential for urban uses. Slope is the main limitation. The sandy surface layer mainly limits recreation uses.

This complex is not placed in a capability subclass or woodland suitability group.

59—Tonkawa fine sand, 0 to 8 percent slopes. This deep, nearly level to sloping, sandy soil is on convex and smooth areas mainly in the northern part of the county. In some places, the areas are more than 2,000 acres.

Typically, this Tonkawa soil is fine sand to a depth of 80 inches or more. The surface layer is about 12 inches thick. It is dark grayish brown in the upper 5 inches and yellowish brown in the lower 7 inches. The underlying material is brownish yellow and yellow to a depth of 37 inches and very pale brown to a depth of 84 inches. Reaction is extremely acid throughout the profile.

This soil is excessively drained. It has rapid permeability and low available water capacity. Runoff is very slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Betis soils that have a subsoil of reddish loamy fine sand. The Betis soils make up as much as 25 percent of some mapped areas. Also included are areas of Darco soils that have a subsoil of sandy clay loam within a depth of 80 inches. The Darco soils are on knobs and ridges.

This Tonkawa soil is used mainly for woodland.

This soil has low potential for most cultivated crops. Watermelons, however, grow well. Use of crop residue and cover crops helps to maintain soil tilth and available water capacity. Applications of fertilizer and lime are needed for high production.

This soil has low potential for pastureland unless special management is provided. Grazing management and the proper use of fertilizers and lime are needed for fair production of improved bermudagrass or lovegrass. The droughty sand is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. However, under natural conditions the dominant species is sandjack oak. The droughty sand is the main limitation. Pinehill bluestem, broomsedge bluestem, arrowfeather threeawn, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is high for most urban uses and low for most recreation uses. The sandy surface layer mainly limits recreation uses. Cutbanks tend to cave in excavations.

This soil is in capability subclass IVs and woodland suitability group 5s3.

60—Tonkawa fine sand, 8 to 20 percent slopes. This deep, strongly sloping to moderately steep soil is on side slopes above drainageways. Areas are long and narrow. Many perennial springs flow from lower areas of this soil.

Typically, this Tonkawa soil is fine sand to a depth of 80 inches or more. The surface layer is about 12 inches thick. It is dark grayish brown in about the upper 6 inches and yellowish brown in the lower 6 inches. The underlying material is brownish yellow to a depth of 43 inches and very pale brown to light gray to a depth of 80 inches. Reaction is extremely acid throughout the profile.

This soil is excessively drained. It has rapid permeability and low available water capacity. Runoff is very slow, and the hazard of erosion is moderate.

Included with this soil in mapping are small spots of Darco soils which have a subsoil of sandy clay loam between the depth of 40 and 80 inches. Also included are small areas of poorly drained, wet Osier soils at the base of slopes.

This Tonkawa soil is used almost entirely for woodland.

This soil has low potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth and available water capacity. Applications of fertilizer and lime are needed for high production.

This soil has low potential for pastureland and hayland unless proper management is provided. Grazing management and the proper use of fertilizers and lime are needed for fair production of improved bermudagrass or lovegrass. The droughty sand is the main limitation.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. However, under natural conditions the dominant species is sandjack oak. The droughty sand is the main limitation. Pinehill bluestem, broomsedge bluestem, arrowfeather threeawn, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is medium for most urban uses and low for most recreation uses. The strong to moderately steep slopes are the main limitation for urban uses. In addition, cutbanks tend to cave in excavations. The sandy surface layer mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 5s3.

61—Trawick fine sandy loam, 8 to 20 percent slopes. This deep, strongly sloping to moderately steep soil is on hills and side slopes above drainageways. Areas are long and narrow and are commonly less than 100 acres.

Typically, the surface layer of this Trawick soil is dark red fine sandy loam about 6 inches thick. The subsoil extends to a depth of 46 inches. It is red clay in the upper part and dark red clay that contains bits of yellowish glauconite in the lower part. The underlying material, to a depth of 92 inches, is partially weathered greensand marl. Reaction is neutral in the surface layer and strongly acid to medium acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are spots of Nacogdoches soils, Trawick clay loam, and Trawick gravelly fine sandy loam. Trawick clay loam, 8 to 20 percent slopes, and Trawick gravelly fine sandy loam, 8 to 20 percent slopes make up as much as 35 percent of some mapped areas.

Areas of this Trawick soil are used mainly for woodland. Some areas are used for pastureland. This soil is not suitable for cultivated crops because of the steepness of slope and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The steep and moderately steep slopes are the main limitation. Longleaf uniola, pinehill bluestem, various thorny haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. Steepness of slope is the main limitation. In addition, low strength limits urban uses.

This soil is in capability subclass VIe and woodland suitability group 4r2.

62—Trawick gravelly fine sandy loam, 8 to 20 percent slopes. This deep, strongly sloping to moderately steep soil is on hills and side slopes above drainageways. Areas are long and narrow and are commonly less than 70 acres.

Typically, the surface layer of this Trawick soil is dusky red gravelly fine sandy loam about 7 inches thick. The

subsoil extends to a depth of 50 inches. It is dark red clay. The underlying material, to a depth of more than 80 inches, is partially weathered glauconite. Reaction is neutral in the surface layer and medium acid and strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. Runoff is rapid, and the hazard of erosion is severe.

Included with this soil in mapping are spots of Nacogdoches fine sandy loam, Trawick clay loam, and Trawick gravelly clay loam. Trawick gravelly clay loam and Trawick fine sandy loam, 8 to 20 percent slopes, make up as much as 35 percent of some mapped areas.

Most areas of this Trawick soil are used for woodland. This soil is not suitable for cultivated crops because of the steep and moderately steep slopes and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. Steepness of slope is the main limitation. Longleaf uniola, pinehill bluestem, various thorny haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. Steepness of slope is the main limitation. In addition, low strength is a limitation for urban uses.

This soil is in capability subclass VIe and woodland suitability group 4r2.

63—Trawick clay loam, 8 to 20 percent slopes. This deep, strongly sloping to moderately steep soil is on hills and side slopes above drainageways. Areas are long and narrow and are commonly less than 100 acres. The soil contains as much as 15 percent gravel.

Typically, the surface layer of this Trawick soil is dark red clay loam about 4 inches thick. The subsoil extends to a depth of 45 inches. It is dark red clay. The underlying material, to a depth of 80 inches, is partially weathered glauconite. Reaction is neutral in the surface layer and strongly acid in the subsoil.

This soil is well drained. It has moderately slow permeability and medium available water capacity. The hazard of erosion is severe.

Included with this soil in mapping are spots of Trawick fine sandy loam and a few spots of Nacogdoches fine sandy loam, 1 to 8 percent slopes. Trawick fine sandy loam, 8 to 20 percent slopes, and Trawick gravelly clay loam make up as much as 35 percent of some mapped areas.

Areas of this Trawick soil are used mostly for woodland. This soil is not suitable for cultivated crops because of the steep to moderately steep slopes and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. Steepness of slope is the main limitation. Longleaf uniola, pinehill bluestem, various thorny haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for most urban and recreation uses. Steepness of slope is the main limitation. In addition, low strength limits urban uses.

This soil is in capability subclass VIe and woodland suitability group 4r2.

64—Trawick-Bub complex, stony, 5 to 35 percent slopes. This complex of sloping to steep, deep and shallow soils is in the Redland Belt. Areas are large and are on landforms locally known as mountains. The deep Trawick soils are on less sloping parts of the complex, and the shallow Bub soils are in steeper areas that have slopes of 25 to 35 percent. About 10 percent of the surface is covered with stones that range from 6 to 8 feet across. Trawick soils make up about 50 to 60 percent of each area and Bub soils, about 30 to 40 percent. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Trawick soils is dark red gravelly clay loam 4 inches thick. The subsoil, to a depth of 42 inches, is red clay. The underlying material is glauconite or greensand marl. Reaction is neutral in the surface layer and strongly acid in the subsoil.

Typically, the surface layer of the Bub soils is dark reddish brown gravelly clay loam about 4 inches thick. The subsoil, to a depth of 14 inches, is yellowish red clay. The underlying material is glauconite or greensand marl. Reaction is slightly acid throughout.

These soils are well drained. They have moderately slow permeability. The Trawick soils have medium available water capacity, and the Bub soils have very low available water capacity. The hazard of erosion is severe.

Included with these soils in mapping are a few spots of Trawick gravelly fine sandy loam, 8 to 20 percent slopes, and areas where the slope is nearly vertical.

The soils of this Trawick-Bub complex are used mainly for woodland. Because of steepness of slope, hazard of erosion, and shallowness of the Bub soil, these soils are not suitable for cultivated crops.

These soils have low potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for fair production of improved bermudagrass. Steepness of slope, the gravelly surface layer, shallow depth, and stones on the surface are the main limitations.

The potential is low for commercial pine trees. Shortleaf pine and loblolly pine are dominant. Steepness of

slope and shallow depth of the Bub soils are the main limitations. Longleaf uniola, pinehill bluestem, various thorny haws, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of these soils is low for most urban and recreation uses. Steepness of slope is the main limitation.

This complex is in capability subclass VIs. Trawick soils are in woodland suitability group 4r2, and Bub soils are in woodland suitability group 4f2.

65—Trawick-Urban land complex, 8 to 20 percent slopes. This complex of deep, sloping to moderately steep soils and Urban land is on convex side slopes above drainageways. It is about 55 percent Trawick soils, about 30 percent Urban land, and 15 percent other soils. These soils are so intricately mixed that separation is not practical at the scale used in mapping.

Typically, the surface layer of the Trawick soils is dark red clay loam about 5 inches thick. The subsoil extends to a depth of 45 inches. It is dark red clay that contains 10 to 15 percent ironstone fragments and gravel. The underlying material, to a depth of 72 inches, is greensand marl. Reaction is neutral in the surface layer and strongly acid in the subsoil.

The Urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with these soils in mapping are small areas of Bub soils and Nacogdoches soils.

The Trawick soil has low potential for urban uses. Slope and low strength are the main limitations. Vertical cutbanks tend to cave if not shored up or otherwise supported.

This complex is not placed in a capability subclass or woodland suitability group.

66—Tuscosso clay loam, frequently flooded. This deep, nearly level soil is on bottomlands. It is along the meanders of streams, and in places it makes up all of the bottomland area of a stream. Areas are long and narrow.

Typically, the surface layer of this Tuscosso soil is dark reddish brown clay loam about 8 inches thick. The subsoil extends to a depth of 53 inches. From 8 to 15 inches it is yellowish red silty clay; from 15 to 27 inches it is yellowish red clay; from 27 to 40 inches it is yellowish red clay loam that has grayish brown mottles; and from 40 to 53 inches it is yellowish red clay that has gray mottles. The underlying material, to a depth of 72 inches, is red clay mottled with dark gray. Reaction is strongly acid in the surface layer and the subsoil. The underlying material is medium acid.

This soil is moderately well drained. It has moderately slow permeability and high available water capacity. Runoff is slow. This soil floods in most years for a duration of generally less than 2 days (fig. 17).

Included with this Tuscosso soil in mapping are areas of Hannahatchee soils which is less clayey than the Tuscosso soils. The included soils make up less than 15 percent of any mapped area.

Most areas of this soil are used for improved pasture. This soil is not suitable for cultivated crops because of the hazard of overflow.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of white clover and bahiagrass.

The potential is high for pine and hardwood trees. Water oak, red oak, sweetgum, loblolly pine, and shortleaf pine are dominant. Wetness, which affects the use of equipment, is the main limitation. Longleaf uniola, broomsedge bluestem, giant cane, and diverse panicums, shrubs, and sedges are the main understory vegetation.

This soil is not suitable for urban or recreation uses unless flooding is controlled.

This soil is in capability subclass Vw and woodland suitability group 1w8.

67—Woden fine sandy loam, 1 to 4 percent slopes. This deep, nearly level to gently sloping soil is on broad upland terraces near most of the major streams. It formed in old alluvial deposits that have been modified by wind.

Typically, the surface layer of this Woden soil is fine sandy loam about 11 inches thick. It is brown in the upper part and light brown in the lower part. The subsoil, to a depth of 96 inches, is fine sandy loam. From 11 to 80 inches it is yellowish red, and from 80 to 96 inches it is strong brown mottled with yellowish brown. Reaction is slightly acid and medium acid in the surface layer and medium acid in the subsoil.

This soil is well drained. It has moderately rapid permeability and medium available water capacity. The hazard of erosion is slight.

Included with this soil in mapping are slightly concave spots of Bernaldo soils and areas of Attoyac soils. The included soils make up about 20 percent of any mapped area.

This Woden soil is used mainly for improved pastureland. Some areas are used for woodland.

This soil has high potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terracing and contouring are needed if extensive cultivation is planned. Applications of fertilizers and lime are needed for high production.

This soil has high potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for high production of improved bermudagrass and bahiagrass.

Figure 17.—Frequent flooding on Tuscosso soil limits its use for pastureland and woodland.

The potential is high for pine and hardwood trees. Loblolly pine, shortleaf pine, and red oak are dominant. Longleaf uniola, pinehill bluestem, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is high for urban and recreation uses. There are no major limitations.

This soil is in capability subclass IIe and woodland suitability group 2o7.

68—Woodtell very fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on broad ridges. In some areas the surface has a gilgai microrelief of 2 to 3 inches made up of microdepressions and microknolls.

Typically, the surface layer of this Woodtell soil is very fine sandy loam about 6 inches thick. It is dark brown mottled with brown in the upper 3 inches and brown in the lower 3 inches. The subsoil is dense clay to a depth of 56 inches. It is red with grayish mottles in the upper part and light brownish gray with reddish mottles in the lower part. The underlying material, to a depth of 72 inches, is olive gray shale. Reaction is strongly acid in the surface layer and strongly acid and very strongly acid in the subsoil. The underlying material is medium acid.

This soil is moderately well drained. It has very slow permeability and medium available water capacity. The hazard of erosion is severe.

Included with this soil in mapping are some areas of Lacerda soils and some areas of sloping Woodtell soils. The included soils make up less than 20 percent of any mapped area.

Most areas of this Woodtell soil are used as woodland.

This soil has low potential for cropland. Use of crop residue and cover crops helps to maintain soil tilth. Terraces and contour farming are essential if cultivation is planned. Applications of fertilizer and lime are needed for high production.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clayey subsoil is the main limitation. The shrinking and swelling of this soil during tree growth has caused many trees to have crooked trunks. Longleaf uniola, pinehill bluestem, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for urban and recreation uses. The high shrink-swell potential of the clayey subsoil is the main limitation for urban uses. Very slow permeability mainly limits recreation uses.

This soil is in capability subclass IVe and woodland suitability group 4c2.

69—Woodtell very fine sandy loam, 5 to 20 percent slopes. This deep, sloping to moderately steep soil is on side slopes above drainageways. It formed in clayey marine deposits. Areas are generally long and narrow.

Typically, the surface layer of this Woodtell soil is very fine sand about 5 inches thick. It is dark brown in the upper 2 inches and pale brown in the lower 3 inches. The subsoil is clay to a depth of 45 inches. From 5 to 14 inches it is red mottled with gray, and from 14 to about 45 inches it is gray mottled with shades of gray and yellow. The underlying material, to a depth of 60 inches, is brownish gray shale. Reaction is strongly acid in the surface layer and strongly acid and very strongly acid in the subsoil.

This soil is moderately well drained. It has very slow permeability and medium available water capacity. The hazard of erosion is severe.

Included with this soil in mapping are areas of Sacul soils and Lacerda soils. The Sacul soils have less clay and are more acid than the Woodtell soils. The included soils make up about 20 percent of any mapped area.

Most areas of this Woodtell soil are used as woodland. This soil is not suitable for cultivated crops because of the steep and moderately steep slopes and the hazard of erosion.

This soil has medium potential for pastureland and hayland. Grazing management and the proper use of fertilizers and lime are needed for good production of improved bermudagrass and bahiagrass.

The potential is low for pine trees. Shortleaf pine and loblolly pine are dominant. The dense clayey subsoil is the main limitation. The shrinking and swelling of the clayey subsoil during tree growth has caused many trees to have crooked trunks. Longleaf uniola, pinehill bluestem, purpletop, and diverse panicums, shrubs, and sedges are the main understory vegetation.

The potential of this soil is low for urban and recreation uses. The high shrink-swell potential of the clayey subsoil is the main limitation for urban uses, and steepness of slope mainly limits recreation uses.

This soil is in capability subclass VIe and woodland suitability group 4c2.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops, hay, and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained

from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 170,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*4*). Of this total, over 134,000 acres was used for pastureland or hayland, and about 36,000 acres was used for cropland.

Many of the soils in Nacogdoches County have high potential for increased production of food. More than 100,000 acres of potentially good cropland is currently used as woodland or pastureland. Also, about 80,000 acres of sandy soils, for example, Betis, Briley, Darco, and Lilbert soils, though not prime cropland, is well adapted for watermelons and peanuts. In addition to the reserve productive capacity represented by these soils, food production could also be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help in the use and application of such technology.

Acreage in crops has gradually been decreasing as more and more land is used for woodland and pastureland. However, in the last few years there has been a renewed interest in corn production, and a few areas of soybeans have been planted. 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 a concern on much of the cropland in Nacogdoches County. Except in sandy soils, if slope is more than 2 percent, erosion is a hazard. Normally, where the slope is more than 5 to 8 percent, the erosion hazard is so severe that the soils should not be used for cropland.

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 that have a clayey subsoil, for example, Alto, Nacogdoches, Kirvin, Naclina, Sacul, and Woodtell soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, tilling or preparing a good seedbed is difficult on clayey or hardpan spots because the original friable surface soil has been eroded away. Such spots are common in areas of eroded Nacogdoches soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, provide nitrogen, and improve tilth for the following crop.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. Some soils are less suitable for terraces and diversions because of irregular slopes, excessive wetness in the terrace channels, or a clayey subsoil which would be exposed in terrace channels.

Contouring and contour stripcropping are widespread erosion control practices in the survey area. They are best adapted to soils that have smooth, uniform slopes.

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

Soil drainage is the major management need on about 28,000 acres of the county. Some soils are so wet that the production of crops common to the area is generally not possible. These are the poorly drained Osier and Mollville soils. Mantachie soils are subject to flooding annually, and are also somewhat poorly drained.

Soil fertility is naturally low in most soils on uplands in the survey area. All except the Bub, Chireno, Etoile, and Naclina soils are naturally acid. If they have never been limed, many soils on uplands are acid in their natural state. Applications of ground limestone are required to raise the pH level sufficiently for good growth of most crops and pasture plants. Available phosphorus and 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.

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. In most cases, these soils have a higher available water capacity than other soils.

Most of the soils used for crops in the survey area have a surface layer that is light in color and low in content of organic matter. Regular additions of crop residue, manure, and other organic material help improve soil structure.

The sandy soils on uplands, for example, Betis, Briley, Darco, and Lilbert soils, tend to be droughty. The thick sandy surface layer of these soils has low fertility, and holds little available water for newly sprouted plants or sprigs of bermudagrass. In many old fields or areas that have recently burned, the very low content of organic matter lowers the available water capacity, and tends to raise the temperature at the surface. Many soils on uplands are on slopes so steep that the hazard of erosion prevents cultivation. Cuthbert, Naclina, and Trawick soils are on slopes of more than 5 percent.

Such stony soils as Bub and Cuthbert soils have large stones on the surface that restrict use of the equipment needed for the planting and upkeep of pastures.

Special crops grown commercially in the survey area are vegetables, watermelons, peanuts, small fruits, tree

fruits, and nursery plants. A small acreage throughout the survey area is used for strawberries, sweet corn, tomatoes, and peppers.

Pasture and hay are important crops because livestock raising is one of the main farm enterprises in Nacogdoches County. Common bermudagrass, coastal bermudagrass, bahiagrass, and weeping lovegrass are important grasses. Crimson clover and vetch are among the main legumes. Most improved pastures in the county are old cropland areas which were converted to grasses. An improved pasture or meadow is one in which grasses are introduced to obtain high production of forage (see fig. 12). Coastal bermudagrass is established by sprigging. Common bermudagrass can either be sprigged or seeded, but on clayey soils sprigging is more successful. Bahiagrass and weeping lovegrass are seeded.

Good pasture management requires rotational grazing, weed control, applications of fertilizer, and other appropriate management practices. On well managed soils used for hay, fertilizer is applied and the forage is cut when the grasses reach the desired height. All of the soils in Nacogdoches County need fertilizer for high production of good quality forage, and most of the soils need lime. Many of the soils on bottom lands and in wet areas on uplands need some surface drainage to attain high production.

In general, the soils in the survey area that are well suited to crops are also well suited to urban development and other uses. The data about specific soils in this soil survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm development.

Yields per acre

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

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

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

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

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

Land capability classification

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

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

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

Class VII soils have very severe limitations that make them unsuitable for cultivation. (None in county).

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. (None in county).

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

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

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Woodland management and productivity

About 379,100 acres or 67 percent of Nacogdoches County is forested (*4*). The dominant species of trees used for commercial purposes vary greatly, depending on the soils. Most upland soils are covered with loblolly pine and shortleaf pine and numerous understory shrubs, vines, grasses, and legumes (see fig. 13). Many old fields have been planted in loblolly pine and slash pine. A few natural stands of longleaf pine are near Camp Tonkawa and Oil Springs. These trees grow mainly on sandy or gravelly soils. On the wetter soils in the bottom lands, for example, on Mantachie soils, water oak, willow oak, and blackgum are dominant.

Forest products are the largest source of income in Nacogdoches County. Lumber, pulpwood, poles, piling, plywood, and fiberboard are manufactured. Production could be much higher, however, if all woodland were properly managed.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the woodland suitability group for each soil. Soils assigned the same woodland suitability group require the same general management and have about the same expected productivity.

The first part of the *woodland suitability group*, a number, indicates the expected 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 group 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 that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r. The third part of the group symbol is local in nature.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

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

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. Site index was calculated at age 30 years for eastern cottonwood, and at 50 years for pine and other hardwoods. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in inter-

mediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 9 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 9 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Engineering

Henry J. Keller, civil engineer, Soil Conservation Service, helped prepare this section.

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

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

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

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

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

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

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

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

Building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and

severe if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Sanitary facilities

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

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

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

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

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

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

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level

of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

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

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

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

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

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

Construction materials

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

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

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

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

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

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

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

in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as good or fair has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines, the top of which is within a depth of 6 feet. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. Other soils are rated as poor. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel. Fine grained soils are not suited as sources of sand and gravel.

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, or stones.

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, or stones; 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

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

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

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

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

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading

and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

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

Recreation

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 14, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 14 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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

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

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

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

Wildlife habitat

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

In table 15, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are beaked panicum, goldenrod, beggarweed, and Florida paspalum.

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

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

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

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

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

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

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

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

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

Soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

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

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

Engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture (*5*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

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

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

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

Physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

water movement under saturated conditions affects behavior.

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

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

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. All measurements are less than 2 millimhos in Nacogdoches County; therefore, no soils are saline.

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

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

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

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

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

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

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

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

Soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have 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, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 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. A water table that is seasonally high for less than 1 month is not indicated in table 18.

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

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either rippable or hard. If the rock is rippable or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Engineering index test data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and morphology." The soil samples were tested by Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (Particle density)—T 100 (AASHTO), D653 (ASTM).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil gen-

esis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Alto series

The Alto series consists of deep, moderately well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in glauconitic greensand marl. Slope is 0 to 4 percent.

Typical pedon of Alto fine sandy loam, 0 to 4 percent slopes; from the town of Melrose, 1.1 miles west on Texas Highway 21 and 500 feet south, in a pasture:

Ap—0 to 9 inches; reddish brown (5YR 4/4) fine sandy loam; weak medium subangular blocky structure; soft, friable; common fine roots; few wormcasts; common fine concretions of iron oxide; slightly acid; clear wavy boundary.

B21t—9 to 15 inches; brown (7.5YR 4/4) clay loam; few fine faint mottles of yellowish red (5YR 4/6); moderate fine and medium subangular blocky structure; hard, firm; common fine roots; clay films on most peds; 7 to 10 percent by volume fine concretions of iron oxide; medium acid; gradual wavy boundary.

B22t—15 to 24 inches; strong brown (7.5YR 5/6) clay; few fine distinct mottles of yellowish red (5YR 4/6); strong medium subangular blocky structure; very hard, firm; clay films on most peds; about 7 to 10 percent fine concretions of iron oxide; slightly acid; gradual wavy boundary.

B23t—24 to 44 inches; yellowish brown (10YR 5/6) clay; common fine mottles of strong brown (7.5YR 5/6) and few medium prominent mottles of yellowish red (5YR 4/6); moderate medium subangular blocky structure; hard, firm; almost continuous clay films on surfaces of peds; common fine rounded concretions of iron oxide; slightly acid; gradual wavy boundary.

B24t—44 to 72 inches; yellowish red (5YR 5/6) clay loam; many medium distinct mottles of strong brown (7.5YR 5/6); weak subangular blocky structure; hard, firm; few clay films; few fine concretions of iron oxide; slightly acid.

The solum ranges from 60 to 80 inches in thickness.

The A horizon is brown, dark brown, and reddish brown clay loam or fine sandy loam and has up to 15 percent concretions of iron oxide. Reaction is slightly acid or neutral.

The Bt horizon is yellowish red, brown, strong brown, dark yellowish brown, or yellowish brown clay loam or clay. Reddish mottles range from few to many. Mottles of gray and olive are below a depth of 36 inches in most pedons. Clay content of the upper part of the Bt horizon

ranges from 35 to 50 percent. About 5 to 25 percent iron oxide concretions 1 millimeter to 5 millimeters in size occur in the Bt horizons. Reaction in the upper part of the Bt horizon is strongly acid through slightly acid; the lower part is strongly acid through neutral.

The C horizon is partially weathered glauconite and greensand. Reaction is medium acid through mildly alkaline.

Angelina series

The Angelina series consists of deep, very poorly drained, loamy soils on marsh flood plains. Permeability is slow. These soils formed in recent alluvial deposits. Slope is less than 1 percent.

Typical pedon of Angelina sandy clay loam in an area of Angelina soils, frequently flooded; from the city of Nacogdoches, about 8 miles southwest on U.S. Highway 59, then 2 miles west on dirt road to Stephen F. Austin Experimental Forest headquarters and 2,800 feet south-southwest, in a marsh:

O1—3 inches to 2; leaves, stems, and other litter in various stages of decomposition.

O2—2 inches to 0; decomposing organic material that has most of the original form destroyed.

A1g—0 to 4 inches; light gray (10YR 6/1) sandy clay loam; common fine distinct strong brown mottles mainly around old root channels; massive; friable; many fine roots; many fine pores; very strongly acid; clear smooth boundary.

C1g—4 to 11 inches; light gray (10YR 7/1) sandy clay loam; common fine distinct yellowish brown mottles; massive; friable; common fine roots; common fine pores; very strongly acid; clear smooth boundary.

C2g—11 to 23 inches; light gray (10YR 6/1) sandy clay loam; common medium distinct strong brown (7.5YR 5/8) mottles; massive; friable; common fine roots; common fine pores; very strongly acid; gradual smooth boundary.

C3g—23 to 32 inches; light gray (10YR 6/1) sandy clay loam; many fine and medium distinct red (2.5YR 4/8) mottles; massive; friable; few fine roots; few fine pores; very strongly acid; gradual smooth boundary.

C4g—32 to 60 inches; prominently mottled light gray (10YR 6/1), red (2.5YR 4/8), and strong brown (7.5YR 5/6) clay loam; massive; friable; few fine roots; few fine pores; very strongly acid.

Reaction is strongly acid or very strongly acid.

The Ag horizon is gray, grayish brown, light brownish gray, or light gray sandy clay loam, loam, or fine sandy loam.

The Cg horizon is light gray, gray, or light brownish gray, mottled with brown, yellow, gray, and red. The 10- to 40-inch control section is sandy clay loam, clay loam, or loam. Clay content ranges from 24 to 35 percent, and silt content is more than 20 percent. In some pedons, pockets, lenses, or thin strata of more sandy material is at a depth of less than 50 inches. Krotovinas are common throughout the solum.

Attoyac series

The Attoyac series consists of deep, well drained, loamy soils on terraces. Permeability is moderate. These soils formed in old alluvium. Slope ranges from 0 to 15 percent.

Typical pedon of Attoyac fine sandy loam, 0 to 4 percent slopes; from the city of Nacogdoches, about 8 miles southwest on U.S. Highway 59, then 2 miles west on dirt road to Stephen F. Austin Experimental Forest headquarters, and 1,600 feet northeast, in a pasture 150 feet north of fenced experimental plot:

Ap—0 to 5 inches; reddish brown (5YR 4/4) fine sandy loam; weak medium granular structure; soft, very friable; common fine roots; common fine pores; slightly acid; clear smooth boundary.

A1—5 to 9 inches; reddish brown (5YR 5/4) fine sandy loam; weak medium subangular blocky structure; soft, very friable; common fine roots; common fine pores; slightly acid; gradual smooth boundary.

B21t—9 to 17 inches; dark red (2.5YR 3/6) fine sandy loam; weak medium subangular blocky structure; soft, friable; common fine roots; common fine pores; few thin patchy clay films; medium acid; gradual wavy boundary.

B22t—17 to 35 inches; dark red (2.5YR 3/6) sandy clay loam; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; common thin clay films; medium acid; diffuse boundary.

B23t—35 to 75 inches; red (2.5YR 4/8) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; common thin clay films; few uncoated sand grains; medium acid.

The solum ranges from 60 to more than 100 inches in thickness. Rounded quartz and iron enriched pebbles range from 0 to 5 percent by volume throughout the soil.

The A horizon is reddish brown, yellowish red, brown, strong brown, yellowish brown, or dark brown fine sandy loam. Where moist value is less than 3.5 and chroma is 3 or less, the horizon is less than 6 inches thick. Reaction ranges from strongly acid through slightly acid.

The upper Bt horizon is dark red, red, or yellowish red sandy clay loam, loam, or fine sandy loam. The average clay content ranges from 18 to 32 percent; silt content exceeds 20 percent. The lower part of the Bt horizon is red, dark red, yellowish red, or strong brown sandy clay loam or loam. Base saturation ranges from 35 to 60

percent in the Bt horizon. Few skeletans and small pockets of uncoated sand and silt make up less than 5 percent of some pedons. Reaction ranges from strongly acid through slightly acid.

Bernaldo series

The Bernaldo series consists of deep, well drained, loamy soils on terraces. Permeability is moderate. These soils formed in deep, loamy sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Bernaldo fine sandy loam in an area of Bernaldo-Besner complex; from the city of Nacogdoches, 10 miles southwest to Stephen F. Austin Experimental Forest headquarters, about 1 mile northeast on Forest Road 401, and about 50 feet from a 90-degree turn in the road:

Ap—0 to 6 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; soft, very friable; common fine roots; slightly acid; clear smooth boundary.

A2—6 to 14 inches; pale brown (10YR 6/3) fine sandy loam; massive; soft, very friable; common fine roots; slightly acid; clear wavy boundary.

B2t—14 to 47 inches; strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; hard, friable; few fine roots; common and very fine pores; thin discontinuous clay films; sand grains coated and bridged; few dark concretions and soft masses; medium acid; gradual wavy boundary.

B2t&A'2—47 to 80 inches; yellowish brown (10YR 5/6) loam; common medium distinct mottles of strong brown (7.5YR 5/6); weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few fine roots; few fine and very fine pores; few discontinuous clay films; about 10 percent brittle mass; about 10 percent light gray (10YR 6/1) vertical ped coatings that are 10 to 20 centimeters long and about 2 to 5 centimeters wide; medium acid.

The solum ranges from 60 to more than 100 inches in thickness. Depth to saturated subhorizons ranges from 48 to 72 inches during the cool season in most years.

The A horizon is commonly fine sandy loam or loam. The A1 or Ap horizon is dark brown, very dark grayish brown, dark yellowish brown, dark grayish brown, brown, pale brown, or grayish brown. The A2 horizon is brown, grayish brown, light brownish gray, pale brown, yellowish brown, light yellowish brown, or very pale brown. Reaction of the A horizon is strongly acid through slightly acid.

The B2t horizon is loam or sandy clay loam. It is reddish brown, light reddish brown, brown, strong brown, light brown, yellowish brown, light yellowish brown, brownish yellow, or yellow. Mottles in shades of brown, gray, and red are in most pedons, but mottles with chroma of 2 or less do not occur within a depth of 30 inches. Clay content ranges between 18 and 30 percent in the upper 20 inches; silt content is 20 to about 45 percent. Reaction is very strongly acid through slightly acid.

The B2t&A'2 horizon is fine sandy loam or sandy clay loam and has a range of color similar to that of the B2t horizon. It consists of vertical streaks, tongues, and ped coatings that are 1 centimeter to 5 centimeters wide and 5 to 30 centimeters long. The A'2 material makes up from 5 to 15 percent of the matrix.

Besner series

The Besner series consists of deep, well drained, loamy soils on low mounds on stream terraces. These soils formed in alluvium that has been modified by wind. Permeability is moderate. Slope ranges from 0 to 3 percent.

Typical pedon of Besner fine sandy loam in an area of Mollville-Besner complex; from the city of Nacogdoches, 10 miles southwest to Stephen F. Austin Experimental Forest and 1.2 miles west of headquarters; 280 feet west of oil pipeline, and 20 feet south of road:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; soft, loose; many roots; medium acid; abrupt wavy boundary.

A21—2 to 9 inches; brown (10YR 5/3) fine sandy loam; weak fine granular structure; slightly hard, loose; common medium and coarse roots; very strongly acid; clear wavy boundary.

A22—9 to 38 inches; pale brown (10YR 6/3) fine sandy loam; weak fine granular structure; slightly hard, loose; common medium and coarse roots; slightly acid; gradual wavy boundary.

B21t—38 to 55 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; sand grains coated and bridged with clay; upper 3 inches has ped coatings of pale brown (10YR 6/3); strongly acid; clear wavy boundary.

B22t&A'2—55 to 73 inches; reddish yellow (7.5YR 6/6) loam (B22t); few medium distinct mottles of red (2.5YR 5/8) and few ped coatings of very pale brown (10YR 7/3) (A'2); weak medium subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; sand grains coated and bridged with clay; about 10 percent of the matrix is brittle and has high chroma; strongly acid; clear wavy boundary.

B23t&A'2—73 to 80 inches; reddish yellow (7.5YR 6/8) loam (B23t); common medium distinct mottles of brownish yellow (10YR 6/8) and very pale brown (10YR 7/3) (A'2); about 15 to 20 percent light gray (10YR 7/2) interfingering of fine sandy loam; weak

subangular blocky structure; slightly hard, friable; about 15 percent of the matrix is brittle and has high chroma; strongly acid.

The solum ranges from 70 to more than 80 inches in thickness. Clay content of the upper 20 inches of the argillic horizon ranges from 14 to 18 percent; the silt content ranges from 20 to 45 percent. Reaction ranges from very strongly acid through slightly acid.

The A horizon is fine sandy loam 20 to 40 inches thick. The A1 horizon is dark grayish brown, grayish brown, or brown. The A2 horizon is brown, very pale brown, pale brown, light gray, or light yellowish brown.

The B2t horizon is yellowish brown, brownish yellow, light yellowish brown, strong brown, or reddish yellow.

The B2t&A'2 horizon has matrix colors similar to those of the B2t horizon. It is light yellowish brown and olive yellow in some pedons. In the B2t&A'2 horizon, the B2t part has mottles of red and yellowish red. The A'2 part is light gray pale brown or very pale brown. Brittle bodies make up from 2 to 20 percent by volume of the B2t&A'2 horizon.

Betis series

The Betis series consists of deep, somewhat excessively drained sandy soils on uplands. Permeability is rapid. These soils formed in thick, sandy Coastal Plain sediment. Slope ranges from 0 to 8 percent.

Typical pedon of Betis loamy fine sand, 0 to 8 percent slopes; from intersection of Texas Highway 21 with Loop 224 west of the city of Nacogdoches, 5 miles west on Texas Highway 21 to church building, about 100 feet behind the church:

A11—0 to 10 inches; brown (10YR 4/3) loamy fine sand; weak fine granular structure; soft, very friable; many medium and coarse roots; strongly acid; clear smooth boundary.

A12—10 to 37 inches; brown (7.5YR 5/4) loamy fine sand, few pockets of pale brown (10YR 6/3); single grain; soft, very friable; many medium and few coarse roots; strongly acid; gradual smooth boundary.

B1—37 to 57 inches; strong brown (7.5YR 5/6) loamy fine sand that contains common small bodies of very pale brown (10YR 7/3); single grain; soft, very friable; medium acid; few coarse and fine roots; gradual smooth boundary.

A2&B2t—57 to 80 inches; very pale brown (10YR 7/3) loamy fine sand (A2) that contains yellowish brown (10YR 5/6) lamellae of fine sandy loam (B2t) 1/4 to 3/4 inch thick; single grain; lamellae are massive; soft, very friable; lamellae have coated sand grains and some clay bridging; medium acid.

The solum ranges from 60 to 80 inches in thickness. The matrix is loamy fine sand. Base saturation at a depth of 72 inches ranges from 20 to 35 percent. Reaction ranges from very strongly acid through medium acid unless lime has been added.

The A1 horizon is dark grayish brown, grayish brown, or brown.

The B1 horizon is strong brown, yellowish brown, and yellowish red. Randomly distributed pockets of clean sand grains range from few to common.

The A2 part of the A2&B2t horizon is brown, pale brown, very pale brown, light yellowish brown, or yellowish brown. The B2t part (lamellae) is yellowish red, strong brown, or yellowish brown loamy fine sand or fine sandy loam. Composite thickness is more than 6 inches within a depth of 2 meters.

Bienville series

The Bienville series consists of deep, somewhat excessively drained sandy soils on stream terraces. Permeability is moderately rapid. These soils formed in sandy old alluvial sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Bienville loamy fine sand, 1 to 5 percent slopes; from intersection of Farm Road 225 and Loop 224 on west side of the city of Nacogdoches, 11 miles west on Farm Road 225 to county dirt road, 1.7 miles west-northwest, 1.3 miles north and 50 feet south of road, in pasture on Stripling Island, about 450 feet from the Angelina River:

Ap—0 to 8 inches; brown (10YR 4/3) loamy fine sand; weak medium granular structure; soft, loose; many fine roots; slightly acid; gradual smooth boundary.

A2—8 to 25 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; soft, loose; many fine roots; slightly acid; gradual smooth boundary.

A&B—25 to 45 inches; brown (10YR 5/3) loamy fine sand (A2 part) that has splotches and lamellae (B2t part) of reddish brown (5YR 5/4); single grain; soft, loose; common fine roots; clay bridging; medium acid; gradual wavy boundary.

B&A—45 to 72 inches; strong brown (7.5YR 5/6) loamy fine sand that has common splotches and lamellae (B2t part) of yellowish red (5YR 4/6), and many coarse prominent striped areas (A2 part) of pale brown (10YR 6/3); soft, loose; common fine roots; medium acid.

The solum is more than 60 inches thick.

The A horizon is loamy fine sand. The A1 or Ap horizon is dark grayish brown, brown, or grayish brown. The A2 horizon is brown, pale brown, yellowish brown, or light yellowish brown. Reaction is slightly acid through medium acid.

The A&B horizon contains few to common splotches or lamellae of reddish brown.

The Bt part of the A&B horizon is reddish brown and averages a loamy fine sand. It occurs as few to common splotches or lamellae (see fig. 8).

The A2 part of the B&A horizon is brown, pale brown, light yellowish brown, or very pale brown and makes up 15 to 40 percent of the horizon. The Bt part of the B&A horizon is strong brown, reddish brown, or yellowish red. It is typically loamy fine sand but ranges to fine sandy loam. Reaction is medium acid through very strongly acid.

Bowie series

The Bowie series consists of deep, moderately well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in deep, loamy material. Slope ranges from 1 to 8 percent.

Typical pedon of Bowie fine sandy loam, 1 to 8 percent slopes; from the town of Chireno, 1 mile south on Farm Road 95 and 50 feet east, in a pasture:

A1—0 to 3 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; soft, very friable; many fine roots; strongly acid; clear smooth boundary.

A2—3 to 7 inches; pale brown (10YR 6/3) fine sandy loam; massive; soft, very friable; many fine roots; common fine pores; few concretions of iron oxide; strongly acid; gradual wavy boundary.

B21t—7 to 23 inches; strong brown (7.5YR 5/6) sandy clay loam; common fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; many fine pores; thin patchy clay films on faces of peds and in pores; few fine strongly cemented pitted brown concretions of iron oxide; strongly acid; gradual wavy boundary.

B22t—23 to 42 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; hard, friable, few fine and medium roots; common fine pores; thin patchy clay films on faces of peds and in pores; 2 to 3 percent by volume nodular plinthite; few fine strongly cemented brown concretions of iron oxide; very strongly acid; diffuse wavy boundary.

B23t—42 to 61 inches; yellowish brown (10YR 5/6) sandy clay loam ped interiors with 25 percent red mottles (2.5YR 4/8), ped surfaces have vertically oriented streaks and coatings of gray (10YR 6/1); moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few fine roots in gray parts; thin patchy clay films; 20 percent by volume red mottles that range from soft to brittle; about 8 to 10 percent nodular plinthite; very strongly acid; gradual boundary.

B24t—61 to 72 inches; yellowish brown (10YR 5/6) sandy clay loam ped interiors with 20 percent red (2.5YR 4/8) mottles; ped surfaces have light gray (10YR 6/1) vertical tongues and light gray ped coatings; moderate coarse prismatic structure parting to weak subangular blocky; hard, friable; few fine pores; 8 to 10 percent by volume brittle plinthite; few clay films; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. Depth to horizons that have more than 5 percent plinthite is 30 to 45 inches. Strongly cemented to indurated iron oxide concretions less than 2 centimeters in diameter range from 0 to 5 percent by volume throughout the profile. Base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 23 to 35 percent.

The A horizon is fine sandy loam. The Ap or A1 horizon is grayish brown, brown, dark grayish brown, very dark grayish brown, dark brown, or brown. The A2 horizon is light brownish gray, grayish brown, brown, pale brown, very pale brown, or light yellowish brown. Reaction is strongly acid through slightly acid.

The B2t horizon is sandy clay loam. The B21t and B22t horizons are yellowish brown, brownish yellow, strong brown, or reddish yellow. Few to common mottles of red and yellowish red are in most pedons. The B23t and B24t horizons are similar in color to the upper part of the B2t horizon and contain mottles and streaks of gray, light gray, light brownish gray, or grayish brown. In a horizontal cross section, colors are generally reticulate. Content of clay in the B2t horizon ranges from 18 to 35 percent, and content of silt and very fine sand ranges from 25 to 40 percent. Plinthite makes up 5 to 30 percent of the B23t and B24t horizons. Reaction is very strongly acid through strongly acid.

Briley series

The Briley series consists of deep, well drained sandy soils on uplands. Permeability is moderate. These soils formed in sandy marine sediment. Slope ranges from 1 to 8 percent.

Typical pedon of Briley loamy fine sand, 1 to 8 percent slopes; from the city of Nacogdoches, about 15 miles northeast on U.S. Highway 259 to Farm Road 1087, 7.6 miles east on Farm Road 1087 to Mt. Vernon Union Church, 0.3 mile south on dirt road to Walnut Grove Church and 50 feet east, in woods:

A11—0 to 5 inches; brown (10YR 4/3) loamy fine sand; weak fine granular structure; soft, very friable; many roots; medium acid; clear wavy boundary.

A21—5 to 17 inches; brown (10YR 5/3) loamy fine sand; massive; soft, very friable; common roots; medium acid; clear smooth boundary.

A22—17 to 23 inches; pale brown (10YR 6/3) loamy fine sand; massive; soft, very friable; common medium

and coarse roots; strongly acid; gradual wavy boundary.

B21t—23 to 43 inches; yellowish red (5YR 4/8) sandy clay loam; medium fine subangular blocky structure; slightly hard, friable; few patchy clay films on faces of peds; few fine and medium roots; very strongly acid; gradual wavy boundary.

B22t—43 to 72 inches; yellowish red (5YR 5/8) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) and red (2.5YR 4/6) mottles; weak subangular blocky structure; slightly hard, friable; few thin patchy clay films on faces of peds; few fine and medium roots; very strongly acid.

The solum ranges from 65 to more than 80 inches in thickness. Base saturation at a depth of 72 inches ranges from 23 to 35 percent. In some pedons, plinthite is in the lower part of the solum but makes up less than 5 percent of any horizon.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon is brown or dark grayish brown. The A2 horizon is pale brown, yellowish brown, or light yellowish brown. An A3 or B1 horizon of reddish brown, strong brown, reddish yellow, or yellowish red loamy fine sand is present in some pedons. Reaction of the A horizon is very strongly acid through slightly acid.

The B2t horizon is yellowish red or red fine sandy loam, sandy clay loam, or loam. The lower part has few to many strong brown, yellowish brown, or red mottles. Clay content of the B2t horizon ranges from 17 to 28 percent. Reaction is very strongly acid through medium acid.

Bub series

The Bub series consists of shallow, well drained soils on uplands. Permeability is moderately slow. These soils formed in glauconitic greensand marl. Slope is mainly 10 to 25 percent but ranges from 5 to 35 percent.

Typical pedon of Bub gravelly clay loam in an area of Trawick-Bub complex, stony, 5 to 35 percent slopes; from the town of Melrose, 2 miles south on Melrose-Woden Road and 300 feet west, in timber:

A1—0 to 4 inches; dark reddish brown (5YR 3/4) gravelly clay loam; moderate fine and very fine granular structure; hard, friable; common fine and very fine roots; about 35 to 50 percent flattened fragments of ironstone 2 to 10 inches across; slightly acid; clear smooth boundary.

Bt—4 to 14 inches; yellowish red (5YR 4/6) clay; moderate medium subangular blocky structure; very hard, firm; common fine roots; clay films on surfaces of peds; about 10 to 15 percent flattened fragments of ironstone 1/4 to 1 inch across; slightly acid; abrupt wavy boundary.

Cr—14 to 32 inches; alternate layers of yellowish brown (10YR 5/6) partially weathered glauconite and glauconitic marl that has the texture of clay loam; massive; cleavages and faces of some ironstone plates are coated with clay; neutral.

The solum ranges from 12 to 20 inches in thickness. The A horizon is dark reddish brown or dark brown clay loam. If the A horizon has value of 3 and chroma of 2 or 3, the horizon is less than 4 inches thick. Content of ironstone fragments ranges from 25 to 50 percent. Reaction is medium acid or slightly acid.

The Bt horizon is red, dark red, reddish brown, or yellowish red through strong brown. Clay content is 40 to 55 percent. Content of pebble and ironstone fragments ranges from 10 to 35 percent. Reaction is very strongly acid through slightly acid.

The Cr horizon is yellowish, partially weathered glauconite that has intermittent ironstone ledges. Reaction is medium acid through neutral.

Chireno series

The Chireno series consists of deep, moderately well drained clayey soils on uplands. Permeability is slow. These soils formed in glauconitic greensand marl. Slope is less than 2 percent.

Typical pedon of Chireno clay loam, 0 to 2 percent slopes; from the city of Nacogdoches, about 7 miles southeast on Texas Highway 21 to Farm Road 226, 3 miles south on Farm Road 226 and 50 feet west, in pasture, about 500 feet north of the channel of Tuscosso Creek:

Ap—0 to 7 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; hard, friable; many medium and fine roots; many wormcasts; mildly alkaline; clear wavy boundary.

A11—7 to 12 inches; faintly mottled very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) clay, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; hard, firm; many fine roots; many wormcasts; mildly alkaline; gradual wavy boundary.

A12—12 to 18 inches; very dark grayish brown (10YR 3/2) clay; few medium distinct and faint mottles of brown (7.5YR 5/4) and very dark gray (10YR 3/1); moderate coarse prismatic structure parting to moderate medium granular; many fine roots; many wormcasts; hard, firm; mildly alkaline; gradual wavy boundary.

B21—18 to 31 inches; brown (10YR 4/3) clay; common medium distinct mottles of strong brown (7.5YR 5/6); moderate medium granular structure; hard, firm; 7 to 8 percent black concretions; few fine roots; mildly alkaline; gradual wavy boundary.

B22—31 to 47 inches; yellowish brown (10YR 5/6) clay; common medium distinct mottles of dark grayish brown (2.5Y 4/2); weak medium granular structure; hard, firm; 10 to 12 percent black concretions; moderately alkaline; gradual wavy boundary.

B3—47 to 62 inches; faintly mottled light olive brown (2.5Y 5/6) and dark grayish brown (2.5Y 4/2) clay; weak medium granular structure; hard, firm; 15 to 20 percent black concretions; moderately alkaline.

The solum ranges from 50 to more than 70 inches in thickness. Depth to the horizon containing more than 5 percent black iron-manganese concretions ranges from 15 to 35 inches. Average clay content of the control section ranges from 35 to 42 percent. Cracks 0.3 inch wide extend to a depth of 3 to 5 inches. Reaction ranges from medium acid through mildly alkaline.

The A horizon ranges from 10 to 22 inches in thickness. It is black, very dark brown, dark brown, very dark grayish brown, or very dark gray.

The B2 horizon is strong brown, yellowish brown, brown, light olive brown, or olive brown clay loam or clay. Mottles of dark grayish brown and olive yellow are in most pedons. Black concretions make up from 5 to 25 percent of most pedons.

In some pedons, a C horizon of glauconitic greensand marl is below a depth of 60 inches.

Cuthbert series

The Cuthbert series consists of moderately deep, well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in stratified loamy and clayey sediment. Slope ranges from 5 to 30 percent.

Typical pedon of Cuthbert fine sandy loam, 8 to 20 percent slopes; from the town of Melrose, 1 mile east on Texas Highway 21, 6.5 miles south on dirt road, 400 yards west on another dirt road and about 50 feet south, in timber:

A1—0 to 4 inches; very dark gray (10YR 3/1) fine sandy loam; weak medium granular structure; soft, very friable; about 10 percent by volume flat and angular fragments of ironstone; strongly acid; clear wavy boundary.

A2—4 to 8 inches; brown (10YR 5/3) fine sandy loam; massive; soft, very friable; about 5 percent by volume flat and angular fragments of ironstone; strongly acid; clear wavy boundary.

B21t—8 to 20 inches; dark red (2.5YR 3/6) clay; strong medium blocky structure; hard, firm; continuous clay films on surface of peds; about 1 to 2 percent flat and angular fragments of ironstone; very strongly acid; gradual smooth boundary.

B22t—20 to 29 inches; red (2.5YR 4/8) clay, common fine and medium prominent mottles of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) arranged horizontally; strong coarse and medium blocky structure; hard, firm; continuous thin clay films on surfaces of peds; very strongly acid; gradual smooth boundary.

C—29 to 34 inches; partially weathered horizontal layers of red (2.5YR 4/8), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2) sandy loam, soft sandstone, and grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) shale; weak coarse blocky structure; hard, friable; peds are coated with thick red continuous clay films; common flakes of mica; extremely acid; gradual smooth boundary.

Cr—34 to 60 inches; stratified red (2.5YR 4/8) and strong brown (7.5YR 5/6) soft sandstone and grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) shale; strata are 1/4 inch to 4 inches thick; weakly cemented sandy material can be easily cut with a spade; common fine flakes of mica mainly on surfaces of shale strata; extremely acid.

The solum ranges from 20 to 40 inches in thickness (fig. 9). Base saturation above the paralithic contact with the Cr horizon ranges from 10 to 30 percent. Clay content of the control section ranges from 40 to 60 percent, and silt content ranges from 15 to 30 percent.

The A horizon is fine sandy loam or gravelly fine sandy loam. Coarse fragments of ironstone make up as much as 35 percent by volume of this horizon. The A1 horizon is dark brown, brown, very dark gray, dark grayish brown, grayish brown, or pale brown. The A2 horizon is brown, light brown, pale brown, yellowish brown, or light yellowish brown. Reaction of the A horizon ranges from very strongly acid through slightly acid.

The Bt horizon is dark reddish brown, reddish brown, dark red, red, or yellowish red. Mottles of light brownish gray, pale brown, and strong brown are in the lower part of many pedons. The gray color is caused by shale fragments. The Bt horizon generally is 1 to 10 percent by volume pebbles of angular and flat ironstone. Reaction ranges from extremely acid through strongly acid.

The Cr horizon is interbedded or stratified sandy loam and shale. In most pedons, the weakly cemented or cemented sandy material can be cut with a spade. In many pedons, flakes of mica are visible along cleavage planes between strata and in the sandy material. The Cr horizon ranges from extremely acid through strongly acid.

Darco series

The Darco series consists of deep, well drained sandy soils on uplands. Permeability is moderate. These soils formed in sandy sediment. Slope is dominantly 2 to 10 percent, but ranges from 1 to 25 percent.

Typical pedon of Darco loamy fine sand, 1 to 8 percent slopes; from the city of Nacogdoches, about 2 miles

south on Highway 59 to Fern Lake Fire Tower Road, 300 feet west and 50 feet north:

A1—0 to 4 inches; brown (10YR 4/3) loamy fine sand; weak granular structure; soft, loose; many fine and medium roots; medium acid; gradual smooth boundary.

A21—4 to 24 inches; brown (10YR 5/3) loamy fine sand; single grain; soft, very friable; common fine roots; medium acid; gradual smooth boundary.

A22—24 to 48 inches; pale brown (10YR 6/3) loamy fine sand; single grain; soft, very friable; few fine roots; medium acid; gradual smooth boundary.

B21t—48 to 68 inches; yellowish red (5YR 5/6) sandy clay loam; moderate fine subangular blocky structure; hard, friable; few fine pores; thick patchy clay films; strongly acid; gradual smooth boundary.

B3—68 to 80 inches; yellowish red (5YR 5/6) sandy clay loam; common medium distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; hard, friable; thin patchy clay films; strongly acid.

The solum is more than 80 inches thick. Base saturation ranges from 20 to 35 percent at a depth of 72 inches. The A horizon ranges from 40 to 72 inches in thickness.

The A horizon is loamy fine sand. The A1 horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. Reaction is strongly acid through slightly acid. The A2 horizon is brown, pale brown, light yellowish brown, or yellowish brown. Reaction is very strongly acid through slightly acid.

The Bt horizon is red, yellowish red, strong brown, or yellowish brown sandy loam or sandy clay loam. Brownish and reddish mottles range from none to common. In some pedons, mottles with chroma of 2 are below a depth of 50 inches. The Bt horizon has clay content of 15 to 25 percent. Plinthite content ranges from 0 to about 5 percent. Reaction ranges from very strongly acid to strongly acid.

Etoile series

The Etoile series consists of deep, somewhat poorly drained loamy soils on uplands. Permeability is very slow. These soils formed in calcareous, clayey sediment. Slope ranges from 1 to 20 percent.

Typical pedon of Etoile fine sandy loam, 1 to 5 percent slopes; from intersection of Texas Highway 103 and Farm Road 226 in the community of Etoile, 1.2 miles north on Farm Road 226 and 100 feet east, in woods:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam; moderate medium grandular structure; slightly hard, friable; common roots; medium acid; abrupt wavy boundary.

A2—3 to 8 inches; pale brown (10YR 6/3) loam; massive; slightly hard, friable; common medium and coarse roots; medium acid; clear wavy boundary.

B21t—8 to 17 inches; yellowish red (5YR 4/6) clay; common medium distinct mottles of pale brown (10YR 6/3); moderate medium blocky structure; extremely hard, very firm; common medium and coarse roots; strongly acid; gradual smooth boundary.

B22t—17 to 41 inches; mottled yellowish red (5YR 5/6) and light brownish gray (10YR 6/2) clay; weak medium subangular blocky structure; extremely hard, very firm; few pebbles of ironstone; few small slickensides; few medium and coarse roots; neutral; gradual smooth boundary.

1B3—41 to 53 inches; olive (5Y 4/4) clay; weak medium subangular blocky structure; extremely hard, very firm; few flattened roots; common small slickensides; common soft and hard rounded masses of lime; slight effervescence; moderately alkaline; clear smooth boundary.

C—53 to 60 inches; olive brown (2.5Y 4/4), light olive brown (2.5Y 5/6), and gray (5Y 6/1) platy clay; extremely hard, very firm; many soft rounded masses and seams of lime; strong effervescence; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to calcareous material ranges from 25 to 50 inches.

The A horizon is less than 10 inches thick. It is very fine sandy loam or loam. The A1 horizon is very dark grayish brown, dark grayish brown, dark brown, and brown. If present the A2 horizon is brown, pale brown, light brownish gray, light yellowish brown, or brownish yellow. Reaction of the A horizon ranges from strongly acid through neutral.

The upper part of the B2t horizon is red, yellowish red, or strong brown. It has mottles of yellowish brown, gray, pale brown, and light brownish gray. Gray mottles are generally more abundant as depth increases. Reaction ranges from very strongly acid through neutral. The lower parts of the B2t horizon and the B3 horizon are light brownish gray, light olive brown, olive brown, olive, pale olive, or olive yellow. They have mottles of yellowish red, yellowish brown, and gray. Reaction is neutral to moderately alkaline.

The C horizon is similar in color to the lower part of the B2t horizon and the B3 horizon. It is laminated or is platy, calcareous clay or marl.

Hannahatchee series

The Hannahatchee series consists of deep, moderately well drained loamy soils on bottom lands. Permeability is moderate. These soils formed in recent alluvial material derived mainly from outwash of the Redland Belt soils.

Slope is less than 1 percent. These soils generally flood annually.

Typical pedon of Hannahatchee loam, frequently flooded; from the town of Douglass, 1 mile north on Farm Road 225, and 0.3 mile into creek bottom, about 100 feet from stream, in pasture:

A1—0 to 9 inches; reddish brown (5YR 4/4) loam; weak medium granular structure; soft, very friable; many fine and medium grass roots; medium acid; clear smooth boundary.

B21—9 to 21 inches; yellowish red (5YR 4/6) loam; weak medium subangular blocky structure; slightly hard, friable; many fine and medium grass roots; medium acid; gradual smooth boundary.

B22—21 to 45 inches; yellowish red (5YR 4/6) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; many fine grass roots; medium acid; gradual smooth boundary.

C—45 to 65 inches; yellowish red (5YR 4/6) sandy clay loam; structureless; slightly hard, friable; medium acid.

The solum ranges from 30 to 60 inches in thickness. Reaction is medium acid through neutral.

The A horizon is reddish brown, yellowish red, dark brown, or brown fine sandy loam or loam.

The B horizon is dark reddish brown, reddish brown, yellowish red, brown, or strong brown sandy clay loam, fine sandy loam, or loam. Common faint through distinct brown, pale brown, red, and strong brown mottles are in some pedons. The average clay content of the 10- to 40-inch control section is 18 to 28 percent.

The C horizon is yellowish red, reddish brown, light brown, or yellowish brown sandy clay loam, loam, sandy loam, or fine sandy loam and has strata of loamy fine sand. Few or common brown, yellowish brown, reddish brown, red, or gray mottles are in many pedons.

luka series

The luka series consists of deep, moderately well drained loamy soils on bottom lands. Permeability is moderate. These soils formed in recent alluvium. Slope is less than 1 percent. These soils flood about once every 2 to 5 years.

Typical pedon of luka fine sandy loam, occasionally flooded; from Sacul Cemetery which is about 25 miles northwest of the city of Nacogdoches, 300 feet south, into Indian Creek bottom:

A11—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam; weak medium granular structure; slightly hard, friable; many roots; common fine pores; few wormcasts; strongly acid; clear smooth boundary.

A12—4 to 12 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; slightly hard, friable; common roots; common fine and very fine pores; strongly acid; gradual smooth boundary.

C1—12 to 26 inches; brown (10YR 5/3) fine sandy loam with common medium distinct mottles of grayish brown (10YR 5/2); massive; slightly hard, friable; few fine pores; strongly acid; gradual smooth boundary.

A1b—26 to 33 inches; dark grayish brown (10YR 4/2) fine sandy loam; massive; slightly hard, friable; strongly acid; gradual boundary.

C2—33 to 60 inches; distinctly mottled brown (10YR 5/3), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) fine sandy loam; massive; slightly hard, friable; strongly acid.

Thin bedding planes or buried horizons are common in some pedons. Reaction is strongly acid or very strongly acid unless the surface layer is limed.

The A horizon is brown, grayish brown, dark grayish brown, or dark yellowish brown fine sandy loam.

The upper part of the C horizon is light yellowish brown, yellowish brown, pale brown, brown, or dark grayish brown sandy loam, fine sandy loam, or loam. The lower part is sandy loam, fine sandy loam, or loam. It is mottled in shades of gray and brown, or is dominantly gray and has many brown, red, or yellow mottles. Clay content of the 10- to 40-inch control section is 10 to 18 percent. In some pedons, a few fine black and brown concretions occur in the C horizon.

In some pedons, a buried A horizon is below a depth of 20 inches.

Kirvin series

The Kirvin series consists of deep, well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in stratified sandstone and clayey sediment. Slope ranges from 1 to 8 percent.

Typical pedon of Kirvin fine sandy loam, 1 to 8 percent slopes; from the city of Nacogdoches, about 8 miles northwest to intersection of Farm Road 1638 and Farm Road 698, 2 miles north on Farm Road 698, 0.75 mile north on dirt road and 50 feet east, in a pasture:

A1—0 to 5 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; about 5 to 6 percent by volume pebbles of ironstone; medium acid; clear smooth boundary.

A2—5 to 12 inches; brown (7.5YR 5/4) fine sandy loam; massive; slightly hard, friable; few fine roots; about 5 percent by volume pebbles of ironstone; strongly acid; clear wavy boundary.

B21t—12 to 28 inches; red (2.5YR 4/6) clay; moderate medium blocky structure; hard, firm; common fine roots; thick continuous clay films; strongly acid; gradual smooth boundary.

B22t—28 to 38 inches; red (2.5YR 4/6) clay; common fine distinct strong brown mottles; moderate medium subangular blocky structure; hard, firm; common fine roots; thick continuous clay films; very strongly acid; gradual smooth boundary.

B23t—38 to 52 inches; distinctly mottled red (2.5YR 4/8) and strong brown (7.5YR 5/6) clay loam; moderate coarse blocky structure; slightly hard, friable; few fine roots; red clayflows between peds; common horizontal gray shale fragments; few flakes of mica; very strongly acid; clear wavy boundary.

Cr—52 to 62 inches; stratified yellowish red (5YR 5/6) soft sandstone that has faint mottles of strong brown (7.5YR 5/6) and light gray (10YR 7/1) shale plates; few fine flakes of mica; very strongly acid.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is fine sandy loam or gravelly fine sandy loam. The A1 horizon is dark brown, brown, dark grayish brown, or dark reddish brown. The A2 horizon is brown, light brown, pale brown, yellowish red, or strong brown. In some pedons, ironstone pebbles make up as much as 35 percent of the A horizon. Reaction is neutral through strongly acid.

The B21t and B22t horizons are red or yellowish red. The upper 20 inches of the B2t horizon is clay or clay loam. Clay content ranges between 35 and 60 percent and averages about 45 percent. Ironstone pebbles make up 1 to 10 percent by volume of the B2t horizon. Base saturation is 15 to 35 percent. The B23t horizon is mainly yellowish red, reddish brown, or red sandy loam to clay loam. Reaction of the B2t horizon ranges from extremely acid through strongly acid.

The Cr horizon is brown and red soft sandstone and is interbedded or stratified with gray shale. Texture ranges from sandy loam to clay loam. In some pedons the Cr horizon is weakly consolidated or cemented, but it can be cut with a spade. The Cr horizon is extremely acid through strongly acid.

Kullit series

The Kullit series consists of deep, moderately well drained loamy soils on uplands and terraces. Permeability is moderately slow. These soils formed in clayey old marine and alluvial deposits. Slope ranges from 1 to 3 percent.

Typical pedon of Kullit fine sandy loam, 1 to 3 percent slopes; from the town of Pisgah, 0.5 mile south on the east side of Farm Road 1878, in pasture:

Ap—0 to 7 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; soft, very friable; few medium and fine roots; many fine pores; medium acid; abrupt smooth boundary.

B21t—7 to 15 inches; yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky; slightly hard, friable; few fine roots; strongly acid; clear wavy boundary.

B22t—15 to 21 inches; strong brown (7.5YR 5/8) clay loam; moderate medium subangular blocky structure; very hard, very firm; clay films on ped surfaces; very strongly acid; clear wavy boundary.

B23t—21 to 28 inches; red (2.5YR 4/8) clay; moderate medium blocky structure; very hard, very firm; clay films evident on ped surfaces; very strongly acid; clear wavy boundary.

B24t—28 to 65 inches; coarsely and prominently mottled red (2.5YR 4/6) and gray (10YR 5/1) clay; moderate medium blocky structure; very hard, very firm; few clay films; very strongly acid; clear wavy boundary.

The solum is more than 60 inches thick.

The A horizon is fine sandy loam or loam. The A1 horizon is dark grayish brown, grayish brown, or brown. The A2 horizon, if present, is brown, yellowish brown, pale brown, or light yellowish brown. Reaction is slightly acid through strongly acid.

The B21t horizon is loam, sandy clay loam, or clay loam. It is yellowish brown, brown, strong brown, reddish yellow, or yellowish red mottled with gray. The lower part of the B2t horizon is red or yellowish red clay mottled with gray. Reaction is strongly acid or very strongly acid.

Lacerda series

The Lacerda series consists of deep, somewhat poorly drained clayey soils on uplands. Permeability is very slow. These soils formed in calcareous, clayey Coastal Plain sediment. Slope ranges from 0 to 20 percent.

Typical pedon of Lacerda clay loam, 0 to 5 percent slopes; about 24 miles south of the city of Nacogdoches, from the Etoile Macedonia Baptist Church on Farm Road 226, north 3.7 miles on dirt road to crossroad, east 2 miles on old railroad bed to intersection, north 0.2 mile on old railroad bed, and 100 feet east, in woods:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) clay loam; weak medium granular structure; hard, friable; many roots; strongly acid; abrupt wavy boundary.

B21—2 to 8 inches; yellowish brown (10YR 5/4) silty clay, many medium distinct mottles of light brownish gray (10YR 6/2); weak medium blocky structure; hard, firm; many roots; very strongly acid; gradual wavy boundary.

B22—8 to 21 inches; prominently mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) clay; weak medium subangular blocky structure; extremely hard, extremely firm; common medium roots; very strongly acid; gradual wavy boundary.

B23—21 to 28 inches; prominently mottled grayish brown (10YR 5/2) and yellowish red (5YR 5/6) clay; weak medium subangular blocky structure; extremely hard, extremely firm; few medium roots; few small

intersecting slickensides; very strongly acid; gradual wavy boundary.

B24—28 to 48 inches; gray (10YR 5/1) clay; many medium prominent red (2.5YR 4/6) mottles and few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, extremely firm; few medium roots; few large intersecting slickensides; strongly acid; gradual wavy boundary.

B3—48 to 57 inches; light olive brown (2.5Y 5/4) clay; common medium distinct grayish brown (2.5Y 5/2) mottles; very weak medium subangular blocky structure; extremely hard, extremely firm; few medium roots; common large intersecting slickensides; neutral; gradual wavy boundary.

C1—57 to 65 inches; brownish yellow (10YR 6/8) layered clay that has common medium prominent grayish brown (2.5Y 5/2) streaks; massive; very hard, very firm; common crystals of gypsum; moderately alkaline; gradual wavy boundary.

C2—65 to 72 inches; light olive brown (2.5Y 5/6) layered clay that has common medium distinct olive gray (5Y 5/2) and strong brown (7.5YR 5/8) streaks; massive; hard, firm; few soft rounded masses of lime; moderately alkaline; slight effervescence.

The solum ranges from 40 to 60 inches in thickness. These soils are in an area of gilgai relief. Distance from center of the microknoll to center of the microdepression is 8 to 15 feet; microknolls are 4 to 10 inches higher than microdepressions. Depth to intersecting slickensides ranges from 17 to 31 inches. The extremes of amplitude, or waviness, between the unmottled and mottled horizons (B23 horizon and B24 horizon, respectively) range from 8 to 24 inches.

The A horizon ranges from less than 1 inch in thickness on the microknoll to 8 inches in thickness in the microdepression. It is very dark grayish brown, very dark gray, dark grayish brown, dark gray, or dark brown clay loam. Reaction is strongly acid through medium acid.

The upper part of the B2 horizon is mainly silty clay; however, a few pedons are silty clay loam in the upper few inches. The upper part of the B2 horizon is yellowish brown, strong brown, yellowish red, or red. It is mottled with light brownish gray, grayish brown, or gray. Reaction ranges from very strongly acid through medium acid. The lower part of the B2 horizon and the B3 horizon is light brownish gray, gray, grayish brown, light olive brown, or light yellowish brown clay mottled with gray, strong brown, yellowish red, olive yellow, or olive. Reaction ranges from strongly acid through neutral.

The C horizon is layered clay, marl, or shale. Reaction ranges from medium acid through moderately alkaline.

Lilbert series

The Lilbert series consists of deep, well drained, sandy soils on uplands. Permeability is moderately slow. These soils formed in stratified, sandy and loamy sediment. Slope ranges from 1 to 8 percent.

Typical pedon of Lilbert loamy fine sand, 1 to 8 percent slopes; from the intersection of Loop 224 with Farm Road 1275 in the city of Nacogdoches, southwest 6.7 miles on Farm Road 1275, southwest 1.8 miles on Saints Rest Road, west-northwest 0.3 mile on log road, 15 feet southwest of road, in timber:

A11—0 to 3 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak medium granular structure; soft, very friable; many very fine and fine roots; medium acid; clear smooth boundary.

A12—3 to 8 inches; brown (10YR 4/3) loamy fine sand; weak medium granular structure; soft, very friable; many fine and medium roots; strongly acid; gradual smooth boundary.

A2—8 to 28 inches; pale brown (10YR 6/3) loamy fine sand; weak fine granular structure; soft, very friable; common fine and very fine roots; very strongly acid; clear smooth boundary.

B21t—28 to 39 inches; strong brown (7.5YR 5/8) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine dark brown concretions; few thin yellowish red (5YR 5/8) clay films; very strongly acid; gradual smooth boundary.

B22t—39 to 58 inches; strong brown (7.5YR 5/8) sandy clay loam; common medium distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; slightly hard, friable; few fine roots; 3 to 4 percent plinthite; very strongly acid; gradual smooth boundary.

B23t—58 to 72 inches; strong brown (7.5YR 5/8) sandy clay loam; common medium distinct reticulate mottles of yellowish red (5YR 4/6) and light brownish gray (10YR 6/2); weak medium subangular blocky structure; slightly hard; few fine roots; 8 to 10 percent plinthite; 3 to 4 percent pockets and streaks of pale brown (10YR 6/3) clean sand; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. Plinthite content ranges from 5 to 20 percent plinthite between a depth of 30 and 60 inches. Base saturation ranges from 20 to 35 percent at a depth of 72 inches.

The A horizon is loamy fine sand. The A1 horizon is very dark gray, dark gray, dark grayish brown, dark brown, grayish brown, or brown. The A2 horizon is brown, yellowish brown, pale brown, light yellowish brown, or very pale brown. Reaction of the A horizon is very strongly acid to slightly acid.

The Bt horizon is strong brown, yellowish brown, brownish yellow, yellowish red, or reddish yellow, and has few to common dark red, red, and yellowish red mottles. Light gray, light brownish gray, pale brown, and very pale brown mottles are in the lower part of the Bt horizon in most pedons. Clay content of the control section ranges from 24 to 32 percent. Reaction ranges from very strongly acid to medium acid.

If present, the C horizon is loamy and sandy Coastal Plain sediment.

Mantachie series

The Mantachie series consists of deep, somewhat poorly drained loamy soils on bottom lands. Permeability is moderate. Slope is less than 1 percent. These soils generally flood annually.

Typical pedon of Mantachie clay loam in an area of Mantachie soils, frequently flooded; from the city of Nacogdoches, about 10 miles southwest on U.S. Highway 59, then 2 miles west on dirt road to Stephen F. Austin Experimental Forest headquarters, 1.5 miles southwest to intersection of Sun Pipeline and U.S. Forest Road 403, 300 feet northwest along pipeline, and 100 feet west of pipeline:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) clay loam; common fine distinct mottles of gray (10YR 6/1); strong brown (7.5YR 5/6) stains along root channels; weak medium granular and subangular blocky structure; friable, hard; many fine roots; strongly acid; clear smooth boundary.

B21—3 to 15 inches; prominently mottled yellowish brown (10YR 5/6), brown (7.5YR 5/4), and light brownish gray (10YR 6/2) sandy clay loam; common distinct strong brown (7.5YR 5/6) stains along root channels; weak to moderate medium subangular blocky structure; friable, hard; many roots; few wormcasts; strongly acid; gradual smooth boundary.

B22—15 to 60 inches; gray (10YR 6/1) clay loam; many medium distinct mottles of strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and brown (7.5YR 4/4); weak medium subangular blocky structure; friable, hard; few medium and large roots; few fine brown concretions; few wormcasts; very strongly acid; gradual smooth boundary.

These soils are strongly acid or very strongly acid.

The A horizon is loam or clay loam. It is dark brown, dark grayish brown, brown, dark yellowish brown, or is mottled brown and gray.

The B horizon is clay loam, loam, or sandy clay loam. The upper part has gray, brown, and yellow mottles, or it has a matrix of grayish brown, brown, or yellowish brown and has few to many grayish mottles. The lower part is grayish brown, gray, light gray, or light brownish gray and has few to many brown and red mottles. Average clay content of the 10- to 40-inch control section ranges from 18 to 32 percent.

Marietta series

The Marietta series consists of deep, moderately well drained loamy soils on bottom lands. Permeability is moderate. These soils formed in recently deposited flood plains throughout the county. Slope is less than 1 percent. These soils flood almost every year.

Typical pedon Marietta fine sandy loam in an area of Marietta soils, frequently flooded; from the town of Garrison, about 5 miles southeast to place where Farm Road 138 crosses the Attoyac River. This is 700 feet west of channel and 30 feet north of Farm Road 138:

A11—0 to 6 inches; brown (10YR 5/3) fine sandy loam; weak granular structure; friable, slightly hard; many fine roots; slightly acid; abrupt boundary.

A12—6 to 12 inches; dark brown (10YR 4/3) fine sandy loam that has common medium faint dark brown (10YR 3/3) mottles; weak granular structure; soft, friable; many fine roots; neutral; abrupt boundary.

B21—12 to 16 inches; dark brown (10YR 4/3) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; many fine roots; slightly hard, friable; medium acid; gradual boundary.

B22—16 to 36 inches; mottled light brownish gray (10YR 6/2), brown (10YR 5/3), and dark grayish brown (10YR 4/2) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; few black soft concretions; medium acid; gradual boundary.

C—36 to 60 inches; mottled light brownish gray (10YR 6/2), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6) sandy clay loam; massive; moist, friable; medium acid.

The solum ranges from 28 to 60 inches in thickness. Reaction ranges from medium acid through mildly alkaline.

The A horizon is loam or fine sandy loam. It is dark grayish brown, grayish brown, dark brown, brown, yellowish brown, or dark brown.

The B horizon is clay loam, sandy clay loam, or loam. The B21 horizon is dark brown, brown, olive brown, or dark yellowish brown and has few to common grayish mottles. The B22 horizon is similar in color to the B21 horizon. Some pedons have gray, brown, and yellow mottles.

The C horizon is clay loam, clay, or silt loam. The B23 horizon and the C horizon are gray, grayish brown, or light brownish gray. Some pedons are mottled in shades of gray, yellow, and brown. The B horizon is clay loam, sandy clay loam, or loam. Clay content of the 10- to 40-inch control section ranges from 18 to 30 percent. Few

to common black and brown concretions are in the lower part of the B horizon and in the C horizon.

Mollville series

The Mollville series consists of deep, poorly drained loamy soils in depressional areas on terraced uplands. Permeability is slow. These soils formed in stratified sediment which was deposited by wind in ancient backwater sloughs. Slope is less than 1 percent. Water stands on the surface of these soils for several weeks each year.

Typical pedon of Mollville loam in an area of Mollville-Besner complex; from the city of Nacogdoches, about 10 miles southwest to Stephen F. Austin Experimental Forest headquarters, 1.2 miles west, 280 feet west of oil pipeline, and 100 feet north of road, in timber:

A1—0 to 4 inches; dark gray (10YR 4/1) loam; weak fine subangular blocky and granular structure; hard, friable; many roots; many fine pores; very strongly acid; clear wavy boundary.

A2g—4 to 12 inches; light gray (10YR 6/1) loam, weak fine subangular blocky structure; hard, friable; common roots; common fine pores; strongly acid; clear wavy boundary.

A2g&B21tg—12 to 19 inches; light gray (10YR 6/1) loam that has isolated and connected bodies of strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay loam; coarse medium blocky structure; very hard, friable; common medium tree roots; strongly acid; gradual irregular boundary.

B22tg&A2g—19 to 39 inches; light gray (10YR 6/1) clay loam ped interiors that have mottles of strong brown (7.5YR 5/6); light gray (10YR 7/2) tongues of loam penetrating from the horizon above; weak coarse columnar structure parting to moderate medium subangular blocky; very hard; firm; few medium tree roots; strongly acid; gradual wavy boundary.

B23tg—39 to 65 inches; light gray (10YR 6/1) clay loam that has common medium prominent mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6); moderate medium subangular blocky structure; hard, firm; strongly acid.

The solum ranges from 40 to about 70 inches in thickness.

The A horizon is loam, very fine sandy loam, silt loam, or fine sandy loam. It is very dark grayish brown, dark gray, gray, grayish brown, or dark grayish brown. The A2g horizon is light gray, light brownish gray, or grayish brown. Tongues or streaks of A2 material 1/2 inch to 4 inches wide extend through the B21t horizon and in some pedons through the B22t horizon. Reaction of the A horizon is very strongly acid through medium acid.

The Bt horizon is clay loam or sandy loam. Where present, the B21t horizon is light brownish gray or grayish brown. Ped exteriors are coated with dark grayish brown or very dark grayish brown. The B22tg and B23tg horizons are gray, light gray, light brownish gray, or grayish brown. Few to many strong brown and yellowish red mottles are in the Bt horizon. The Bt horizon is clay loam or sandy clay loam. The clay content averages between 22 to 35 percent, and sand content that is coarser than very fine sand averages 20 to about 40 percent. The B21tg and B22tg horizons are very strongly acid through medium acid. The B23tg and B3g horizons are strongly acid through mildly alkaline.

The C horizon is grayish loamy fine sand or fine sandy loam.

Naclina series

The Naclina series consists of deep, somewhat poorly drained clayey soils on uplands. Permeability is very slow. These soils formed in calcareous, clayey Coastal Plain sediment. Slope ranges from 5 to 20 percent.

Typical pedon of Naclina clay, 5 to 20 percent slopes; from intersection of Texas Highway 103 and Farm Road 95 about 30 miles southeast of the city of Nacogdoches, 1.2 miles north on Farm Road 95 and 50 feet east, in woods:

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) clay; moderate medium subangular blocky and moderate medium granular structure; very hard, very firm; common medium and coarse roots; neutral; clear wavy boundary.

A12—5 to 9 inches; reddish brown (5YR 4/3) clay; moderate medium subangular blocky structure; extremely hard, very firm; few ironstone pebbles; common medium roots; neutral; clear wavy boundary.

B21—9 to 14 inches; reddish brown (5YR 4/4) clay; few stains of dark grayish brown (10YR 4/2); moderate medium subangular blocky structure; extremely hard, very firm; few ironstone pebbles; common medium roots; neutral; clear wavy boundary.

B22—14 to 21 inches; light olive brown (2.5Y 5/4) clay distinctly mottled with light brownish gray (2.5Y 6/2); weak subangular blocky structure; extremely hard, very firm; few shiny ped surfaces; common fine and medium roots; mildly alkaline; gradual wavy boundary.

B23—21 to 36 inches; light olive brown (2.5Y 5/4) clay; distinct mottles of yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2); weak subangular blocky structure; extremely hard, very firm; few strongly cemented pitted concretions of lime; common slickensides; slight effervescence; moderately alkaline; gradual wavy boundary.

B3—36 to 46 inches; light yellowish brown (2.5Y 6/4) clay distinctly mottled with yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2); massive; very hard, very firm; few roots on slickensides; common slickensides; common soft masses and few

strongly cemented, pitted concretions of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—46 to 65 inches; laminated strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) clay; weak bedding planes; strong effervescence.

The solum ranges from 35 to 60 inches in thickness. Depth to horizon with slickensides ranges from 15 to 36 inches and depth to calcareous material ranges from 10 to 40 inches.

The A horizon is less than 12 inches thick. The A11 horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. The A12 horizon is reddish brown, brown, dark brown, dark grayish brown, or very dark grayish brown. In some pedons, the A12 horizon has a few mottles. The extremes of amplitude, or waviness, between the A12 horizon and the B21 horizon range from 4 to 24 inches. Reaction of the A horizon ranges from strongly acid through neutral.

The upper part of the B2 horizon is clay. It is reddish brown, red, yellowish red, or strong brown and has yellowish brown, gray, light brownish gray, grayish brown, and dark grayish brown mottles. Reaction ranges from strongly acid through neutral. The lower part of the B2 horizon and the B3 horizon are light olive brown, light yellowish brown, olive brown, olive, or olive yellow. Mottles are yellowish brown, strong brown, or light brownish gray. Reaction ranges from neutral through moderately alkaline.

The C horizon is laminated calcareous clay, marl, or shale.

Nacogdoches series

The Nacogdoches series consists of deep, well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in glauconitic greensand marl. Slope is dominantly less than 5 percent, but ranges from 1 to 8 percent.

Typical pedon of Nacogdoches sandy clay loam, 1 to 8 percent slopes; from intersection of Farm Road 95 and Texas Highway 21 in the town of Chireno, 1.4 miles east on Texas Highway 21 and 400 feet north and 350 feet west of fence, in pasture:

Ap—0 to 6 inches; dark reddish brown (5YR 3/4) fine sandy loam; very weak subangular blocky structure; slightly hard, very friable; many fine roots; common fine angular fragments of ironstone; medium acid; gradual smooth boundary.

B21t—6 to 30 inches; dark red (10R 3/6) clay, moderate medium and fine angular and subangular blocky structure; very hard, friable; common fine roots; common fine pores; thin continuous clay films; common fine angular fragments of ironstone; strongly acid; diffuse wavy boundary.

B22t—30 to 70 inches; dark red (2.5YR 3/6) clay, weak and moderate medium subangular blocky structure; very hard, friable; few fine roots; common fine and very fine pores; common thin discontinuous clay films; few fine angular fragments of ironstone; 20 to 30 percent by volume yellowish brown partially weathered brittle fragments of glauconitic material less than 1 inch across the long axis; very strongly acid; diffuse smooth boundary.

B3—70 to 80 inches; stratified red (2.5YR 4/6) clay and partially weathered olive yellow (5Y 6/6) glauconitic material; weak medium subangular blocky structure and massive; very hard, friable; patchy clay films and few thick clayflows and ironflows in clayey part; glauconitic material is brittle and contains shell fossils; strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. Base saturation ranges from 35 to 60 percent at a depth of 72 inches.

The A horizon is fine sandy loam, clay loam, or gravelly phases of these textures. It is very dusky red, dusky red, dark red, or dark reddish brown. Where chroma is 3 or less, the horizon is less than 6 inches thick. Reaction ranges from strongly acid through slightly acid.

The B2t horizon is dark red in the upper 40 inches. Below this depth in the Bt horizon and in the B3 horizon, the soil is dark red or red. The B horizon has clay content of 40 to 60 percent, and sand content of more than 25 percent. The clay fraction is dominated by tabular halloysite. Content of coarse fragments, dominantly ironstone, ranges from very little to about 15 percent by volume throughout the Bt horizon. Reaction is very strongly acid or strongly acid.

Within a depth of 80 inches, the C horizon is weathered glauconitic sandstone and greensand material. Marine shells are in some pedons. The C horizon ranges from strongly acid through mildly alkaline.

Osier series

The Osier series consists of deep, very poorly drained soils on uplands. These soils formed in thick sandy deposits. Permeability is rapid. Slope ranges from 0 to 2 percent.

Typical pedon of Osier fine sand, 0 to 2 percent slopes; from intersection of Woden Road and Loop 224 in the city of Nacogdoches, 400 feet north and 50 feet west, in wooded area:

O—2 to 0 inches; partially decomposed forest litter.

A11—0 to 4 inches; dark gray (10YR 4/1) fine sand; weak medium granular structure; soft, friable; many roots; strongly acid; clear wavy boundary.

A12—4 to 11 inches; grayish brown (10YR 5/2) fine sand; weak medium granular structure; soft, very

friable; many roots; strongly acid; gradual wavy boundary.

Cg—11 to 80 inches; light gray (10YR 7/2) fine sand; massive; strongly acid.

These soils are fine sand to a depth of more than 80 inches. Reaction is extremely acid through medium acid.

The A11 horizon is black, very dark gray, dark gray, and very dark grayish brown. The A12 horizon is grayish brown, brown, very pale brown, or light brownish gray.

The C horizon is very pale brown, light gray, or white.

These soils are taxadjuncts to the Osier series because they are very poorly drained, are on foot slopes, and range to extremely acid in reaction.

Percilla series

The Percilla series consists of deep, poorly drained loamy soils in depressional areas and swales. Permeability is very slow. These soils formed in thick clayey sediment high in glauconite. Slope is less than 1 percent.

Typical pedon of Percilla clay loam, 0 to 1 percent slopes; from the city of Nacogdoches, about 5 miles east to intersection of Texas Highway 7 and Farm Road 2112, north 0.3 mile on Farm Road 2112 and east 300 feet, in wooded depressional area:

O—1 inch to 0; partially decomposed hardwood litter.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam; moderate medium granular structure; hard, friable; common roots; very strongly acid; clear wavy boundary.

B21t—4 to 8 inches; distinctly mottled dark gray (10YR 4/1) and strong brown (7.5YR 5/6) clay; moderate medium subangular blocky structure; very hard, firm; common roots; very strongly acid; gradual wavy boundary.

B22t—8 to 14 inches; gray (10YR 5/1) clay; many large distinct mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 5/8); moderate medium subangular blocky structure; very hard, very firm; few coarse and fine roots; few patchy clay films; very strongly acid; gradual wavy boundary.

B23tg—14 to 30 inches; gray (10YR 5/1) clay; many coarse distinct mottles of strong brown (7.5YR 5/6); weak medium subangular blocky structure; very hard, very firm; few coarse and fine roots; few patchy clay films; very strongly acid; gradual wavy boundary.

B24tg—30 to 48 inches; gray (10YR 5/1) clay; many large distinct mottles of strong brown (7.5YR 5/6) and red (2.5YR 4/6); weak medium subangular blocky structure; very hard, very firm; few coarse and fine roots; few patchy clay films; very strongly acid; gradual wavy boundary.

B3g—48 to 65 inches; gray (10YR 5/1) clay; many prominent dark red (2.5YR 3/6) and few prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm; very strongly acid.

The solum ranges from 50 to more than 70 inches in thickness. Base saturation at a depth of 50 inches below the top of the argillic horizon ranges from 35 to 50 percent. Reaction ranges from very strongly acid through neutral in the A horizon and in the B3 horizon and from very strongly acid through medium acid in the B2t horizon.

The A horizon is brown, dark brown, very dark grayish brown, or dark grayish brown loam or clay loam.

The B horizon is dark gray, gray, grayish brown, or light brownish gray and has prominent mottles of red, dark red, yellowish red, strong brown, yellowish brown, or light olive brown. Gray is dominant. More than 40 percent of the upper part of the B2 horizon has chroma of more than 1.

In some pedons, a C horizon of glauconitic greensand marl is below a depth of 60 inches.

Rentzel series

The Rentzel series consists of deep, somewhat poorly drained sandy soils on uplands. Permeability is moderately slow. These soils formed in sandy and loamy Coastal Plain sediment. Slope ranges from 0 to 4 percent.

Typical pedon of Rentzel loamy fine sand, 0 to 4 percent slopes; from intersection of U.S. Highway 59 and Loop 224 in the city of Nacogdoches, 0.75 mile south on U.S. Highway 59 and about 800 feet west, in timber:

A11—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand; weak medium subangular blocky structure; soft, very friable; many fine and medium roots; medium acid; clear wavy boundary.

A12—5 to 12 inches; brown (10YR 5/3) loamy fine sand; common medium faint mottles of pale brown (10YR 6/3); weak medium subangular blocky structure; soft, very friable; many fine and medium roots; medium acid; clear wavy boundary.

A21—12 to 21 inches; pale brown (10YR 6/3) loamy fine sand; single grain; soft, very friable; common fine and medium roots; medium acid; clear wavy boundary.

A22—21 to 29 inches; very pale brown (10YR 7/3) and light gray (10YR 7/2) loamy fine sand; few medium faint mottles of strong brown (7.5YR 5/6); single grain; soft, very friable; common fine and medium roots; slightly acid; gradual wavy boundary.

B21t—29 to 41 inches; distinctly mottled strong brown (7.5YR 5/8), light brownish gray (10YR 6/2), and red (2.5YR 5/8) sandy clay loam; weak medium subangular blocky structure; hard, friable; few fine and medium roots; 3 to 7 percent by volume plinth-

ite; few thin clay films; very strongly acid; gradual wavy boundary.

B22t—41 to 50 inches; reticulately mottled yellowish brown (10YR 5/8), light brownish gray (10YR 6/2), and red (2.5YR 5/8) sandy clay loam; weak medium subangular blocky structure; very hard, firm; few fine roots; 8 to 14 percent by volume plinthite; few patchy clay films; very strongly acid; gradual wavy boundary.

B23t—50 to 75 inches; light gray (10YR 7/2) sandy clay loam; many coarse prominent mottles of yellowish brown (10YR 5/8) and red (2.5YR 4/8); moderate medium prismatic structure; very hard, firm; few fine roots; 5 to 9 percent by volume plinthite; about 10 percent by volume brittle bodies; extremely acid.

The solum ranges from 65 to more than 80 inches in thickness. Plinthite content by volume ranges from 5 to 20 percent in the Bt horizon. Base saturation ranges from 15 to 35 percent at a depth of 72 inches. Reaction ranges from strongly acid through slightly acid in the A horizon and from extremely acid through strongly acid in the Bt horizon.

The A horizon is 20 to 40 inches thick. It is loamy fine sand. The A1 horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. The A2 horizon is light gray, light brownish gray, grayish brown, very pale brown, pale brown, brown, light yellowish brown, pinkish gray, or light brown.

The B2t horizon is fine sandy loam or sandy clay loam. The B21t horizon is mainly bright colors mottled with gray. It is yellowish red, strong brown, reddish yellow, yellowish brown, red, or brownish yellow. The B22t horizon is similar in color but has a higher percentage of grays and yellows. The B23t horizon is mainly gray, light gray, or light brownish gray and has reddish and yellowish mottles. Some mottles are red and dark red.

Ruston series

This series consists of deep, well drained loamy soils on uplands. Permeability is moderate. These soils formed in loamy Coastal Plain sediment. Slope ranges from 1 to 8 percent.

Typical pedon of Ruston fine sandy loam, 1 to 8 percent slopes; from junction of Texas Highway 204 and U.S. Highway 259, about 10 miles north of the city of Nacogdoches, 4 miles north on U.S. Highway 259 and 3 miles west, on dirt road:

Ap—0 to 5 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; friable; common fine pebbles; medium acid; clear smooth boundary.

A2—5 to 10 inches; brown (10YR 5/3) fine sandy loam; weak medium subangular blocky structure; very friable; many fine pores; common fine pebbles; strongly acid; clear smooth boundary.

B21t—10 to 55 inches; yellowish red (5YR 4/6) sandy clay loam; moderate fine subangular blocky structure; friable; thick nearly continuous dark red (2.5YR 3/6) clay films on surfaces of peds; strongly acid; clear wavy boundary.

B22t—55 to 72 inches; red (2.5YR 4/6) sandy clay loam that has stripped areas of pale brown (10YR 6/3); moderate medium subangular blocky structure; thin nearly continuous clay films in upper part of horizon and thin patchy clay films in lower part; strongly acid.

The solum is more than 60 inches thick.

The A horizon is dark grayish brown, pale brown, light yellowish brown, yellowish brown, brown, or dark brown. Reaction is slightly acid through strongly acid.

The Bt horizon is reddish brown, reddish yellow, yellowish red, or red. Clay content of the B2t horizon averages from 18 to 30 percent in the upper 20 inches. Reaction of the B horizon is medium acid through very strongly acid. The stripped areas in the lower part of the Bt horizon are pale brown or very pale brown.

Sacul series

This series consists of deep, moderately well drained, loamy soils on uplands. Permeability is slow. These soils formed in clayey Coastal Plain sediment. Slope is 1 to 20 percent.

Typical pedon of Sacul fine sandy loam, 1 to 5 percent slopes; from intersection of Farm Road 226 and Texas Highway 103 in the community of Etoile, 5.5 miles southeast to Wooten Cemetery, 600 feet northeast on dirt road, and 75 feet north:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; soft, very friable; strongly acid; abrupt wavy boundary.

A2—2 to 7 inches; brown (10YR 5/3) fine sandy loam; structureless; soft, very friable; very strongly acid; abrupt smooth boundary.

B21t—7 to 14 inches; red (2.5YR 4/6) clay; strong medium subangular blocky structure; hard, firm; very strongly acid; gradual smooth boundary.

B22t—14 to 21 inches; red (2.5YR 4/6) clay that has common medium prominent mottles of light brownish gray (10YR 6/2); strong medium subangular blocky structure; hard, firm; very strongly acid; gradual smooth boundary.

B23t—21 to 30 inches; mottled red (2.5YR 4/6) and light brownish gray (10YR 6/2) clay; moderate medium subangular blocky structure; hard, firm; very strongly acid; diffuse smooth boundary.

B24t—30 to 46 inches; mottled light brownish gray (10YR 6/2), red (2.5YR 4/6), and strong brown (7.5YR 5/6) clay; moderate coarse subangular

blocky structure; hard, firm; very strongly acid; diffuse smooth boundary.

B3—46 to 53 inches; mottled red (2.5YR 4/6), reddish yellow (7.5YR 6/8), and light brownish gray (10YR 6/2) clay loam; few distinct clay films; weak medium subangular blocky structure; hard, firm; very strongly acid; diffuse smooth boundary.

Cr—53 to 72 inches; alternate layers of strong brown (7.5YR 5/6) and red (2.5YR 4/6) sandstone, and light brownish gray (10YR 6/2) shale; very strongly acid.

The solum ranges from 40 to 65 inches in thickness. The A1 horizon is very dark grayish brown, dark brown, dark grayish brown, and brown. The A2 horizon is brown or pale brown. The A horizon is very strongly acid or strongly acid.

In the upper 20 inches of the Bt horizon, clay content averages 45 to 55 percent. The B21t horizon is red and dark red and has few to common mottles of strong brown in some pedons. The B22t horizon and lower part of the Bt horizon are red and dark red and are mottled with gray, light gray, light brownish gray, and strong brown. In some pedons the mottles are dominantly gray. The Bt horizon is very strongly acid or strongly acid.

The underlying material is alternate layers of red to strong brown soft sandstone and gray shale.

Tenaha series

The Tenaha series consists of deep, well drained sandy soils on uplands. Permeability is moderate. These soils formed in sandy and clayey sediment. Slope is 5 to 20 percent.

Typical pedon of Tenaha loamy fine sand, 5 to 20 percent slopes; from the city of Nacogdoches, north about 12 miles to junction of U.S. Highway 259 and Farm Road 1087, south 0.5 mile on U.S. Highway 259, east 0.7 mile on dirt road and 600 feet north, in timber:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy fine sand; weak medium granular structure; soft, loose; many fine roots; slightly acid; clear smooth boundary.

A21—5 to 22 inches; pale brown (10YR 6/3) loamy fine sand; single grain; soft, loose; many roots; few black concretions; slightly acid; gradual smooth boundary.

B1t—22 to 36 inches; yellowish red (5YR 4/8) sandy clay loam; common mottles of strong brown (7.5YR 5/6); weak medium blocky structure; slightly hard, friable; continuous thick clay films; few pebbles; strongly acid; gradual smooth boundary.

B2t—36 to 46 inches; yellowish red (5YR 5/8) sandy clay loam; few faint mottles of red (2.5YR 4/8); weak medium subangular blocky structure; hard, friable; patchy clay films on vertical faces of peds; very strongly acid; gradual smooth boundary.

Cr—46 to 65 inches; yellowish red (5YR 5/8) and strong brown (7.5YR 5/6) soft sandstone; weakly consolidated; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. The A horizon ranges from about 22 to 40 inches thick. A few pebbles occur in most pedons.

The A horizon is loamy fine sand or fine sand. The A1 horizon is very dark grayish brown, dark grayish brown, grayish brown, or brown. The A2 horizon is pale brown, brown, or yellowish brown. Reaction of the A horizon ranges from strongly acid to slightly acid.

The Bt horizon is yellowish red or strong brown, and is mottled red, yellowish red, or strong brown. Average clay content is 22 to 35 percent in the upper 20 inches. Pockets of gray weathered shale are common in the lower part of the Bt horizon. In some pedons, few to common flakes of mica are in the lower part of the Bt horizon. Reaction of the Bt horizon is strongly acid or very strongly acid.

The Cr horizon is soft sandstone that has thin layers of gray shale. Mica flakes are abundant.

Tonkawa series

The Tonkawa series consists of deep, excessively drained sandy soils on uplands. Permeability is rapid. These soils formed in sandy deposits. Slope ranges from 0 to 20 percent.

Typical pedon of Tonkawa fine sand, 0 to 8 percent slopes; from the city of Nacogdoches, about 12 miles north to intersection of U.S. Highway 259 and Farm Road 1087, east 5 miles on Farm Road 1087 to Camp Tonkawa crossing, north 0.6 mile, and 90 feet east of road:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sand; weak medium granular structure; loose; many medium and coarse roots; extremely acid; gradual wavy boundary.

A12—5 to 12 inches; yellowish brown (10YR 5/4) fine sand; common medium distinct dark grayish brown (10YR 4/2) mottles; single grain; loose; many medium and coarse roots; few nodules of ironstone 2 to 5 millimeters across; extremely acid; gradual wavy boundary.

C1—12 to 22 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; many medium and coarse roots; few nodules of ironstone 2 to 5 millimeters across; extremely acid; gradual wavy boundary.

C2—22 to 37 inches; yellow (10YR 7/6) fine sand; common medium faint very pale brown (10YR 7/4) mottles; single grain; loose; common medium and coarse roots; few nodules of ironstone 2 to 5 millimeters across; extremely acid; diffuse boundary.

C3—37 to 84 inches; very pale brown (10YR 7/4) fine sand; single grain; loose; few medium roots; few

nodules of ironstone 2 to 5 millimeters across; strongly acid.

These soils are sand or fine sand more than 80 inches thick. They have 5 to 10 percent clay content in the 10- to 40-inch control section and small amounts of silt and very fine sand. Reaction ranges from extremely acid through slightly acid.

The A1 horizon is dark grayish brown, very dark grayish brown, brown, or grayish brown. The A12 horizon is brown, pale brown, light yellowish brown, or yellowish brown.

The C horizon is yellowish brown, brownish yellow, yellow, very pale brown, or strong brown. In a few pedons, the lower part of the C horizon is light gray or white. In some pedons, lamellae that are not thick enough to be an argillic horizon are below a depth of 70 inches.

Trawick series

The Trawick series consists of deep, well drained loamy soils on uplands. Permeability is moderately slow. These soils formed in glauconitic greensand marl. Slope is mainly 8 to 20 percent, but ranges from 5 to 35 percent.

Typical pedon of Trawick fine sandy loam, 8 to 20 percent slopes; from intersection of Loop 224 and Texas Highway 21 at city limits of east Nacogdoches, 4 miles east on Texas Highway 21 to steep cut in hill east of the Carrizo Creek bottom and 600 yards north, in open pasture:

Ap—0 to 6 inches; dark red (2.5YR 3/6) fine sandy loam; moderate fine and medium granular structure; hard, friable; common fine roots; about 20 percent ironstone pebbles mostly less than 5 millimeters across but which range to about 50 millimeters across; neutral; clear smooth boundary.

B21t—6 to 21 inches; dark red (10R 3/6) clay; moderate medium subangular blocky structure; very hard, friable; common fine roots; continuous clay films on surfaces of peds; contains about 10 percent ironstone pebbles mostly less than 5 millimeters across; medium acid; gradual smooth boundary.

B22t—21 to 30 inches; dark red (2.5YR 3/6) clay; moderate medium and coarse prismatic structure parting to medium and fine angular blocky; very hard, firm; few fine roots; distinct thick clay films on surfaces of peds; about 10 percent ironstone pebbles and thin fragments; strongly acid; gradual wavy boundary.

B3—30 to 46 inches; red (2.5YR 4/6) clay; dark red (10R 3/6) clay films on surfaces of peds; weak medium blocky structure; very hard, firm; 20 to 30 percent mottles of yellowish weathered glauconite; about 15 percent limonitic ironstone fragments; strongly acid; gradual wavy boundary.

Cr—46 to 92 inches; mottled red (2.5YR 4/6), olive yellow (5Y 6/6), and yellowish red (5YR 5/6) glauconite or greensand marl; platy to massive; very hard; intermittent layers of ironstone; strongly acid.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is dusky red, dark reddish brown, or dark red fine sandy loam, clay loam, or gravelly phases of these textures. Ironstone pebbles make up from 10 to 35 percent of the A horizon. Reaction is medium acid through neutral.

The upper part of the Bt horizon is dark reddish brown, dark red, or red clay loam or clay. Clay content is 35 to 50 percent. Rounded and flat pebbles and ironstone fragments make up from 2 to 10 percent of the upper part of the Bt horizon in most pedons, but make up as much as 35 percent in some pedons. Reaction is strongly acid or medium acid. The B3 horizon is similar in color to the upper part of the Bt horizon, but value ranges to 5 in the lower part. In addition, it has yellowish spots of weathered glauconite. Reaction ranges from very strongly acid through medium acid.

The Cr horizon consists of glauconite or greensand marl that has intermittent layers of ironstone. Content of coarse fragments in the lower part of the Bt horizon and in the Cr horizon ranges from 5 to 35 percent.

Tuscosso series

The Tuscosso series consists of deep, moderately well drained loamy soils on flood plains. Permeability is moderately slow. These soils formed in recent clayey alluvial deposits. Slope is less than 1 percent.

Typical pedon of Tuscosso clay loam, frequently flooded; from intersection of Loop 224, Texas Highway 7, and Upper Melrose Road, 6.2 miles east on Melrose Road and 0.25 mile north, 200 feet east of Tuscosso Creek channel:

A11—0 to 8 inches; dark reddish brown (5YR 3/4) clay loam; weak medium granular structure; hard, firm; common roots; strongly acid; gradual smooth boundary.

B1—8 to 15 inches; yellowish red (5YR 4/6) silty clay; weak medium subangular blocky structure parting to moderate medium granular; hard, firm; common roots; strongly acid; gradual smooth boundary.

B21—15 to 27 inches; yellowish red (5YR 4/6) clay; few fine faint mottles of brown (10YR 5/3); weak medium subangular blocky structure; hard, firm; few roots; strongly acid; gradual smooth boundary.

B22—27 to 40 inches; yellowish red (5YR 5/6) clay loam; common medium prominent mottles of grayish brown (2.5Y 5/2); weak medium subangular blocky structure; hard, firm; few roots; strongly acid; gradual smooth boundary.

B23—40 to 53 inches; yellowish red (5YR 4/6) clay; many medium prominent mottles of gray (5Y 5/1); weak medium subangular blocky structure; very hard, very firm; strongly acid; gradual smooth boundary.

C—53 to 72 inches; red (2.5YR 4/6) clay; many medium prominent mottles of dark gray (10YR 4/1); massive; very hard, very firm; medium acid; few gypsum crystals in lower part.

The solum ranges from 30 to 60 inches in thickness. Average clay content of the 10- to 40-inch control section ranges from 35 to 55 percent, and silt content ranges from 25 to 50 percent.

The A horizon is less than 20 inches thick. It is dark brown, brown, dark reddish brown, reddish brown, yellowish red, or very dark grayish brown clay loam, clay, or silty clay. The A horizon does not have the combination of darkness and thickness to qualify as a mollic epipedon. Reaction ranges from strongly acid through neutral.

The B2 horizon is yellowish red, brown, dark brown, red, or strong brown clay loam, clay, or silty clay in the matrix. Mottles of brown, yellowish brown, or light yellowish brown are throughout this horizon. Mottles in shades of gray and olive are at a depth of more than 24 inches. Reaction ranges from very strongly acid through slightly acid.

The C horizon has the same range of color as the B2 horizon. In most pedons, the lower part of the C horizon contains gypsum crystals.

Woden series

The Woden series consists of deep, well drained loamy soils on upland terraces. Permeability is moderately rapid. These soils formed in loamy material. Slope ranges from 1 to 4 percent.

Typical pedon of Woden fine sandy loam, 1 to 4 percent slopes; from the city of Nacogdoches, about 8 miles southwest on U.S. Highway 59, then 2 miles west on dirt road to Stephen F. Austin Experimental Forest headquarters, 2,400 feet northeast, 50 feet south and 20 feet west of right angle corner in road, and about 300 feet east of Forest Road 401C:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam; structureless; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A2—7 to 11 inches; light brown (7.5YR 6/4) fine sandy loam; structureless; slightly hard, very friable; common fine roots; many fine pores; medium acid; clear smooth boundary.

B21t—11 to 15 inches; yellowish red (5YR 4/6) fine sandy loam; weak medium and coarse subangular blocky structure; hard, friable; common fine roots; many fine pores; clay films and clay bridges on sand grains; medium acid; clear wavy boundary.

B22t—15 to 43 inches; yellowish red (5YR 4/8) fine sandy loam; weak medium and coarse subangular blocky structure; hard, friable; common fine roots; many very fine pores; sand grains coated and bridged with clay; few patchy clay films on ped surfaces; medium acid; gradual wavy boundary.

B23t—43 to 80 inches; yellowish red (5YR 5/8) fine sandy loam; weak medium and coarse subangular blocky structure; hard, friable; few fine roots; many very fine pores; sand grains coated and bridged with clay; few patchy clay films on ped surfaces; medium acid; gradual wavy boundary.

B24t—80 to 96 inches; strong brown (7.5YR 5/8) fine sandy loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; common fine pores; sand grains coated and bridged with clay; medium acid.

The solum ranges from 60 to more than 100 inches in thickness. The A horizon is fine sandy loam. Reaction ranges from neutral through strongly acid.

The Ap or A1 horizon is brown, reddish brown, dark reddish brown, dark grayish brown, or dark brown. If present, the A2 horizon is light brown, brown, reddish brown, light reddish brown, pale brown, or light yellowish brown.

The B2t horizon is fine sandy loam or loam. The upper part is red, yellowish red, reddish brown, or strong brown. In some pedons, the lower part is mottled with yellowish brown or light yellowish brown. Clay content of the B2t horizon is 8 to 18 percent, and silt content is 20 to 45 percent. Reaction ranges from slightly acid through strongly acid.

Woodtell series

The Woodtell series consists of deep, moderately well drained soils on uplands. Permeability is very slow. These soils formed in clay and shale sediment of the Coastal Plain. Slope ranges from 1 to 20 percent.

Typical pedon of Woodtell very fine sandy loam, 1 to 5 percent slopes; from the community of Etoile, 2.5 miles northwest on Farm Road 226, 700 feet southwest on dirt road and 50 feet north, about 20 miles southeast of the city of Nacogdoches:

A1—0 to 3 inches; dark brown (10YR 3/3) very fine sandy loam, common medium faint brown (10YR 5/3) mottles; moderate medium granular structure; slightly hard, friable; many medium and coarse roots; few chert pebbles; strongly acid; abrupt wavy boundary.

A2—3 to 6 inches; brown (10YR 5/3) very fine sandy loam; structureless; slightly hard, friable; many medium roots; few chert gravels; very strongly acid; clear wavy boundary.

B21t—6 to 9 inches; red (2.5YR 4/6) clay; strong medium subangular blocky structure; very hard, very firm; few medium roots; very strongly acid; gradual wavy boundary.

B22t—9 to 15 inches; red (2.5YR 4/6) clay, common medium prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; very strongly acid; gradual wavy boundary.

B23t—15 to 25 inches; prominently mottled red (2.5YR 4/6) and light brownish gray (10YR 6/2) clay; weak medium subangular blocky structure; extremely hard, extremely firm; few fine roots; few shiny surfaces and small slickensides; very strongly acid; gradual smooth boundary.

B24t—25 to 47 inches; light brownish gray (10YR 6/2) clay, many medium prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; extremely hard, extremely firm; few fine roots; few medium and large intersecting slickensides; very strongly acid; gradual smooth boundary.

B3&C—47 to 56 inches; light brownish gray (10YR 6/2) clay, many medium prominent mottles of red (2.5YR 4/6) and yellowish red (5YR 5/8); weak medium subangular blocky structure; extremely hard, extremely firm; few medium and large intersecting slickensides; common pieces of olive gray (5Y 5/2) shale; very strongly acid; gradual smooth boundary.

C—56 to 72 inches; olive gray (5Y 5/2) platy shale with few layers of olive (5Y 5/4, 5/6); medium acid.

The solum ranges from 35 to 60 inches in thickness.

The A horizon is fine sandy loam, very fine sandy loam, or loam. The A1 horizon is very dark grayish brown, dark grayish brown, or dark brown. The A2 horizon is brown, pale brown, or very pale brown. Reaction of the A horizon is strongly acid to medium acid.

The Bt horizon is generally red that has gray and light brownish gray mottles in the upper part. The grayness increases as depth increases. The lower part of the Bt horizon is gray mottled in shades of red, yellow, and olive. The Bt horizon ranges from 50 to 70 percent clay content. Reaction ranges from extremely acid in the upper part through medium acid in the lower part.

The C horizon is gray to olive shale. Reaction ranges from very strongly acid through neutral.

Formation of the soils

In this section the factors of soil formation are described and related to the soils in the survey area. In addition, the processes of soil formation are described.

Factors of soil formation

The characteristics of a soil at any given point are determined by the physical and mineral composition of the parent material; the climate under which the parent material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. All five of these factors have influenced the present characteristics of every soil in Nacogdoches County, but the significance of each factor varies from one place to another.

The interrelationship among these five factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient to discuss each factor separately, however, and to indicate the probable effects of each.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineralogical composition of the soil. The soils of Nacogdoches County have formed in unconsolidated sediment of the Eocene, Pleistocene, and Holocene Ages (*3*).

Deposits of the Eocene System are the Wilcox Group, the Carrizo Sand, Reklaw, Queen City Sand, Weches, Sparta Sand, Cook Mountain, and the Yegua Formations. The fluviatile terraces in Nacogdoches County are probably of the Pleistocene system. The Holocene (recent) system includes alluvial deposits of the Angelina River, Attoyac Bayou, and many smaller streams in the county.

Soils of the Wilcox group and Reklaw Formation include the Cuthbert, Kirvin, and Sacul series. These deposits are mainly alternate layers of shale and soft sandstone. Soils in these areas generally have a clayey subsoil.

The Carrizo Sand Formation is a deposit of fine grained sand. The sandy Tonkawa and Betis soils formed in this area. These soils are sandy to a depth of more than 80 inches.

Bowie, Lilbert, Darco, Tenaha, and Betis soils are the dominant series formed in the Queen City Sand and Sparta Sand Formations. These deposits are mainly soft sandstone interbedded with thin layers of shale. Soils in these areas vary greatly, but generally they have a loamy subsoil.

The glauconitic Weches Formation, which crosses the center of the county (Redland Belt), is the parent material of the "Redland soils." These soils generally have a clayey subsoil that is highly enriched with iron. Included are the Nacogdoches, Trawick, and Alto soils.

The Cook Mountain Formation between the communities of Woden and Etoile is characterized by dense clayey or shaly deposits. The slightly acid through mod-

erately alkaline dense clayey parent material of the Woodtell, Etoile, Lacerda, and Naclina soils are of this formation.

The Yegua Formation in the extreme southern part of the county is highly dissected by old erosional patterns. The Cuthbert, Sacul, and Kirvin soils make up most of this area.

Fluviatile terraces occur along the Angelina River, the Attoyac Bayou, and a few other large creeks. These areas are old alluvial bottom land areas that have been modified by wind. Soils in these places have high content of very fine sand and silt-sized particles.

Alluvial areas or overflow bottom lands occur along most streams. These areas have formed soils that have little horizon development.

Climate

The climate of Nacogdoches County is subtropical and humid. Rainfall, evaporation, and temperature are the main factors that influence climate. The moderate to large amount of rainfall has promoted moderately rapid formation of soils throughout the county. Rainfall is uniform over the entire county; its effect, however, is modified locally by runoff caused by steepness of slope. Because of this uniformity of climate, the differences among the soils in Nacogdoches County are not attributed to climatic differences.

Plant and animal life

In Nacogdoches County, plants, insects, micro-organisms, crayfish, earthworms, and other forms of living organisms have contributed to the development of the soils. Increased organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are caused by plant and animal life.

Vegetation, dominantly trees, has had great effect on soil formation in the county. The soils that formed under trees are generally low in content of organic matter and light in color. Grasses have influenced the formation of only one soil in the county. This soil, in the Chireno series, is dark and has a relatively high content of organic matter.

Relief

Relief or topography influences soil development through its effect on drainage, runoff, and depth of penetration by soil moisture. Topography ranges from nearly level to steep. The nearly level areas consist of bottom lands and terraces. Most of the broad interstream divides are gently sloping to sloping. Side slopes above drainageways are generally strongly sloping to moderately steep. A few hills are steep.

If other factors are equal, the degree of soil profile development depends on the amount and depth of penetration by soil moisture. The more times a soil passes through a wetting and drying cycle, the greater and the more distinct will be the soil development.

Soils on a nearly level landscape tend to have marked differences in development depending on their natural drainage. Many nearly level soils are poorly drained and remain saturated with water much of the time. These soils do not have pronounced soil horizonation; they are gleyed and generally are not developed below a depth of 60 inches. However, well drained soils that are nearly level can be distinctly developed to a depth of more than 80 inches.

Most of the gently sloping to sloping soils are developed to a depth of more than 60 inches.

As the slope gradient in Nacogdoches County increases, especially to more than 8 percent, the depth of water penetration distinctly decreases. Because much of the water is removed by runoff, soil development is less. The sloping to moderately steep Cuthbert soils, which are on rounded knobs or side slopes of hills and ridges, have moderately deep soil development. The steep Bub soils have shallow development.

Time

A great length of time is required for the formation of soils with distinct horizons. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of soil horizons. Young soils have very little horizon development; old soils have well-expressed horizons.

The Mantachie and Marietta soils are young soils. They formed in sediment recently deposited on bottom lands by soil-laden flood waters. These soils have little horizon development.

The Attoyac and Bernaldo soils are soils of intermediate development. Because they are on fluviatile terraces which have not been in place as long as most formations in the county, these soils have not had time for maximum development. Unlike many other soils on uplands, neither of these soils have been leached of bases.

Advanced development is evident in the Bowie and Lilbert soils. These soils have distinct horizonation, have been leached of most bases, and have accumulations of iron-enriched nodules (plinthite).

Interaction of factors

The interaction of the five major factors of soil formation has caused some very pronounced differences among the soils in Nacogdoches County.

The Etoile and Naclina soils of Cook Mountain Formation have one major difference from all other soils in the county. These soils are calcareous. There are two likely reasons why calcium still remains in these soils when other soils have been leached of most bases. The parent material probably had a higher content of calcium carbonate. In addition, the parent material is very dense

clayey shale which allows little leaching by water passing through the soil.

The Mollville soils have more crayfish activity than other soils in the county because of wetness. Crayfish burrow into the soil and bring clay from the subsoil to the surface. As water penetrates downward, this clay is melted down and is transported back through the soil.

Although no one of the five factors can be separated from the other four, some factors have a more pronounced effect on soil formation under certain conditions.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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 that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically 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.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

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 soil. Sandy clay, silty clay, and clay.

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.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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 that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have 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 in which the solum 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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Light textured soil. Sand and loamy sand.

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.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

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 simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size

of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater 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.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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 (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminat-

ed), *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.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

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.

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 (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

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.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Center, Texas]

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----	58.2	35.1	46.7	81	13	80	4.08	1.98	5.78	7	.7
February---	62.3	37.1	49.8	82	17	108	3.86	2.53	5.06	7	.3
March------	69.1	43.4	56.3	87	23	243	4.13	2.10	5.77	6	.2
April------	77.4	53.2	65.3	90	33	459	4.99	2.52	7.00	6	.0
May--------	84.1	61.0	72.6	94	44	701	4.98	2.24	7.20	6	.0
June-------	90.3	67.5	78.9	99	54	867	4.10	1.66	6.11	5	.0
July-------	94.3	70.1	82.2	103	61	998	3.33	1.21	5.03	5	.0
August-----	94.5	69.1	81.8	105	58	986	3.82	1.52	5.71	5	.0
September--	89.0	63.7	76.3	101	47	789	4.15	1.52	6.27	6	.0
October----	81.0	52.2	66.6	95	33	515	3.09	1.12	4.69	4	.0
November---	68.8	42.1	55.5	86	22	198	4.09	2.10	5.71	6	.0
December---	60.8	36.2	48.5	81	16	85	4.70	2.60	6.41	7	.0
Year-----	77.5	52.6	65.0	106	11	6,029	49.32	38.93	59.12	70	1.2

[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 1951-75 at Center, Texas]

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 16	March 26	April 6
2 years in 10 later than--	March 5	March 19	March 31
5 years in 10 later than--	February 13	March 5	March 21
First freezing temperature in fall:			
1 year in 10 earlier than--	November 12	November 8	October 27
2 years in 10 earlier than--	November 20	November 13	November 1
5 years in 10 earlier than--	December 5	November 22	November 11

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-75 at Center, Texas]

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	260	236	214
8 years in 10	271	245	221
5 years in 10	293	262	234
2 years in 10	316	278	247
1 year in 10	330	287	254

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Cultivated farm crops	Pasture	Woodland	Urban uses	Recreation areas
1. Nacogdoches-Trawick	Medium: slope, erodes easily, low fertility.	Medium: low fertility, too clayey.	Medium: too clayey, small stones, rooting depth.	Medium: low strength, slope.	Medium: percs slowly, slope.
2. Sacul-Cuthbert	Low: low fertility, erodes easily, slope.	Medium: low fertility, too clayey.	Medium: too clayey.	Low: shrink-swell, slope.	Medium: percs slowly, slope.
3. Woodtell-Lacerda	Low: low fertility, erodes easily, too clayey.	Medium: low fertility, too clayey.	Low: too clayey.	Low: shrink-swell, too clayey, wetness.	Low: shrink-swell, too clayey, wetness.
4. Sacul-Kirvin	Low: low fertility, erodes easily.	Medium: low fertility, too clayey.	Medium: too clayey.	Low: shrink-swell, low strength.	Medium: percs slowly.
5. Lilbert-Darco	Medium: droughty, low fertility.	Medium: droughty, low fertility.	Medium: droughty.	High.	Medium: too sandy.
6. Cuthbert-Tenaha	Low: low fertility, erodes easily.	Medium: low fertility, slope.	Low: too clayey, droughty.	Low: slope.	Medium: too sandy, slope.
7. Tonkawa	Low: droughty, low fertility.	Low: droughty, low fertility.	Low: droughty.	High.	Low: too sandy.
8. Darco-Tenaha	Medium: droughty, slope.	Medium: droughty, low fertility.	Low: droughty.	Medium: slope.	Medium: too sandy.
9. Mantachie-Marietta	Low: floods.	High.	High.	Low: floods.	Low: floods.
10. Tuscosso-Hannahatchee	Low: floods.	High.	High.	Low: floods.	Medium: floods.
11. Attoyac-Bernaldo-Besner	High.	High.	High.	High.	High.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Alto fine sandy loam, 0 to 4 percent slopes	9,030	1.5
3	Alto clay loam, 0 to 1 percent slopes	1,450	0.2
4	Alto clay loam, 1 to 3 percent slopes	2,000	0.3
5	Angelina soils, frequently flooded	555	0.1
6	Attoyac fine sandy loam, 0 to 4 percent slopes	11,250	1.8
7	Attoyac fine sandy loam, 8 to 15 percent slopes	2,540	0.4
8	Attoyac-Urban land complex, 0 to 4 percent slopes	975	0.2
9	Bernaldo fine sandy loam, 0 to 3 percent slopes	1,950	0.3
10	Bernaldo-Besner complex	17,158	2.8
11	Betis loamy fine sand, 0 to 8 percent slopes	6,015	1.0
12	Bienville loamy fine sand, 1 to 5 percent slopes	2,115	0.3
13	Bowie fine sandy loam, 1 to 8 percent slopes	14,400	2.3
14	Briley loamy fine sand, 1 to 8 percent slopes	10,710	1.7
15	Chireno clay loam, 0 to 2 percent slopes	1,070	0.2
16	Cuthbert fine sandy loam, 8 to 20 percent slopes	62,150	10.0
17	Cuthbert gravelly fine sandy loam, 8 to 20 percent slopes	3,220	0.5
18	Cuthbert stony fine sandy loam, 5 to 30 percent slopes	1,170	0.2
19	Darco loamy fine sand, 1 to 8 percent slopes	25,530	4.1
20	Darco loamy fine sand, 8 to 20 percent slopes	12,975	2.0
21	Darco-Urban land complex, 1 to 8 percent slopes	1,940	0.3
22	Darco-Urban land complex, 8 to 25 percent slopes	280	(1)
23	Etoile loam, 1 to 5 percent slopes	3,510	0.6
24	Etoile loam, 5 to 20 percent slopes	1,595	0.2
25	Hannahatchee loam, frequently flooded	12,250	2.0
26	Hannahatchee-Urban land complex, frequently flooded	1,000	0.2
27	Iuka fine sandy loam, occasionally flooded	14,145	2.3
28	Kirvin fine sandy loam, 1 to 8 percent slopes	32,180	5.2
29	Kirvin gravelly fine sandy loam, 1 to 8 percent slopes	6,060	1.0
30	Kirvin-Urban land complex, 1 to 5 percent slopes	220	(1)
31	Kirvin soils, graded, 2 to 8 percent slopes	1,745	0.3
32	Kullit fine sandy loam, 1 to 3 percent slopes	5,910	1.0
33	Lacerda clay loam, 0 to 5 percent slopes	7,295	1.2
34	Lacerda clay loam, 5 to 20 percent slopes	730	0.1
35	Lilbert loamy fine sand, 1 to 8 percent slopes	37,070	6.0
36	Lilbert-Urban land complex, 1 to 8 percent slopes	1,465	0.2
37	Mantachie soils, frequently flooded	20,535	3.3
38	Marietta soils, frequently flooded	17,840	2.9
39	Mollville loam	1,125	0.2
40	Mollville-Besner complex	5,915	1.0
41	Naclina clay, 5 to 20 percent slopes	1,100	0.2
42	Nacogdoches fine sandy loam, 1 to 8 percent slopes	43,000	7.0
43	Nacogdoches gravelly fine sandy loam, 1 to 8 percent slopes	6,095	1.0
44	Nacogdoches clay loam, 1 to 8 percent slopes	12,180	2.0
45	Nacogdoches clay loam, 2 to 5 percent slopes, eroded	1,555	0.3
46	Nacogdoches gravelly clay loam, 1 to 8 percent slopes	1,100	0.2
47	Nacogdoches-Urban land complex, 1 to 5 percent slopes	830	0.1
48	Osier fine sand, 0 to 2 percent slopes	2,980	0.5
49	Osier-Urban land complex, 0 to 2 percent slopes	220	(1)
50	Percilla clay loam, 0 to 1 percent slopes	860	0.1
51	Pits	289	(1)
52	Rentzel loamy fine sand, 0 to 4 percent slopes	7,875	1.3
53	Rentzel-Urban land complex, 0 to 4 percent slopes	380	0.1
54	Ruston fine sandy loam, 1 to 8 percent slopes	5,499	0.9
55	Sacul fine sandy loam, 1 to 5 percent slopes	23,910	3.9
56	Sacul fine sandy loam, 5 to 20 percent slopes	24,540	4.0
57	Tenaha loamy fine sand, 5 to 20 percent slopes	27,040	4.4
58	Tenaha-Urban land complex, 5 to 20 percent slopes	548	0.1
59	Tonkawa fine sand, 0 to 8 percent slopes	8,090	1.3
60	Tonkawa fine sand, 8 to 20 percent slopes	2,385	0.4
61	Trawick fine sandy loam, 8 to 20 percent slopes	13,775	2.2
62	Trawick gravelly fine sandy loam, 8 to 20 percent slopes	2,530	0.4
63	Trawick clay loam, 8 to 20 percent slopes	17,000	2.8
64	Trawick-Bub complex, stony, 5 to 35 percent slopes	3,500	0.6
65	Trawick-Urban land complex, 8 to 20 percent slopes	875	0.1
66	Tuscosso clay loam, frequently flooded	18,375	3.0
67	Woden fine sandy loam, 1 to 4 percent slopes	2,905	0.5
68	Woodtell very fine sandy loam, 1 to 5 percent slopes	8,140	1.3
69	Woodtell very fine sandy loam, 5 to 20 percent slopes	3,135	0.5
	Water	17,816	2.9
	Total	617,600	100.0

[1] Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Oats	Watermelons	Improved bermudagrass	Bahiagrass
	Bu	Bu	Ton	AUM*	AUM*
2--- Alto	60	60	---	8	9
3--- Alto	60	60	---	8	9
4--- Alto	60	60	---	8	9
5--- Angelina	---	---	---	---	---
6--- Attoyac	65	60	---	10	10
7--- Attoyac	55	50	---	8	---
8--- Attoyac	---	---	---	---	---
9--- Bernaldo	65	60	---	8	9
10--- Bernaldo-Besner	65	60	---	8	9
11--- Betis	40	---	8	6	---
12--- Bienville	60	---	9	11	---
13--- Bowie	60	60	---	10	10
14--- Briley	45	45	---	6.5	---
15--- Chireno	90	---	---	---	11
16, 17--- Cuthbert	---	---	---	7	6
18--- Cuthbert	---	---	---	5	4
19--- Darco	45	---	8	6.5	---
20--- Darco	---	---	---	5	---
21--- Darco	---	---	---	---	---
22--- Darco	---	---	---	---	---
23--- Etoile	45	---	---	7.5	6

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Watermelons	Improved bermudagrass	Baniagrass
	Bu	Bu	Ton	AUM*	AUM*
24---------- Etoile	---	---	---	6	5
25---------- Hannahatchee	---	---	---	12	10
26---------- Hannahatchee	---	---	---	---	---
27---------- Iuka	90	---	---	9	9
28---------- Kirvin	45	45	---	9	8
29---------- Kirvin	40	---	---	8	7
30---------- Kirvin	---	---	---	---	---
31---------- Kirvin	---	---	---	6	5
32---------- Kullit	50	---	---	9	9
33---------- Lacerda	45	---	---	7.5	6
34---------- Lacerda	---	---	---	6	5.5
35---------- Lilbert	45	45	8	6.5	---
36---------- Lilbert	---	---	---	---	---
37---------- Mantachie	---	---	---	---	8
38---------- Marietta	---	---	---	10.5	9
39---------- Mollville	---	---	---	---	7.5
40---------- Mollville-Besner	---	---	---	---	7.5
41---------- Naclina	---	---	---	7.5	6
42, 43, 44---------- Nacogdoches	60	60	---	8	7
45---------- Nacogdoches	50	50	---	8	7
46---------- Nacogdoches	60	60	---	8	7
47---------- Nacogdoches	---	---	---	---	---
48---------- Osier	---	---	---	---	5
49---------- Osier	---	---	---	---	---
50---------- Percilla	---	---	---	---	6.5

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Watermelons	Improved bermudagrass	Bahiagrass
	Bu	Bu	Ton	AUM*	AUM*
51**. Pits					
52---------- Rentzel	---	---	---	8.5	8
53---------- Rentzel	---	---	---	---	---
54---------- Ruston	60	---	---	12	9.5
55---------- Sacul	40	---	---	---	7.5
56---------- Sacul	---	---	---	---	6.5
57---------- Tenaha	---	---	---	5	---
58---------- Tenaha	---	---	---	---	---
59---------- Tonkawa	---	---	7	5	---
60---------- Tonkawa	---	---	---	5	---
61, 62, 63---------- Trawick	---	---	---	6	---
64---------- Trawick-Bub	---	---	---	4.5	---
65---------- Trawick	---	---	---	---	---
66---------- Tuscosso	---	---	---	---	12
67---------- Woden	65	60	---	10	9
68---------- Woodtell	35	---	---	7	7
69---------- Woodtell	---	---	---	6	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (s)
		Acres	Acres	Acres	Acres
I	1,450	---	---	---	---
II	64,446	49,231	14,145	1,070	---
III	196,591	180,337	8,084	8,130	---
IV	95,481	64,905	22,486	8,090	---
V	54,794	---	54,794	---	---
VI	177,305	172,430	555	4,320	---
VII	---	---	---	---	---
VIII	---	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available. Site index was calculated at 30 years for eastern cottonwood, at 35 years for American sycamore, and at 50 years for all other species]

Soil name and map symbol	Woodland suitability group	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
2---------- Alto	3o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine------- Southern red oak-----	80 70 70	Loblolly pine, slash pine.
3, 4---------- Alto	4c2	Slight	Moderate	Moderate	Slight	Loblolly pine--------- Shortleaf pine-------	70 60	Loblolly pine, slash pine.
6, 7---------- Attoyac	2o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine------- Sweetgum------------ Southern red oak-----	90 80 90 80	Loblolly pine, slash pine, American sycamore, black walnut.
9---------- Bernaldo	2o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine------- Sweetgum------------ Southern red oak-----	90 80 --- ---	Loblolly pine, slash pine, sweetgum.
10*:								
Bernaldo----------	2o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine------- Sweetgum------------ Southern red oak-----	90 80 --- ---	Loblolly pine, slash pine, sweetgum.
Besner----------	2o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine------- Sweetgum------------ Southern red oak-----	90 80 --- ---	Loblolly pine, slash pine, sweetgum.
11---------- Betis	4s3	Slight	Moderate	Severe	Slight	Shortleaf pine------- Loblolly pine---------	63 70	Loblolly pine, slash pine.
12---------- Bienville	3s2	Slight	Moderate	Moderate	Slight	Loblolly pine--------- Shortleaf pine-------	80 70	Loblolly pine, slash pine.
13---------- Bowie	3o1	Slight	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine-------	83 74	Loblolly pine, slash pine, shortleaf pine.
14---------- Briley	3s2	Slight	Slight	Moderate	Moderate	Loblolly pine--------- Shortleaf pine------- Slash pine----------	80 70 ---	Loblolly pine, slash pine.
15---------- Chireno	4c2	Slight	Moderate	Moderate	Moderate	Loblolly pone--------- Shortleaf pine-------	75 65	Loblolly pine.
16---------- Cuthbert	4c2	Moderate	Slight	Slight	Slight	Loblolly pine--------- Shortleaf pine-------	70 60	Loblolly pine, shortleaf pine.
17, 18---------- Cuthbert	4r2	Moderate	Moderate	Slight	Moderate	Loblolly pine--------- Shortleaf pine-------	70 60	Loblolly pine, shortleaf pine.
19, 20---------- Darco	4s3	Slight	Moderate	Severe	Moderate	Loblolly pine--------- Shortleaf pine-------	70 65	Loblolly pine, shortleaf pine.
23, 24---------- Etoile	4c2	Slight	Moderate	Slight	Moderate	Shortleaf pine------- Loblolly pine---------	65 74	Loblolly pine, slash pine.
25---------- Hannahatchee	1o7	Slight	Slight	Slight	Slight	Loblolly pine--------- Sweetgum------------ Southern red oak----- White oak-----------	110 100 90 ---	Loblolly pine, sweetgum, American sycamore, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Woodland suitability group	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
27---------- Iuka	1w8	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Sweetgum------------ Eastern cottonwood-- Water oak-----------	100 100 105 100	Loblolly pine, eastern cottonwood.
28---------- Kirvin	3o1	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------	80 70	Loblolly pine, slash pine.
29---------- Kirvin	4f2	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------	70 60	Loblolly pine.
31*---------- Kirvin	4c2	Moderate	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------	70 60	Loblolly pine.
32---------- Kullit	2w8	Slight	Moderate	Slight	Moderate	Loblolly pine------- Southern red oak---- White oak----------- Sweetgum------------	90 --- --- ---	Loblolly pine, sweetgum, cherrybark oak.
33, 34---------- Lacerda	4c2	Slight	Moderate	Slight	Moderate	Shortleaf pine------ Loblolly pine-------	65 74	Loblolly pine, slash pine.
35---------- Lilbert	3s2	Slight	Slight	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Longleaf pine------- Sweetgum------------ Southern red oak----	80 70 70 --- ---	Loblolly pine, slash pine.
37*---------- Mantachie	1w6	Slight	Severe	Severe	Severe	Green ash----------- Eastern cottonwood-- Cherrybark oak------ Sweetgum------------ Water oak-----------	80 90 100 95 ---	Green ash, eastern cottonwood, cherrybark oak, sweetgum, water oak.
38*---------- Marietta	1w8	Slight	Moderate	Moderate	Slight	Eastern cottonwood-- Green ash----------- Sweetgum------------ Loblolly pine-------	105 90 100 100	Eastern cottonwood, sweetgum, green ash, water oak, loblolly pine.
39---------- Mollville	3w9	Slight	Severe	Moderate	Severe	Water oak----------- Willow oak---------- Sweetgum------------	80 80 80	Water oak, sweetgum, loblolly pine.
40*: Mollville---------	3w9	Slight	Severe	Moderate	Severe	Water oak----------- Willow oak---------- Sweetgum------------	80 80 80	Water oak, sweetgum, loblolly pine.
Besner------------	2o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum------------ Southern red oak----	90 80 --- ---	Loblolly pine, slash pine, sweetgum.
41---------- Naclina	4c2	Slight	Moderate	Moderate	Moderate	Shortleaf pine------ Loblolly pine-------	60 68	Loblolly pine, shortleaf pine.
42---------- Nacogdoches	3o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum------------ Southern red oak----	80 70 --- ---	Loblolly pine, shortleaf pine, sweetgum, southern red oak.
43---------- Nacogdoches	4f2	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------	70 60	Loblolly pine, shortleaf pine.
44---------- Nacogdoches	3c2	Moderate	Slight	Moderate	Slight	Loblolly pine------- Shortleaf pine------	80 70	Loblolly pine, shortleaf pine.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Woodland suitability group	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
45---------- Nacogdoches	4c2	Moderate	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------	70 60	Loblolly pine, shortleaf pine.
46---------- Nacogdoches	4f2	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------	70 60	Loblolly pine, shortleaf pine.
48---------- Osier	3w9	Slight	Severe	Severe	Severe	Slash pine---------- Loblolly pine------- Longleaf pine------- Sweetgum----------	80 80 68 ---	Slash pine, loblolly pine, sweetgum.
50---------- Percilla	2w9	Slight	Severe	Severe	Severe	Water oak---------- Willow oak---------- Loblolly pine-------	90 90 87	Water oak, willow oak.
52---------- Rentzel	2w8	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Sweetgum----------	92 81 ---	Loblolly pine, sweetgum.
54---------- Ruston	3o1	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------	84 75	Loblolly pine.
55---------- Sacul	3c2	Moderate	Slight	Slight	Moderate	Loblolly pine------- Shortleaf pine------	80 70	Loblolly pine, shortleaf pine.
57---------- Tenaha	3s2	Slight	Slight	Moderate	Slight	Loblolly pine------- Shortleaf pine------	80 70	Slash pine, loblolly pine.
59, 60---------- Tonkawa	5s3	Slight	Severe	Severe	Moderate	Shortleaf pine------ Loblolly pine------- Longleaf pine-------	55 --- ---	Loblolly pine, slash pine.
61, 62, 63--------- Trawick	4r2	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------ Southern red oak----	70 60 60	Loblolly pine.
64*: Trawick---------- Bub----------	4r2 4f2	Moderate Moderate	Moderate Moderate	Slight Moderate	Slight Slight	Loblolly pine------- Shortleaf pine------ Shortleaf pine------ Loblolly pine------- Southern red oak----	70 60 60 70 60	Loblolly pine, shortleaf pine. Shortleaf pine, loblolly pine.
66---------- Tuscosso	1w8	Slight	Moderate	Moderate	Moderate	Water oak---------- Southern red oak---- Sweetgum----------	96 86 96	Water oak, southern red oak, loblolly pine.
67---------- Woden	2o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	90 80 90 80	Loblolly pine, slash pine, black walnut.
68, 69---------- Woodtell	4c2	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	70 60	Slash pine, loblolly pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
2, 3, 4----------	Favorable	3,500	Longleaf uniola----------	15
Alto	Normal	2,000	Indiangrass----------	15
	Unfavorable	1,500	Sedge----------	15
			Pinehill bluestem----------	10
			Beaked panicum----------	10
			Panicum----------	10
			Brownseed paspalum----------	5
6, 7----------	Favorable	3,000	Pinehill bluestem----------	15
Attoyac	Normal	2,000	Beaked panicum----------	15
	Unfavorable	1,500	Longleaf uniola----------	10
			Panicum----------	10
			Indiangrass----------	5
			Purpletop----------	5
9----------	Favorable	2,500	Pinehill bluestem----------	20
Bernaldo	Normal	2,000	Beaked panicum----------	20
	Unfavorable	1,500	Longleaf uniola----------	20
			Panicum----------	10
			Purpletop----------	5
10*:				
Bernaldo----------	Favorable	2,500	Pinehill bluestem----------	20
	Normal	2,000	Beaked panicum----------	20
	Unfavorable	1,500	Longleaf uniola----------	20
			Panicum----------	10
			Purpletop----------	5
Besner----------	Favorable	3,000	Pinehill bluestem----------	15
	Normal	2,000	Beaked panicum----------	15
	Unfavorable	1,500	Longleaf uniola----------	10
			Indiangrass----------	10
			Sedge----------	10
			Common carpetgrass----------	10
			Purpletop----------	5
11----------	Favorable	3,000	Pinehill bluestem----------	15
Betis	Normal	2,000	Arrowfeather threeawn----------	15
	Unfavorable	1,200	Longleaf uniola----------	15
			Broomsedge bluestem----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Indiangrass----------	5
12----------	Favorable	---	Pinehill bluestem----------	20
Bienville	Normal	1,100	Little bluestem----------	20
	Unfavorable	---	Panicum----------	20
			Longleaf uniola----------	10
			Threeawn----------	10
13----------	Favorable	3,500	Pinehill bluestem----------	15
Bowie	Normal	3,000	Beaked panicum----------	15
	Unfavorable	2,000	Panicum----------	15
			Longleaf uniola----------	10
			Brownseed paspalum----------	10
			Indiangrass----------	5
			Purpletop----------	5
14----------	Favorable	3,000	Longleaf uniola----------	15
Briley	Normal	2,300	Pinehill bluestem----------	15
	Unfavorable	1,500	Broomsedge bluestem----------	10
			Beaked panicum----------	5
			Panicum----------	5
			Purpletop----------	5
			Indiangrass----------	5
			Arrowfeather threeawn----------	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
15---------- Chireno	Favorable	3,500	Longleaf uniola----------	20
	Normal	2,500	Sedge----------	10
	Unfavorable	2,000	Purpletop----------	10
			Indiangrass----------	5
			Little bluestem----------	5
			Panicum----------	5
16, 17, 18---------- Cuthbert	Favorable	2,500	Pinehill bluestem----------	20
	Normal	2,000	Beaked panicum----------	20
	Unfavorable	1,250	Longleaf uniola----------	10
			Panicum----------	10
			Big bluestem----------	5
			Purpletop----------	5
			Indiangrass----------	5
19, 20---------- Darco	Favorable	3,000	Longleaf uniola----------	30
	Normal	2,600	Pinehill bluestem----------	20
	Unfavorable	1,500	Indiangrass----------	10
			Purpletop----------	10
			Switchgrass----------	5
23, 24---------- Etoile	Favorable	3,500	Longleaf uniola----------	20
	Normal	2,100	Pinehill bluestem----------	10
	Unfavorable	1,500	Panicum----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Sedge----------	5
			Gayfeather----------	5
25---------- Hannahatchee	Favorable	5,000	Beaked panicum----------	15
	Normal	4,000	Giant cane----------	10
	Unfavorable	2,000	Longleaf uniola----------	10
			Sedge----------	10
			Virginia wildrye----------	5
27---------- Iuka	Favorable	5,000	Beaked panicum----------	15
	Normal	4,000	Giant cane----------	10
	Unfavorable	2,000	Longleaf uniola----------	10
			Sedge----------	10
			Virginia wildrye----------	5
28, 29---------- Kirvin	Favorable	2,500	Longleaf uniola----------	15
	Normal	1,750	Pinehill bluestem----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Purpletop----------	10
			Giant cane----------	10
			Brownseed paspalum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
31*---------- Kirvin	Favorable	2,500	Longleaf uniola----------	15
	Normal	1,750	Pinehill bluestem----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Purpletop----------	10
			Giant cane----------	10
			Brownseed paspalum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
32---------- Kullit	Favorable	2,500	Beaked panicum----------	10
	Normal	2,000	Sedge----------	10
	Unfavorable	1,600	Switchgrass----------	10
			Canada wildrye----------	10
			Greenbrier----------	10
			Broadleaf uniola----------	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
33, 34---------- Lacerda	Favorable	3,500	Longleaf uniola----------	20
	Normal	2,100	Pinehill bluestem----------	10
	Unfavorable	1,500	Panicum----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Sedge----------	5
			Gayfeather----------	5
35---------- Lilbert	Favorable	3,000	Pinehill bluestem----------	20
	Normal	2,250	Longleaf uniola----------	15
	Unfavorable	1,500	Broomsedge bluestem----------	10
			Beaked panicum----------	10
			Indiangrass----------	10
			Purpletop----------	5
			Arrowfeather threeawn----------	5
37*---------- Mantachie	Favorable	---	Longleaf uniola----------	35
	Normal	2,000	Pinehill bluestem----------	20
	Unfavorable	---		
38---------- Marietta	Favorable	5,000	Beaked panicum----------	15
	Normal	4,000	Giant cane----------	10
	Unfavorable	2,000	Longleaf uniola----------	10
			Sedge----------	10
			Virginia wildrye----------	5
39---------- Mollville	Favorable	3,500	Pinehill bluestem----------	20
	Normal	2,500	Florida paspalum----------	20
	Unfavorable	1,500	Virginia wildrye----------	10
			Beaked panicum----------	10
			Panicum----------	10
40*:				
Mollville---------	Favorable	3,500	Pinehill bluestem----------	20
	Normal	2,500	Florida paspalum----------	20
	Unfavorable	1,500	Virginia wildrye----------	10
			Beaked panicum----------	10
			Panicum----------	10
Besner----------	Favorable	3,000	Pinehill bluestem----------	15
	Normal	2,000	Beaked panicum----------	15
	Unfavorable	1,500	Longleaf uniola----------	10
			Indiangrass----------	10
			Sedge----------	10
			Common carpetgrass----------	10
			Purpletop----------	5
41---------- Naclina	Favorable	5,000	Hawthorn----------	25
	Normal	3,800	Pinehill bluestem----------	10
	Unfavorable	2,500	Longleaf uniola----------	10
			Panicum----------	10
			Beaked panicum----------	10
			Purpletop----------	5
42, 43, 44, 45, 46- Nacogdoches	Favorable	3,500	Longleaf uniola----------	20
	Normal	2,000	Indiangrass----------	15
	Unfavorable	1,500	Panicum----------	10
			Pinehill bluestem----------	10
			Sedge----------	10
48---------- Osier	Favorable	---	Cutover muhly----------	25
	Normal	1,200	Toothachegrass----------	17
	Unfavorable	---	Little bluestem----------	8
			Panicum----------	8
			Pineland threeawn----------	8
			Switchgrass----------	8
			Large holly----------	8

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
50---------- Percilla	Favorable	2,000	Sedge----------	25
	Normal	1,500	Rustyseed paspalum----------	15
	Unfavorable	1,000	Virginia wildrye----------	15
			Beaked panicum----------	10
			Paspalum----------	5
			Panicum----------	5
52---------- Rentzel	Favorable	2,000	Broomsedge bluestem----------	20
	Normal	1,700	Pinehill bluestem----------	15
	Unfavorable	1,400	Longleaf uniola----------	15
			Beaked panicum----------	10
			Purpletop----------	10
54---------- Ruston	Favorable	---	Longleaf uniola----------	50
	Normal	1,200	Pinehill bluestem----------	15
	Unfavorable	---	Beaked panicum----------	10
			Panicum----------	10
55, 56---------- Sacul	Favorable	3,000	Bluestem----------	25
	Normal	2,200	Beaked panicum----------	15
	Unfavorable	1,500	Uniola----------	10
			Plumegrass----------	8
			Panicum----------	7
			Sedge----------	5
57---------- Tenaha	Favorable	2,500	Pinehill bluestem----------	20
	Normal	2,000	Slender bluestem----------	15
	Unfavorable	1,250	Longleaf uniola----------	15
			Switchgrass----------	10
			Indiangrass----------	5
			Purpletop----------	5
59, 60---------- Tonkawa	Favorable	3,000	Broomsedge bluestem----------	20
	Normal	2,000	Pinehill bluestem----------	20
	Unfavorable	1,200	Arrowfeather threeawn----------	15
			Panicum----------	10
			Indiangrass----------	10
61, 62, 63---------- Trawick	Favorable	3,200	Longleaf uniola----------	20
	Normal	2,000	Indiangrass----------	15
	Unfavorable	1,200	Panicum----------	10
			Pinehill bluestem----------	10
			Sedge----------	10
64*:				
Trawick----------	Favorable	3,200	Longleaf uniola----------	20
	Normal	2,000	Indiangrass----------	15
	Unfavorable	1,200	Panicum----------	10
			Pinehill bluestem----------	10
			Sedge----------	10
Bub----------	Favorable	2,500	Longleaf uniola----------	20
	Normal	1,500	Indiangrass----------	15
	Unfavorable	1,000	Panicum----------	10
			Pinehill bluestem----------	10
			Sedge----------	10
66---------- Tuscosso	Favorable	5,000	Longleaf uniola----------	25
	Normal	3,500	Broomsedge bluestem----------	15
	Unfavorable	2,000	Indiangrass----------	15
			Giant cane----------	15
			Purpletop----------	10
			Paspalum----------	10
			Virginia wildrye----------	10

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
67---------- Woden	Favorable Normal Unfavorable	3,000 2,000 1,500	Pinehill bluestem---------- Beaked panicum---------- Panicum---------- Longleaf uniola---------- Brownseed paspalum---------- Indiangrass---------- Purpletop----------	15 15 15 10 10 5 5
68, 69---------- Woodtell	Favorable Normal Unfavorable	3,500 2,500 2,000	Pinehill bluestem---------- Panicum---------- Sedge---------- Brownseed paspalum---------- Indiangrass---------- Longleaf uniola---------- Purpletop---------- Carolina jointtail---------- Knotroot bristlegrass---------- Splitbeard bluestem----------	20 10 10 10 5 5 5 5 5 5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
2, 3, 4---------- Alto	Severe: too clayey, wetness.	Moderate: wetness, low strength, shrink-swell.	Severe: wetness.	Moderate: wetness, low strength, shrink-swell.	Severe: low strength.
5*---------- Angelina	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
6---------- Attoyac	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
7---------- Attoyac	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
8*: Attoyac----------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
Urban land.					
9---------- Bernaldo	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
10*: Bernaldo---------	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
Besner----------	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
11---------- Betis	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
12---------- Bienville	Severe: too sandy, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
13---------- Bowie	Moderate: wetness.	Slight----------	Moderate: wetness.	Slight----------	Moderate: low strength.
14---------- Briley	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
15---------- Chireno	Severe: too clayey.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, floods, low strength.	Severe: low strength, shrink-swell.
16, 17---------- Cuthbert	Severe: too clayey.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Severe: low strength.
18---------- Cuthbert	Severe: too clayey, large stones, slope.	Severe: large stones, slope, low strength.	Severe: depth to rock, large stones, slope.	Severe: depth to rock, large stones, slope.	Severe: low strength, slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
19--- Darco	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
20--- Darco	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
21*: Darco	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Urban land.					
22*: Darco	Severe: cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land.					
23--- Etoile	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.
24--- Etoile	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.
25--- Hannahatchee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
26*: Hannahatchee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Urban land.					
27--- Iuka	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
28, 29--- Kirvin	Moderate: too clayey, depth to rock.	Moderate: low strength, shrink-swell.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
30*: Kirvin	Moderate: too clayey, depth to rock.	Moderate: low strength, shrink-swell.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
Urban land.					
31*--- Kirvin	Moderate: too clayey, depth to rock.	Moderate: low strength, shrink-swell.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
32--- Kullit	Moderate: wetness, too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
33--- Lacerda	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
34---------- Lacerda	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.
35---------- Lilbert	Slight----------	Slight----------	Slight----------	Moderate: low strength.	Moderate: low strength.
36*: Lilbert----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.	Moderate: low strength.
Urban land.					
37*---------- Mantachie	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
38*---------- Marietta	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength.
39---------- Mollville	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
40*: Mollville--------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Besner----------	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
41---------- Naclina	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope, wetness.	Severe: shrink-swell, low strength.
42---------- Nacogdoches	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
43---------- Nacogdoches	Moderate: too clayey, small stones.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
44, 45---------- Nacogdoches	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
46---------- Nacogdoches	Moderate: too clayey, small stones.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
47*: Nacogdoches------	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Urban land.					
48---------- Osier	Severe: floods, wetness.	Severe: floods wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
49*: Osier----------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
49*: Urban land.					
50---- Percilla	Severe: floods, wetness, too clayey.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.
51*. Pits					
52---- Rentzel	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
53*: Rentzel----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Urban land.					
54---- Ruston	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: low strength.
55---- Sacul	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
56---- Sacul	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
57---- Tenaha	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
58*: Tenaha----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Urban land.					
59---- Tonkawa	Severe: too sandy, cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight.
60---- Tonkawa	Severe: too sandy, cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
61, 62, 63---- Trawick	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength, depth to rock.	Severe: slope.	Severe: low strength.
64*: Trawick----	Severe: slope, too clayey, large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, low strength.
Bub----	Severe: slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: low strength, slope.
65*: Trawick----	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength, depth to rock.	Severe: slope.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
65*: Urban land.					
66---------- Tuscosso	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, low strength, shrink-swell.
67---------- Woden	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
68---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
69---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: low strength, shrink-swell, slope.	Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2--- Alto	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: thin layer.
3--- Alto	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: thin layer.
4--- Alto	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: thin layer.
5*--- Angelina	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
6--- Attoyac	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
7--- Attoyac	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
8*: Attoyac	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
9--- Bernaldo	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Good.
10*: Bernaldo	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Good.
Besner	Moderate: wetness.	Moderate: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Good.
11--- Betis	Slight	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Fair: too sandy.
12--- Bienville	Moderate: wetness, floods.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Fair: too sandy.
13--- Bowie	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
14--- Briley	Slight	Moderate: seepage.	Slight	Slight	Fair: too sandy.
15--- Chireno	Severe: percs slowly.	Slight	Severe: too clayey, wetness.	Moderate: floods.	Poor: too clayey.
16, 17--- Cuthbert	Severe: percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18--Cuthbert	Severe: percs slowly, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: slope.	Poor: thin layer, large stones, slope.
19--Darco	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
20--Darco	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
21*: Darco	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Urban land.					
22*: Darco	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage, slope.	Poor: too sandy, slope.
Urban land.					
23--Etoile	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: thin layer, wetness.
24--Etoile	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: thin layer, wetness.
25--Hannahatchee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
26*: Hannahatchee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Urban land.					
27--Iuka	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
28, 29--Kirvin	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
30*: Kirvin	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
Urban land.					
31*--Kirvin	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
32--Kullit	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
33--Lacerda	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
34--Lacerda	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
35--Lilbert	Moderate: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too sandy.
36*: Lilbert	Moderate: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too sandy.
Urban land.					
37*--Mantachie	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey.
38*--Marietta	Severe: floods, wetness.	Moderate: seepage, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
39--Mollville	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
40*: Mollville	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Besner	Moderate: wetness.	Moderate: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Good.
41--Naclina	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
42, 43, 44, 45, 46--Nacogdoches	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
47*: Nacogdoches	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
Urban land.					
48--Osier	Severe: floods, wetness.	Severe: floods, seepage.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness, too sandy.
49*: Osier	Severe: floods, wetness.	Severe: floods, seepage.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness, too sandy.
Urban land.					
50--Percilla	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness.
51*. Pits					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
52--Rentzel	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too sandy.
53*: Rentzel	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too sandy.
Urban land.					
54--Ruston	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
55--Sacul	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
56--Sacul	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
57--Tenaha	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Fair: too sandy.
58*: Tenaha	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Fair: too sandy.
Urban land.					
59--Tonkawa	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
60--Tonkawa	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
61--Trawick	Severe: percs slowly.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
62--Trawick	Severe: percs slowly.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	
63--Trawick	Severe: percs slowly.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Poor: too clayey.
64*: Trawick	Severe: percs slowly, slope, depth to rock.	Severe: slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: thin layer, large stones.
Bub	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: slope.	Poor: thin layer.
65*: Trawick	Severe: percs slowly.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
Urban land.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
66---------- Tuscosso	Severe: floods, percs slowly.	Severe: floods.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
67---------- Woden	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
68---------- Woodtell	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
69---------- Woodtell	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2---------- Alto	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
3, 4---------- Alto	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
5*---------- Angelina	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
6, 7---------- Attoyac	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
8*: Attoyac----------	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Urban land.				
9---------- Bernaldo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
10*: Bernaldo----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Besner----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11---------- Betis	Good----------	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
12---------- Bienville	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
13---------- Bowie	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
14---------- Briley	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
15---------- Chireno	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
16, 17---------- Cuthbert	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
18---------- Cuthbert	Poor: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones, slope.
19, 20---------- Darco	Good----------	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
21*: Darco----------	Good----------	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22*: Darco	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, slope.
Urban land.				
23, 24--- Etoile	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
25--- Hannahatchee	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
26*: Hannahatchee---	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Urban land.				
27--- Iuka	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
28--- Kirvin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
29--- Kirvin	Poor: low strength..	Unsuited: excess fines.	Poor: thin layer.	Poor: small stones.
30*: Kirvin---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land.				
31*--- Kirvin	Poor: low strength.	Unsuited: excess fines.	Poor: thin layer.	Poor: small stones.
32--- Kullit	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
33, 34--- Lacerda	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
35--- Lilbert	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
36*: Lilbert---	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land.				
37*--- Mantachie	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
38*--- Marietta	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey thin layer.
39--- Mollville	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
40*:				
Mollville	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Besner	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
41--- Naclina	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
42--- Nacogdoches	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
43--- Nacogdoches	Poor: low strength.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
44, 45--- Nacogdoches	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
46--- Nacogdoches	Poor: low strength.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
47*:				
Nacogdoches	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Urban land.				
48--- Osier	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy, wetness.
49*:				
Osier	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy, wetness.
Urban land.				
50--- Percilla	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
51*. Pits				
52--- Rentzel	Fair: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
53*:				
Rentzel	Fair: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land.				
54--- Ruston	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
55, 56--- Sacul	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
57--Tenaha	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
58*: Tenaha	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land.				
59, 60--Tonkawa	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
61--Trawick	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
62--Trawick	Good	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
63--Trawick	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
64*: Trawick	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones, slope.
Bub	Poor: low strength, thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
65*: Trawick	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Urban land.				
66--Tuscosso	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
67--Woden	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
68, 69--Woodtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
2, 3, 4---------- Alto	Slight---------	Moderate: wetness.	Severe: no water.	Favorable-------	Favorable-------	Favorable.
5*---------- Angelina	Slight---------	Moderate: piping.	Moderate: slow refill.	Wetness, floods.	Wetness, floods.	Wetness, floods.
6, 7---------- Attoyac	Moderate: seepage.	Slight---------	Severe: no water.	Not needed------	Slope----------	Slope.
8*: Attoyac----------	Moderate: seepage.	Slight---------	Severe: no water.	Not needed------	Slope----------	Slope.
Urban land.						
9---------- Bernaldo	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Not needed------	Complex slope---	Favorable.
10*: Bernaldo---------	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Not needed------	Complex slope---	Favorable.
Besner----------	Moderate: seepage.	Moderate: piping, unstable fill, compressible.	Severe: no water.	Not needed------	Slope----------	Favorable.
11---------- Betis	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Not needed------	Too sandy-------	Droughty, erodes easily.
12---------- Bienville	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed------	Too sandy, piping.	Droughty, erodes easily.
13---------- Bowie	Moderate: seepage.	Moderate: low strength, piping.	Severe: deep to water.	Complex slope---	Favorable-------	Favorable.
14---------- Briley	Moderate: seepage.	Moderate: piping, low strength.	Severe: no water.	Not needed------	Too sandy, piping, slope.	Droughty, erodes easily, slope.
15---------- Chireno	Slight---------	Moderate: compressible, hard to pack.	Severe: no water, slow refill.	Not needed------	Percs slowly----	Percs slowly.
16, 17---------- Cuthbert	Moderate: seepage, depth to rock.	Moderate: low strength, compressible.	Severe: no water.	Slope----------	Slope, erodes easily.	Slope, erodes easily.
18---------- Cuthbert	Moderate: seepage, depth to rock.	Moderate: large stones, thin layer.	Severe: no water.	Not needed------	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.
19---------- Darco	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed------	Piping, erodes easily.	Droughty, erodes easily.
20---------- Darco	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed------	Slope, piping, erodes easily.	Droughty, erodes easily.
21*: Darco----------	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed------	Piping, erodes easily.	Droughty, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
21*: Urban land.						
22*: Darco	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed	Slope, piping, erodes easily.	Droughty, erodes easily.
Urban land.						
23, 24---- Etoile	Slight	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Percs slowly, erodes easily, slope.	Percs slowly, erodes easily.
25---- Hannahatchee	Moderate: seepage.	Moderate: piping.	Slight	Floods	Not needed	Not needed.
26*: Hannahatchee	Moderate: seepage.	Moderate: piping.	Slight	Floods	Not needed	Not needed.
Urban land.						
27---- Iuka	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Floods, wetness.	Not needed	Not needed.
28, 29---- Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed	Complex slope, erodes easily.	Favorable.
30*: Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed	Complex slope, erodes easily.	Favorable.
Urban land.						
31*---- Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed	Complex slope, erodes easily.	Favorable.
32---- Kullit	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Moderate: deep to water, slow refill.	Percs slowly	Percs slowly	Percs slowly.
33, 34---- Lacerda	Slight	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Percs slowly, slope, wetness.	Percs slowly, slope.
35---- Lilbert	Moderate: seepage.	Moderate: piping, low strength.	Severe: no water.	Not needed	Too sandy, piping.	Droughty, erodes easily.
36*: Lilbert	Moderate: seepage.	Moderate: piping, low strength.	Severe: no water.	Not needed	Too sandy, piping.	Droughty, erodes easily.
Urban land.						
37*---- Mantachie	Moderate: seepage.	Moderate: piping.	Severe: no water.	Wetness, floods.	Wetness	Wetness.
38*---- Marietta	Moderate: seepage.	Moderate: compressible, piping.	Moderate: deep to water.	Floods, wetness.	Wetness	Wetness.
39---- Mollville	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Floods	Not needed	Not needed.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
40*:						
Mollville	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Floods	Not needed	Not needed.
Besner	Moderate: seepage.	Moderate: piping, unstable fill, compressible.	Severe: no water.	Not needed	Slope	Favorable.
41--- Naclina	Slight	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
42, 43, 44, 45, 46--- Nacogdoches	Moderate: seepage.	Severe: hard to pack.	Severe: no water.	Not needed	Favorable	Favorable.
47*:						
Nacogdoches	Moderate: seepage.	Severe: hard to pack.	Severe: no water.	Not needed	Favorable	Favorable.
Urban land.						
48--- Osier	Severe: seepage.	Severe: seepage, unstable fill.	Moderate: deep to water.	Floods, cutbanks cave.	Not needed	Not needed.
49*:						
Osier	Severe: seepage.	Severe: seepage, unstable fill.	Moderate: deep to water.	Floods, cutbanks cave.	Not needed	Not needed.
Urban land.						
50--- Percilla	Slight	Moderate: compressible.	Severe: slow refill.	Floods, percs slowly.	Not needed	Wetness, percs slowly.
51*. Pits						
52--- Rentzel	Moderate: seepage.	Moderate: piping.	Severe: no water.	Cutbanks cave	Too sandy, piping.	Erodes easily.
53*:						
Rentzel	Moderate: seepage.	Moderate: piping.	Severe: no water.	Cutbanks cave	Too sandy, piping.	Erodes easily.
Urban land.						
54--- Ruston	Moderate: seepage.	Slight	Severe: no water.	Not needed	Favorable	Favorable.
55, 56--- Sacul	Slight	Moderate: compressible, low strength.	Severe: no water.	Not needed	Slope, erodes easily, percs slowly.	Erodes easily, percs slowly, slope.
57--- Tenaha	Moderate: seepage.	Moderate: piping.	Severe: no water.	Not needed	Erodes easily, slope.	Droughty, slope.
58*:						
Tenaha	Moderate: seepage.	Moderate: piping.	Severe: no water.	Not needed	Erodes easily, slope.	Droughty, slope.
Urban land.						
59, 60--- Tonkawa	Severe: seepage.	Severe: seepage, unstable fill, piping.	Severe: no water.	Not needed	Slope, droughty.	Slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
61, 62, 63-------- Trawick	Moderate: seepage.	Moderate: low strength, unstable fill, thin layer.	Severe: no water.	Not needed------	Erodes easily---	Erodes easily.
64*: Trawick----------	Slight---------	Severe: large stones, hard to pack.	Severe: no water.	Not needed------	Slope, large stones.	Slope, large stones, erodes easily.
Bub----------	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Not needed------	Erodes easily, rooting depth, slope.	Erodes easily, rooting depth, slope.
65*: Trawick----------	Moderate: seepage.	Moderate: low strength, unstable fill, thin layer.	Severe: no water.	Not needed------	Erodes easily---	Erodes easily.
Urban land.						
66---------- Tuscosso	Moderate: seepage.	Moderate: compressible.	Severe: slow refill.	Floods----------	Not needed------	Not needed.
67---------- Woden	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Not needed------	Favorable-------	Favorable.
68, 69---------- Woodtell	Slight---------	Moderate: unstable fill, compressible, hard to pack.	Severe: slow refill.	Percs slowly, slope.	Slope, erodes easily, wetness.	Percs slowly, slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
2 Alto	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
3, 4 Alto	Moderate: too clayey, percs slowly, wetness.	Moderate: wetness, too clayey.	Moderate: too clayey, percs slowly, wetness.	Moderate: too clayey.
5* Angelina	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
6 Attoyac	Slight	Slight	Moderate: slope.	Slight.
7 Attoyac	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
8*: Attoyac	Slight	Slight	Moderate: slope.	Slight.
Urban land.				
9 Bernaldo	Slight	Slight	Moderate: slope.	Slight.
10*: Bernaldo	Slight	Slight	Moderate: slope.	Slight.
Besner	Slight	Slight	Moderate: slope.	Slight.
11 Betis	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
12 Bienville	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
13 Bowie	Slight	Slight	Moderate: slope.	Slight.
14 Briley	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
15 Chireno	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
16, 17 Cuthbert	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
18 Cuthbert	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Moderate: slope, large stones.
19 Darco	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
20--- Darco	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
21*: Darco---	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Urban land.				
22*: Darco---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.
Urban land.				
23--- Etoile	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness.	Severe: wetness.
24--- Etoile	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness, slope.	Severe: wetness.
25--- Hannahatchee	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
26*: Hannahatchee---	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Urban land.				
27--- Iuka	Moderate: wetness.	Moderate: wetness, floods.	Moderate: wetness, floods.	Slight.
28--- Kirvin	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Slight.
29--- Kirvin	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
30*: Kirvin---	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Slight.
Urban land.				
31*--- Kirvin	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
32--- Kullit	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Slight.
33--- Lacerda	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
34--- Lacerda	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, percs slowly, slope.	Severe: wetness.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
35--- Lilbert	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
36*: Lilbert---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Urban land.				
37*--- Mantachie	Severe: floods.	Moderate: wetness.	Severe: floods.	Moderate: wetness.
38*--- Marietta	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
39--- Mollville	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
40*: Mollville---	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Besner---	Slight---	Slight---	Slight---	Slight.
41--- Naclina	Severe: percs slowly, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness, slope.	Severe: too clayey, wetness.
42--- Nacogdoches	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Slight.
43--- Nacogdoches	Moderate: percs slowly, small stones.	Slight---	Moderate: percs slowly.	Slight.
44, 45--- Nacogdoches	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Moderate: too clayey.
46--- Nacogdoches	Moderate: percs slowly, small stones.	Slight---	Moderate: percs slowly.	Moderate: too clayey.
47*: Nacogdoches---	Moderate: percs slowly.	Slight---	Moderate: percs slowly.	Slight.
Urban land.				
48--- Osier	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
49*: Osier---	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Urban land.				
50--- Percilla	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
51*. Pits				
52---------- Rentzel	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
53*: Rentzel----------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Urban land.				
54---------- Ruston	Slight----------	Slight----------	Moderate: slope.	Slight.
55---------- Sacul	Moderate: percs slowly.	Slight----------	Moderate: slope, percs slowly.	Slight.
56---------- Sacul	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
57---------- Tenaha	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
58*: Tenaha----------	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Urban land.				
59---------- Tonkawa	Severe: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
60---------- Tonkawa	Severe: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
61---------- Trawick	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	Slight.
62---------- Trawick	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	
63---------- Trawick	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	Moderate: too clayey.
64*: Trawick----------	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Moderate: large stones, slope.
Bub----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: too clayey.
65*: Trawick----------	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Urban land.				
66---------- Tuscosso	Severe: floods.	Moderate: floods, wetness, too clayey.	Severe: floods.	Moderate: floods.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
67--Woden	Slight	Slight	Moderate: slope.	Slight.
68--Woodtell	Severe: slope, percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight.
69--Woodtell	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
2, 3, 4---------- Alto	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
5*---------- Angelina	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
6---------- Attoyac	Good	Good	Good	---	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
7---------- Attoyac	Fair	Good	Good	---	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
8*: Attoyac----------	Good	Good	Good	---	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Urban land.												
9---------- Bernaldo	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
10*: Bernaldo----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Besner----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
11---------- Betis	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
12---------- Bienville	Fair	Fair	Fair	---	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
13---------- Bowie	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
14---------- Briley	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
15---------- Chireno	Good	Good	Good	Good	---	---	Poor	Poor	Good	Good	Poor	---
16, 17---------- Cuthbert	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
18---------- Cuthbert	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.	---
19---------- Darco	Poor	Fair	Good	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.	---
20---------- Darco	Very poor.	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
21*: Darco----------	Poor	Fair	Good	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.	---
Urban land.												

See footnote at end of table.

TABLE 15.--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
22*:												
Darco	Very poor.	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Urban land.												
23, 24 Etoile	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
25 Hannahatchee	Poor	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
26*:												
Hannahatchee	Poor	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
Urban land.												
27 Iuka	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
28 Kirvin	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
29 Kirvin	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
30*:												
Kirvin	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Urban land.												
31* Kirvin	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
32 Kullit	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
33 Lacerda	Fair	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair	---
34 Lacerda	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
35 Lilbert	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
36*:												
Lilbert	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
Urban land.												
37* Mantachie	Poor	Fair	Fair	Good	---	---	Fair	Fair	Fair	Good	Fair	---
38* Marietta	Poor	Fair	Fair	Good	---	---	Poor	Poor	Fair	Good	Poor	---
39 Mollville	Poor	Fair	Fair	Fair	Poor	---	Good	Good	Fair	Fair	Good	---
40*:												
Mollville	Poor	Fair	Fair	Fair	Poor	---	Good	Good	Fair	Fair	Good	---
Besner	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---

See footnote at end of table.

TABLE 15.--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
41---------- Naclina	Fair	Fair	Fair	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
42, 43, 44, 45, 46- Nacogdoches	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
47*: Nacogdoches------- Urban land.	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
48---------- Osier	Very poor.	Poor	Fair	Fair	Fair	---	Fair	Good	Poor	Fair	Fair	---
49*: Osier---------- Urban land.	Very poor.	Poor	Fair	Fair	Fair	---	Fair	Good	Poor	Fair	Fair	---
50---------- Percilla	Poor	Fair	Fair	Fair	---	---	Good	Good	Fair	Fair	Good	---
51*. Pits												
52---------- Rentzel	Poor	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	Fair	---
53*: Rentzel---------- Urban land.	Poor	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	Fair	---
54---------- Ruston	Good	Good	Good	---	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
55---------- Sacul	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
56---------- Sacul	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
57---------- Tenaha	Poor	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
58*: Tenaha---------- Urban land.	Poor	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
59, 60---------- Tonkawa	Poor	Poor	Fair	Poor	---	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
61, 62, 63--------- Trawick	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
64*: Trawick---------- Bub----------	Poor Poor	Fair Poor	Good Fair	Good Fair	Good Fair	--- ---	Very poor. Very poor.	Very poor. Very poor.	Fair Poor	Good Fair	Very poor. Very poor.	--- Very poor.

See footnote at end of table.

TABLE 15.--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
65*: Trawick	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Urban land.												
66--- Tuscosso	Poor	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
67--- Woden	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
68--- Woodtell	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Poor	---
69--- Woodtell	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
2---------- Alto	0-9	Fine sandy loam	SM-SC, SC	A-2-4, A-4	0	95-100	90-95	80-90	30-50	15-26	4-10
	9-72	Clay, clay loam	CL, SC, CH	A-6, A-7	0	95-100	85-95	80-90	45-65	30-55	15-30
3, 4---------- Alto	0-8	Clay loam-------	CL	A-4, A-6	0	95-100	90-95	80-90	51-80	27-40	7-18
	8-73	Clay, clay loam	CL, SC, CH	A-6, A-7	0	95-100	85-95	80-90	45-65	30-55	15-30
5*---------- Angelina	0-4	Sandy clay loam	SC, CL	A-6	0	100	100	80-100	36-55	26-40	11-20
	4-60	Sandy clay loam, clay loam, loam.	CL	A-6	0	100	100	80-100	55-70	26-40	11-20
6, 7---------- Attoyac	0-9	Fine sandy loam	SM-SC, CL-ML, ML, SM	A-4	0	98-100	90-100	70-100	40-65	<23	NP-7
	9-75	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-4, A-6	0	98-100	90-100	80-100	45-75	23-40	7-22
8*:											
Attoyac----------	0-10	Fine sandy loam	SM-SC, CL-ML, ML, SM	A-4	0	98-100	90-100	70-100	40-65	<23	NP-7
	10-75	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-4, A-6	0	98-100	90-100	80-100	45-75	23-40	7-22
Urban land.											
9---------- Bernaldo	0-14	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-65	<25	NP-5
	14-47	Loam, sandy clay loam.	CL	A-6	0	100	100	90-100	51-75	28-40	12-22
	47-80	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	95-100	90-100	45-65	25-40	8-22
10*:											
Bernaldo----------	0-14	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-65	<25	NP-5
	14-47	Loam, sandy clay loam.	CL	A-6	0	100	100	90-100	51-75	28-40	12-22
	47-80	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	95-100	90-100	45-65	25-40	8-22
Besner----------	0-38	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-70	<25	NP-7
	38-80	Loam----------	CL-ML, CL	A-4	0	100	95-100	90-100	55-80	18-30	4-10
11---------- Betis	0-37	Loamy fine sand	SM	A-2	0	100	97-100	90-100	10-35	---	NP
	37-80	Loamy fine sand, fine sandy loam.	SM	A-2, A-4	0	100	97-100	90-100	25-50	---	NP
12---------- Bienville	0-25	Loamy fine sand	SM	A-2-4, A-4	0	100	100	90-100	24-50	<23	NP-3
	25-72	Loamy fine sand, fine sandy loam.	SM, ML	A-2-4, A-4	0	100	100	90-100	24-55	<23	NP-3

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13---------- Bowie	0-7	Fine sandy loam	SM, SM-SC, ML	A-2-4, A-4	0	98-100	98-100	95-100	35-55	<25	NP-6
	7-42	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	90-100	90-100	85-100	40-55	20-40	8-22
	42-72	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	80-100	70-100	65-100	36-65	20-40	8-20
14---------- Briley	0-23	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-98	17-45	<25	NP-4
	23-72	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	95-100	95-100	85-98	36-55	22-39	8-22
15---------- Chireno	0-18	Clay loam, clay	CH, CL	A-7, A-6	0	99-100	90-100	90-97	51-85	37-60	17-35
	18-62	Clay loam, clay	CH, CL	A-7, A-6	0	95-100	75-95	65-95	51-80	37-60	17-35
16---------- Cuthbert	0-8	Fine sandy loam	SM, SM-SC, ML	A-4	0-1	75-100	75-100	65-100	36-60	<30	NP-7
	8-29	Clay----------	CH, MH, CL, ML	A-7	0	90-100	85-100	85-100	51-98	45-63	20-40
	29-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
17---------- Cuthbert	0-6	Gravelly fine sandy loam.	GM, SM, SM-SC, GM-GC	A-1, A-2	2-5	55-75	40-75	40-65	20-35	<25	NP-4
	6-31	Clay----------	CH, MH, CL, ML	A-7	0	90-100	85-100	85-100	51-98	45-60	20-40
	31-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
18---------- Cuthbert	0-5	Stony fine sandy loam.	SM, SM-SC	A-4, A-2	10-40	15-90	60-85	40-60	20-45	<30	NP-7
	5-28	Clay----------	CH, MH, CL, ML	A-7	0-5	80-95	80-95	65-90	51-85	45-65	20-40
	28-60	Stratified sandy loam to weathered bedrock.	SM, SC, SM-SC, CL	A-6, A-2, A-4	0-5	80-95	80-90	60-85	30-70	18-40	3-20
19, 20---------- Darco	0-48	Loamy fine sand	SM	A-2	0-5	95-100	95-100	60-90	15-30	<20	NP-3
	48-80	Sandy clay loam	SC, CL	A-6, A-7-6	0	100	95-100	80-95	36-55	25-45	11-30
21*, 22*: Darco----------	0-48	Loamy fine sand	SM	A-2	0-5	95-100	95-100	60-90	15-30	<20	NP-3
	48-80	Sandy clay loam	SC, CL	A-6, A-7-6	0	100	95-100	80-95	36-55	25-45	11-30
Urban land.											
23, 24---------- Etoile	0-8	Loam----------	CL-ML, ML	A-4	0	98-100	98-100	85-95	51-85	<30	NP-7
	8-41	Clay----------	CH	A-7-6	0	98-100	98-100	80-100	75-98	51-76	35-50
	41-60	Clay----------	CH	A-7-6	0	98-100	98-100	80-100	75-98	51-76	35-50
25---------- Hannahatchee	0-21	Loam----------	SM-SC, SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	45-75	20-35	5-15
	21-65	Stratified fine sandy loam to sandy clay loam.	SC, SM-SC, CL-ML, CL	A-2-4, A-4, A-6	0-3	95-100	85-95	60-95	30-75	20-35	4-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26*:											
Hannahatchee	0-6	Loam	SM-SC, SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	45-75	20-35	5-15
	6-65	Stratified fine sandy loam to sandy clay loam.	SC, SM-SC, CL-ML, CL	A-2-4, A-4, A-6	0-3	95-100	85-95	60-95	30-75	20-35	4-15
Urban land.											
27	0-12	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	70-95	45-75	<30	NP-7
Iuka	12-60	Sandy loam, fine sandy loam, loam.	SM, ML	A-2, A-4	0	95-100	90-100	70-100	25-55	<30	NP-5
28	0-12	Fine sandy loam	SM, SM-SC	A-4	0-2	75-100	75-95	65-90	36-50	<25	NP-4
Kirvin	12-38	Clay, clay loam	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	38-52	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	52-62	Weathered bedrock.	---	---	---	---	---	---	---	---	---
29	0-13	Gravelly fine sandy loam.	GM, SM, GM-GC, SM-SC	A-1, A-2	0-5	55-75	40-75	40-65	20-35	<25	NP-4
Kirvin	13-41	Clay, clay loam	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	41-47	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	47-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
30*:											
Kirvin	0-7	Fine sandy loam	SM, SM-SC	A-4	0-2	75-100	75-95	65-90	36-50	<25	NP-4
	7-33	Clay, clay loam	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	33-50	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	50-62	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
31*	0-3	Gravelly fine sandy loam.	GM, SM, GM-GC, SM-SC	A-1, A-2	0-5	55-75	40-75	40-65	20-35	<25	NP-4
Kirvin	3-35	Clay, clay loam	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	35-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
32	0-7	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	100	90-100	40-65	<30	NP-9
Kullit	7-21	Loam, sandy clay loam, clay loam.	CL	A-4, A-6	0	100	98-100	90-100	55-85	25-40	8-18
	21-65	Clay	CL, CH	A-7	0	100	98-100	85-95	55-90	44-53	20-27

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
33, 34---------- Lacerda	0-2	Clay loam-------	CL	A-6, A-7	0	98-100	96-100	95-100	80-98	30-50	15-30
	2-57	Silty clay, clay	CH	A-7	0	98-100	96-100	95-100	85-98	51-70	30-46
	57-72	Clay------------	CH	A-7	0	100	100	95-100	80-98	51-70	30-46
35---------- Lilbert	0-28	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-98	17-40	<25	NP-4
	28-58	Sandy clay loam	SC, CL	A-6, A-4	0	95-100	95-100	85-98	36-55	25-39	8-20
	58-72	Sandy clay loam	SC, CL	A-6, A-4	0	90-100	90-100	85-98	36-55	25-39	8-20
36*:											
Lilbert----------	0-33	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-98	17-40	<25	NP-4
	33-50	Sandy clay loam	SC, CL	A-6, A-4	0	95-100	95-100	85-98	36-55	25-39	8-20
	50-72	Sandy clay loam	SC, CL	A-6, A-4	0	90-100	90-100	85-98	36-55	25-39	8-20
Urban land.											
37*---------- Mantachie	0-60	Loam, clay loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0-5	95-100	90-100	80-95	45-80	20-40	5-15
38*---------- Marietta	0-12	Fine sandy loam	ML, CL, SM	A-4	0	100	100	80-95	40-75	20-30	5-10
	12-60	Clay loam, sandy clay loam, loam.	CL, SC	A-6, A-4	0	100	100	85-100	45-90	25-40	8-20
39---------- Mollville	0-14	Loam------------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-95	60-80	25-40	5-15
	14-65	Clay loam-------	CL	A-6	0	100	100	90-100	70-80	30-40	11-20
40*:											
Mollville---------	0-12	Loam------------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-95	60-80	25-40	5-15
	12-65	Clay loam-------	CL	A-6	0	100	100	90-100	70-80	30-40	11-20
Besner----------	0-38	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-70	<25	NP-7
	38-80	Loam------------	CL-ML, CL	A-4	0	100	95-100	90-100	55-80	18-30	4-10
41---------- Naclina	0-14	Clay------------	CH	A-7-6	0	98-100	96-100	95-100	85-98	51-70	26-40
	14-46	Clay, silty clay	CH	A-7-6	0	98-100	96-100	95-100	85-98	58-76	35-50
	46-65	Clay------------	CH	A-7-6	0	98-100	96-100	95-100	80-98	58-76	35-50
42---------- Nacogdoches	0-6	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	90-100	83-100	68-95	25-45	20-30	2-10
	6-70	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30
	70-80	Clay loam, clay	CL, CH, MH, ML	A-7	0	90-100	75-98	70-95	51-70	41-60	17-28
43---------- Nacogdoches	0-5	Gravelly fine sandy loam.	SM, SM-SC	A-2-4, A-4	1-5	70-80	65-80	60-70	20-40	20-30	2-7
	5-72	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30
44---------- Nacogdoches	0-5	Clay loam-------	SC, CL-ML, CL, SM-SC	A-4, A-6	0	90-100	85-100	65-95	36-65	25-35	6-12
	5-72	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
45---------- Nacogdoches	0-1	Clay loam-------	SC, CL-ML, CL, SM-SC	A-4, A-6	0	90-100	85-100	65-95	36-65	25-35	6-12
	1-72	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30
46---------- Nacogdoches	0-4	Gravelly clay loam.	SM, SM-SC	A-2-4, A-4	1-5	70-80	65-80	60-70	20-40	20-30	2-7
	4-72	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30
47*: Nacogdoches-------	0-6	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	90-100	85-100	80-95	25-45	20-30	2-10
	6-80	Clay------------	CL, CH, MH	A-7	0	90-100	75-98	70-95	51-75	41-60	18-30
Urban land.											
48---------- Osier	0-80	Fine sand-------	SP-SM	A-2, A-3	0	100	98-100	60-85	5-12	---	NP
49*: Osier----------	0-80	Fine sand-------	SP-SM	A-2, A-3	0	100	98-100	60-85	5-12	---	NP
Urban land.											
50---------- Percilla	0-4	Clay loam-------	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	55-90	15-35	4-14
	4-65	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	90-100	65-95	35-60	17-35
51*. Pits											
52---------- Rentzel	0-29	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	75-98	15-40	<25	NP-4
	29-75	Sandy clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0	95-100	90-100	75-98	36-55	20-39	4-20
53*: Rentzel----------	0-29	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	75-98	15-40	<25	NP-4
	29-75	Sandy clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0	95-100	90-100	75-98	36-55	20-39	4-20
Urban land.											
54---------- Ruston	0-10	Fine sandy loam	SM, ML	A-4, A-2-4	0	85-100	78-100	65-100	30-75	<20	NP-3
	10-72	Sandy clay loam,	SC, CL	A-6	0	85-100	78-100	70-100	36-75	30-40	11-18
55, 56---------- Sacul	0-7	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<21	NP-3
	7-53	Clay, silty clay	CH, MH, CL	A-7	0	95-100	90-100	85-95	55-90	45-76	20-48
	53-72	Clay loam-------	CL, CH, ML, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
57---------- Tenaha	0-22	Loamy fine sand	SM	A-2-4	0	95-100	95-100	70-85	15-34	---	NP
	22-46	Sandy clay loam	SC, CL	A-6, A-4	0	95-100	95-100	80-90	36-55	25-35	8-15
	46-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
58*:											
Tenaha	0-30	Loamy fine sand	SM	A-2-4	0	95-100	95-100	70-85	15-34	---	NP
	30-45	Sandy clay loam	SC, CL	A-6, A-4	0	95-100	95-100	80-90	36-55	25-35	8-15
	45-55	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
59, 60 Tonkawa	0-84	Fine sand	SP-SM	A-3, A-2	0	100	97-100	90-100	6-12	<25	NP-3
61 Trawick	0-6	Fine sandy loam	SC, CL-ML, CL, SM-SC	A-2-4, A-4	0	90-100	90-100	85-95	25-55	20-30	4-10
	6-46	Clay, clay loam	CL, CH, MH	A-7	0	90-100	75-98	70-85	51-75	41-60	18-30
	46-92	Weathered bedrock.	---	---	---	---	---	---	---	---	---
62 Trawick	0-7	Gravelly fine sandy loam.	SM, SM-SC	A-2-4, A-4	1-5	70-80	65-80	60-70	20-40	20-30	2-7
	7-50	Clay, clay loam	CL, CH, MH	A-7	0	90-100	75-98	70-85	51-75	41-60	18-30
	50-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
63 Trawick	0-4	Clay loam	SC, CL-ML, CL, SM-SC	A-2-4, A-4	0	90-100	90-100	85-95	25-55	20-30	4-10
	4-45	Clay, clay loam	CL, CH, MH	A-7	0	90-100	75-98	70-85	51-75	41-60	18-30
	45-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
64*:											
Trawick	0-4	Gravelly clay loam.	SC, CL-ML, CL, SM-SC	A-4, A-2	10-40	70-90	60-90	50-80	25-55	20-30	4-10
	4-42	Clay, clay loam	CL, CH, MH	A-7	0-5	85-95	80-95	65-85	51-85	41-60	18-30
	42-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Bub	0-4	Gravelly clay loam.	GC, SC, CL	A-2, A-6, A-4	1-10	35-85	35-85	30-80	30-65	25-40	8-18
	4-14	Clay, gravelly clay.	CH, GC, CL, SC	A-7	1-5	50-85	50-85	45-85	36-75	41-60	20-35
	14-32	Weathered bedrock.	---	---	---	---	---	---	---	---	---
65*:											
Trawick	0-5	Clay loam	SC, CL-ML, CL, SM-SC	A-2-4, A-4	0	90-100	90-100	85-95	25-55	20-30	4-10
	5-45	Clay, clay loam	CL, CH, MH	A-7	0	90-100	75-98	70-85	51-75	41-60	18-30
	45-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
66---------- Tuscosso	0-15	Clay loam-------	CL	A-6, A-7	0	100	97-100	85-100	70-95	35-50	15-25
	15-53	Clay loam, clay, silty clay.	CL, CH, MH	A-7	0	100	97-100	85-100	75-98	41-60	18-30
	53-72	Clay loam, clay, silty clay.	CL, CH, MH	A-7	0	100	97-100	85-100	75-98	41-60	18-30
67---------- Woden	0-11	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	98-100	98-100	70-85	40-65	<23	NP-7
	11-96	Fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4	0	98-100	98-100	70-85	40-65	<23	NP-7
68, 69---------- Woodtell	0-6	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-95	30-60	<25	NP-7
	6-56	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	56-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--(T)" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factor	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
2----------	0-9	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	Moderate	Low------	0.32	5
Alto	9-72	0.2-0.6	0.12-0.18	5.1-7.3	<2	Moderate	High-----	Moderate	0.32	
3, 4----------	0-8	0.6-2.0	0.15-0.20	5.6-7.3	<2	Moderate	High-----	Moderate	0.32	5
Alto	8-73	0.2-0.6	0.12-0.18	5.1-7.3	<2	Moderate	High-----	Moderate	0.32	
5*----------	0-4	0.06-0.2	0.12-0.17	4.5-5.5	<2	Low-------	High-----	High-----	0.28	5
Angelina	4-60	0.06-0.2	0.12-0.17	4.5-5.5	<2	Low-------	High-----	High-----	0.28	
6, 7----------	0-9	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low-------	Low------	Moderate	0.24	5
Attoyac	9-75	0.6-2.0	0.12-0.17	5.1-6.5	<2	Low-------	Moderate	Moderate	0.32	
8*:										
Attoyac----------	0-10	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low-------	Low------	Moderate	0.24	5
	10-75	0.6-2.0	0.12-0.17	5.1-6.5	<2	Low-------	Moderate	Moderate	0.32	
Urban land.										
9----------	0-14	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low-------	Low------	Moderate	0.43	5
Bernaldo	14-47	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate	Moderate	Moderate	0.32	
	47-65	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low-------	Moderate	Moderate	0.32	
10*:										
Bernaldo----------	0-14	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low-------	Low------	Moderate	0.43	5
	14-47	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate	Moderate	Moderate	0.32	
	47-80	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low-------	Moderate	Moderate	0.32	
Besner----------	0-38	2.0-6.0	0.11-0.15	4.5-6.5	<2	Low-------	Low------	Moderate	0.24	5
	38-80	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low-------	Low------	Moderate	0.32	
11----------	0-37	6.0-20	0.05-0.09	4.5-6.0	<2	Low-------	Low------	Moderate	0.17	5
Betis	37-80	6.0-20	0.08-0.11	4.5-6.0	<2	Low-------	Low------	Moderate	0.17	
12----------	0-25	2.0-6.0	0.08-0.11	4.5-6.5	<2	Low-------	Low------	Moderate	0.20	5
Bienville	25-72	2.0-6.0	0.08-0.13	4.5-6.0	<2	Low-------	Low------	Moderate	0.20	
13----------	0-7	2.0-6.0	0.10-0.15	5.1-6.5	<2	Low-------	Low------	Moderate	0.32	5
Bowie	7-42	0.6-2.0	0.15-0.20	4.5-5.5	<2	Low-------	Moderate	High-----	0.32	
	42-72	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low-------	Moderate	High-----	0.28	
14----------	0-23	6.0-20	0.07-0.11	4.5-6.5	<2	Low-------	Low------	High-----	0.20	5
Briley	23-72	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low-------	Moderate	High-----	0.24	
15----------	0-18	0.2-0.6	0.15-0.18	5.6-7.8	<2	High------	High-----	Low------	0.32	5
Chireno	18-62	0.06-0.2	0.13-0.16	5.6-7.8	<2	High------	High-----	Low------	0.32	
16----------	0-8	2.0-6.0	0.11-0.15	4.5-6.5	<2	Low-------	Low------	High-----	0.32	3
Cuthbert	8-29	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High-----	High-----	0.32	
	29-60	---	---	---	---	---	---	---	---	
17----------	0-6	2.0-6.0	0.10-0.14	4.5-6.5	<2	Low-------	Low------	High-----	0.24	3
Cuthbert	6-31	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High-----	High-----	0.32	
	31-80	---	---	---	---	---	---	---	---	
18----------	0-5	2.0-6.0	0.08-0.12	4.5-6.5	<2	Low-------	Low------	High-----	0.24	3
Cuthbert	5-28	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High-----	High-----	0.32	
	28-60	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	High-----	High-----	0.32	
19, 20----------	0-48	6.0-20	0.07-0.11	4.5-6.5	<2	Low-------	Low------	Moderate	0.17	5
Darco	48-80	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low-------	Moderate	High-----	0.24	

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factor	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
21*, 22*:										
Darco	0-48	6.0-20	0.07-0.11	4.5-6.5	<2	Low	Low	Moderate	0.17	5
	48-80	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	Moderate	High	0.24	
Urban land.										
23, 24	0-8	0.6-2.0	0.13-0.20	5.1-7.3	<2	Low	Moderate	Moderate	0.43	5
Etoile	8-41	<0.06	0.12-0.18	4.5-7.3	<2	High	High	Moderate	0.32	
	41-60	<0.06	0.12-0.15	7.4-8.4	<2	High	High	Low	0.32	
25	0-6	0.6-2.0	0.12-0.20	5.6-7.3	<2	Moderate	Moderate	Moderate	0.28	5
Hannahatchee	6-65	0.6-2.0	0.12-0.20	5.6-7.3	<2	Moderate	Moderate	Moderate	0.28	
26*:										
Hannahatchee	0-21	0.6-2.0	0.12-0.20	5.6-7.3	<2	Moderate	Moderate	Moderate	0.28	5
	21-65	0.6-2.0	0.12-0.20	5.6-7.3	<2	Moderate	Moderate	Moderate	0.28	
Urban land.										
27	0-12	0.6-2.0	0.10-0.15	5.1-6.0	<2	Low	Moderate	Moderate	0.24	---
Iuka	12-60	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low	Moderate	High	0.20	
28	0-12	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	Low	Moderate	0.37	4
Kirvin	12-38	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High	High	0.32	
	38-52	0.6-2.0	0.12-0.17	3.6-5.5	<2	Moderate	Moderate	High	0.32	
	52-62	---	---	---	---	---	---	---	---	
29	0-13	2.0-6.0	0.06-0.08	5.1-7.3	<2	Low	Low	Moderate	0.28	4
Kirvin	13-41	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High	High	0.32	
	41-47	0.6-2.0	0.12-0.17	3.6-5.5	<2	Moderate	Moderate	High	0.32	
	47-60	---	---	---	---	---	---	---	---	
30*:										
Kirvin	0-7	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	Low	Moderate	0.37	4
	7-33	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High	High	0.32	
	33-50	0.6-2.0	0.12-0.17	3.6-5.5	<2	Moderate	Moderate	High	0.32	
	50-62	---	---	---	---	---	---	---	---	
Urban land.										
31*	0-3	2.0-6.0	0.06-0.08	5.1-7.3	<2	Low	Low	Moderate	0.28	4
Kirvin	3-35	0.2-0.6	0.12-0.18	3.6-5.5	<2	Moderate	High	High	0.32	
	35-65	---	---	---	---	---	---	---	---	
32	0-7	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	Moderate	High	0.37	5
Kullit	7-21	0.6-2.0	0.11-0.15	4.5-5.5	<2	Low	High	High	0.37	
	21-65	0.2-0.6	0.11-0.15	4.5-5.0	<2	Moderate	High	High	0.28	
33, 34	0-2	0.06-0.2	0.14-0.20	4.5-6.0	<2	High	Moderate	Moderate	0.32	5
Lacerda	2-57	<0.06	0.12-0.18	4.5-7.3	<2	High	High	Moderate	0.32	
	57-72	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Low	0.32	
35	0-28	6.0-20	0.07-0.11	4.5-6.5	<2	Low	Low	High	0.20	5
Lilbert	28-58	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low	Moderate	High	0.24	
	58-72	0.2-0.6	0.10-0.15	4.5-6.0	<2	Low	Moderate	High	0.24	
36*:										
Lilbert	0-33	6.0-20	0.07-0.11	4.5-6.5	<2	Low	Low	High	0.20	5
	33-50	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low	Moderate	High	0.24	
	50-72	0.2-0.6	0.10-0.15	4.5-6.0	<2	Low	Moderate	High	0.24	
Urban land.										
37*	0-60	0.6-2.0	0.14-0.20	4.5-5.5	<2	Low	High	High	28	---
Mantachie										

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factor	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
38* Marietta	0-12 12-60	0.6-2.0 0.6-2.0	0.14-0.18 0.14-0.20	5.6-7.8 5.6-7.8	<2 <2	Low Low	Moderate Moderate	Low Low	0.28 0.28	5
39 Mollville	0-14 14-65	0.2-0.6 0.06-0.2	0.15-0.20 0.15-0.20	4.5-6.0 5.1-7.8	<2 <2	Low Moderate	High High	High Moderate	0.32 0.32	5
40*: Mollville	0-12 12-65	0.2-0.6 0.06-0.2	0.15-0.20 0.15-0.20	4.5-6.0 5.1-7.8	<2 <2	Low Moderate	High High	High Moderate	0.32 0.32	5
Besner	0-38 38-80	2.0-6.0 0.6-2.0	0.11-0.15 0.15-0.20	4.5-6.5 4.5-6.5	<2 <2	Low Low	Low Low	Moderate Moderate	0.24 0.32	5
41 Naclina	0-14 14-46 46-65	<0.06 <0.06 <0.06	0.12-0.18 0.12-0.18 0.12-0.18	5.1-7.3 5.1-8.4 6.6-8.4	<2 <2 <2	High High High	High High High	Moderate Low Low	0.32 0.32 0.32	5
42 Nacogdoches	0-6 6-70 70-80	0.6-2.0 0.2-0.6 0.2-0.6	0.11-0.15 0.12-0.18 0.12-0.18	5.1-6.5 4.5-5.5 5.1-7.8	<2 <2 <2	Low Moderate Moderate	Moderate High High	Moderate High Moderate	0.32 0.32 0.32	5
43 Nacogdoches	0-5 5-72	0.6-2.0 0.2-0.6	0.08-0.12 0.12-0.18	5.1-6.5 4.5-5.5	<2 <2	Low Moderate	Moderate High	Moderate High	0.32 0.32	5
44 Nacogdoches	0-5 5-72	0.6-2.0 0.2-0.6	0.12-0.17 0.12-0.18	5.1-6.5 4.5-5.5	<2 <2	Low Moderate	Moderate High	Moderate High	0.32 0.32	5
45 Nacogdoches	0-1 1-72	0.6-2.0 0.2-0.6	0.12-0.17 0.12-0.18	5.1-6.5 4.5-5.5	<2 <2	Low Moderate	Moderate High	Moderate High	0.32 0.32	5
46 Nacogdoches	0-4 4-72	0.6-2.0 0.2-0.6	0.08-0.12 0.12-0.18	5.1-6.5 4.5-5.5	<2 <2	Low Moderate	Moderate High	Moderate High	0.32 0.32	5
47*: Nacogdoches	0-6 6-80	0.6-2.0 0.2-0.6	0.11-0.15 0.12-0.18	5.1-6.5 4.5-5.5	<2 <2	Low Moderate	Moderate High	Moderate High	0.32 0.32	5
Urban land.										
48	0-80	6.0-20	0.03-0.10	4.5-6.0	<2	Low	High	High	---	---
49*: Osier	0-80	6.0-20	0.03-0.10	4.5-6.0	<2	Low	High	High	---	---
Urban land.										
50 Percilla	0-4 4-65	0.2-0.6 <0.06	0.15-0.18 0.12-0.18	4.5-7.3 4.5-7.3	<2 <2	Low Moderate	High High	Moderate Moderate	0.28 0.32	5
51*. Pits										
52 Rentzel	0-29 29-75	6.0-20 0.2-0.6	0.07-0.11 0.12-0.17	5.1-6.5 3.6-5.5	<2 <2	Low Low	Low Moderate	Moderate High	0.17 0.32	5
53*: Rentzel	0-29 29-75	6.0-20 0.2-0.6	0.07-0.11 0.12-0.17	5.1-6.5 3.6-5.5	<2 <2	Low Low	Low Moderate	Moderate High	0.17 0.32	5
Urban land.										
54 Ruston	0-10 10-72	0.6-2.0 0.6-2.0	0.09-0.16 0.12-0.17	5.1-6.5 4.5-6.0	<2 <2	Low Low	Low Moderate	Moderate Moderate	0.32 0.28	5

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factor	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
55, 56----------	0-7	0.6-2.0	0.10-0.20	4.5-5.5	<2	Low-------	Low------	Moderate	0.32	3
Sacul	7-53	0.06-0.2	0.12-0.18	4.5-5.5	<2	High------	High-----	Moderate	0.32	
	53-72	0.2-0.6	0.16-0.24	4.5-5.5	<2	Moderate	High-----	Moderate	0.37	
57----------	0-22	6.0-20	0.07-0.11	5.1-6.5	<2	Low-------	Low------	Moderate	0.17	3
Tenaha	22-46	0.6-2.0	0.12-0.17	4.5-5.5	<2	Low-------	Moderate	Moderate	0.24	
	46-65	---	---	---	---	---	---	---	---	
58*:										
Tenaha----------	0-34	6.0-20	0.07-0.11	5.1-6.5	<2	Low-------	Low------	Moderate	0.17	3
	34-47	0.6-2.0	0.12-0.17	4.5-5.5	<2	Low-------	Moderate	Moderate	0.24	
	47-55	---	---	---	---	---	---	---	---	
Urban land.										
59, 60----------	0-84	6.0-20	0.04-0.08	4.5-6.5	<2	Low-------	Low------	Moderate	0.15	5
Tonkawa										
61----------	0-6	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	Moderate	Moderate	0.37	4
Trawick	6-46	0.2-0.6	0.12-0.18	4.5-6.0	<2	Moderate	High-----	High-----	0.32	
	46-80	---	---	---	---	---	---	---	---	
62----------	0-7	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low-------	Moderate	Moderate	0.37	4
Trawick	7-50	0.2-0.6	0.12-0.18	4.5-6.0	<2	Moderate	High-----	High-----	0.32	
	50-80	---	---	---	---	---	---	---	---	
63----------	0-4	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	Moderate	Moderate	0.37	4
Trawick	4-45	0.2-0.6	0.12-0.18	4.5-6.0	<2	Moderate	High-----	High-----	0.32	
	45-80	---	---	---	---	---	---	---	---	
64*:										
Trawick----------	0-4	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	Moderate	Moderate	0.37	4
	4-42	0.2-0.6	0.12-0.18	4.5-6.0	<2	Moderate	High-----	High-----	0.32	
	42-80	---	---	---	---	---	---	---	---	
Bub----------	0-4	0.2-0.6	0.08-0.18	5.6-6.5	<2	Low-------	Moderate	Moderate	0.32	2
	4-14	0.2-0.6	0.14-0.18	4.5-6.5	<2	Moderate	High-----	Moderate	0.32	
	14-32	---	---	---	---	---	---	---	---	
65*:										
Trawick----------	0-6	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low-------	Moderate	Moderate	0.37	4
	6-46	0.2-0.6	0.12-0.18	4.5-6.0	<2	Moderate	High-----	High-----	0.32	
	46-80	---	---	---	---	---	---	---	---	
Urban land.										
66----------	0-15	0.6-2.0	0.15-0.20	4.5-7.3	<2	Moderate	High-----	Moderate	0.32	5
Tuscosso	15-53	0.2-0.6	0.12-0.18	4.5-6.0	<2	High------	High-----	Moderate	0.32	
	53-72	0.2-0.6	0.12-0.18	4.5-7.3	<2	High------	High-----	Moderate	0.32	
67----------	0-11	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low-------	Low------	Low------	0.20	5
Woden	11-96	2.0-6.0	0.10-0.15	5.1-6.5	<2	Low-------	Moderate	Moderate	0.20	
68, 69----------	0-6	0.6-2.0	0.10-0.15	4.5-6.5	<2	Low-------	Moderate	High-----	0.43	4
Woodtell	6-56	<0.06	0.12-0.18	3.6-5.5	<2	High------	High-----	High-----	0.32	
	56-72	---	---	---	---	---	---	---	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
2, 3, 4---------- Alto	C	None--------	---	---	2.0-4.0	Perched	Jan-Feb	>60	---
5*---------- Angelina	D	Common------	Very long	Oct-Jun	0-3.0	Apparent	Oct-Jun	>60	---
6, 7---------- Attoyac	B	None--------	---	---	>6.0	---	---	>60	---
8*: Attoyac----------	B	None--------	---	---	>6.0	---	---	>60	---
Urban land.									
9---------- Bernaldo	B	None--------	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---
10*: Bernaldo----------	B	None--------	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---
Besner----------	B	None--------	---	---	4.0-6.0	Apparent	Jan-Feb	>60	---
11---------- Betis	A	None--------	---	---	>6.0	---	---	>60	---
12---------- Bienville	A	None to rare	Brief-----	Dec-Jun	4.0-6.0	Apparent	Dec-Apr	>60	---
13---------- Bowie	B	None--------	---	---	>6.0	---	---	>60	---
14---------- Briley	B	None--------	---	---	>6.0	---	---	>60	---
15---------- Chireno	D	Rare--------	---	---	4.5-6.0	Apparent	Feb-Mar	>60	---
16, 17, 18-------- Cuthbert	C	None--------	---	---	>6.0	---	---	20-40	Rippable
19, 20---------- Darco	A	None--------	---	---	>6.0	---	---	>60	---
21*, 22*: Darco----------	A	None--------	---	---	>6.0	---	---	>60	---
Urban land.									
23, 24---------- Etoile	D	None--------	---	---	0-2.0	Perched	Jan-May	>60	---
25---------- Hannahatchee	B	Frequent----	Brief-----	Mar-May	0.2-4.0	Apparent	Oct-May	>60	---
26*: Hannahatchee-----	B	Frequent----	Brief-----	Mar-May	0.2-4.0	Apparent	Oct-May	>60	---
Urban land.									
27---------- Iuka	C	Common------	Brief-----	Dec-Apr	1.0-3.0	Apparent	Dec-Apr	>60	---

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
28, 29--Kirvin	C	None	---	---	>6.0	---	---	40-60	Rippable
30*: Kirvin	C	None	---	---	>6.0	---	---	40-60	Rippable
Urban land.									
31*--Kirvin	C	None	---	---	>6.0	---	---	40-60	Rippable
32--Kullit	B	None	---	---	2.0-3.0	Apparent	Dec-May	>60	---
33, 34--Lacerda	D	None	---	---	0-2.0	Perched	Jan-May	>60	---
35--Lilbert	B	None	---	---	>6.0	---	---	>60	---
36*: Lilbert	B	None	---	---	>6.0	---	---	>60	---
Urban land.									
37*--Mantachie	C	Frequent	Brief	Jan-Mar	1.0-1.5	Apparent	Dec-Mar	>60	---
38*--Marietta	C	Frequent	Brief	Jan-Mar	2.0	Apparent	Jan-Mar	>60	---
39--Mollville	D	Frequent	Long	Jan-Apr	0-1.0	Perched	Jan-Apr	>60	---
40*: Mollville	D	Frequent	Long	Jan-Apr	0-1.0	Perched	Jan-Apr	>60	---
Besner	B	None	---	---	4.0-6.0	Apparent	Jan-Feb	>60	---
41--Naclina	D	None	---	---	0-2.0	Perched	Jan-Apr	>60	---
42, 43, 44, 45, 46--Nacogdoches	B	None	---	---	>6.0	---	---	>60	---
47*: Nacogdoches	B	None	---	---	>6.0	---	---	>60	---
Urban land.									
48--Osier	D	Common	Brief	Dec-Apr	0.0-1.0	Apparent	Nov-Mar	>60	---
49*: Osier	D	Common	Brief	Dec-Apr	0.0-1.0	Apparent	Nov-Mar	>60	---
Urban land.									
50--Percilla	D	Frequent	Long	Jan-Mar	0-0.5	Perched	Jan-Mar	>60	---
51*. Pits									
52--Rentzel	C	None	---	---	1.5-2.5	Apparent	Jan-Mar	>60	---

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
53*: Rentzel	C	None	---	---	1.5-2.5	Apparent	Jan-Mar	>60	---
Urban land.									
54--- Ruston	B	None	---	---	>6.0	---	---	>60	---
55, 56--- Sacul	C	None	---	---	>6.0	---	---	>60	---
57--- Tenaha	B	None	---	---	>6.0	---	---	40-60	Rippable
58*: Tenaha	B	None	---	---	>6.0	---	---	40-60	Rippable
Urban land.									
59, 60--- Tonkawa	A	None	---	---	>6.0	---	---	>60	---
61, 62, 63--- Trawick	B	None	---	---	>6.0	---	---	40-60	Rippable
64*: Trawick	B	None	---	---	>6.0	---	---	40-60	Rippable
Bub	C	None	---	---	>6.0	---	---	12-20	Rippable
65*: Trawick	B	None	---	---	>6.0	---	---	40-60	Rippable
Urban land.									
66--- Tuscosso	B	Frequent	Very brief	Jan-Jun	2.5-3.5	Apparent	Jan-Jun	>60	---
67--- Woden	B	None	---	---	>6.0	---	---	>60	---
68, 69--- Woodtell	D	None	---	---	1.5-4.0	Apparent	Dec-Feb	>60	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Attoyac fine sandy loam:[3] (S74TX-347-003)																	
Ap--------0 to 5	A-4 (00)	ML	100	100	100	100	100	51	--	10	5	19	3	2.64	17.0	1.4	1.7
B22t-----17 to 35	A-6 (10)	CL	100	100	100	100	100	65	--	31	27	33	21	2.69	13.0	10.2	1.9
Besner fine sandy loam:[4] (S74TX-347-005)																	
A22--------9 to 36	A-4 (00)	ML	100	100	100	100	100	66	--	8	17	17	2	2.65	16.0	1.2	1.7
B21t-----41 to 55	A-4 (02)	CL-ML	100	100	100	100	100	68	--	19	23	23	7	2.64	16.0	3.6	1.8
Bienville loamy fine sand:[5] (S74TX-347-002)																	
A11-------8 to 25	A-2-4(00)	SM	100	100	100	100	100	24	--	6	5	22	3	2.65	20.0	1.4	1.6
B&A------45 to 72	A-2-4(00)	SM	100	100	100	100	100	24	--	7	6	22	3	2.63	21.0	1.5	1.6
Cuthbert fine sandy loam:[6] (S74TX-347-004)																	
A1--------0 to 4	A-4 (01)	ML	100	100	99	95	92	52	--	9	6	29	5	2.59	24.0	2.7	1.5
B21t------8 to 14	A-7-6(40)	CH	100	100	100	100	100	95	--	67	65	63	36	2.70	17.0	18.4	1.8
Lacerda clay loam:[7] (S74TX-347-010)																	
B21-------2 to 8	A-6 (23)	CL	100	100	100	99	98	94	--	45	34	39	24	2.65	15.0	11.7	1.8
B22-------8 to 21	A-7-6(49)	CH	100	100	100	100	99	97	--	67	60	66	45	2.72	11.0	22.2	2.0
B24------28 to 48	A-7-6(50)	CH	100	100	100	100	99	97	--	66	58	65	46	2.72	10.0	22.3	2.0

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Lilbert loamy fine sand:[8] (S74TX-347-011)																	
A2--------8 to 28	A-4 (00)	SM	100	99	98	98	97	37	--	7	3	17	2	2.66	14.0	1.0	1.8
B21t-----28 to 39	A-6 (06)	CL	100	99	98	97	97	53	--	30	27	33	19	2.68	15.0	9.4	1.8
Nacogdoches fine sandy loam:[9] (S74TX-347-006)																	
Ap--------0 to 6	A-2-4(00)	SM-SC	100	99	96	83	68	33	--	12	25	25	6	2.68	18.0	3.6	1.7
B21t------6 to 30	A-7-6(17)	CL-CH or CH	100	100	99	95	89	67	--	53	52	50	28	2.82	19.0	14.0	1.8
Sacul fine sandy loam:[10] (S74TX-347-007)																	
A2--------2 to 7	A-4 (00)	SM	100	100	100	99	97	50	--	11	7	21	3	2.61	18.0	1.8	1.7
B21t------7 to 14	A-7-6(47)	CH	100	100	100	100	100	87	--	76	72	76	48	2.70	17.0	21.6	1.8
B24t-----30 to 46	A-7-6(13)	CL	100	100	100	99	98	56	--	46	43	49	30	2.69	17.0	14.0	1.7
Tuscosso clay loam:[11] (S74TX-347-009)																	
A11-------0 to 8	A-7-6(22)	CL	100	100	100	100	100	90	--	45	35	47	22	2.66	18.0	12.5	1.7
B21------15 to 27	A-7-6(26)	CL	100	100	100	100	100	97	--	54	42	46	24	2.70	18.0	12.7	1.8

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Woodtell very fine sandy loam:[12] (S74TX-347-008)																	
A2--------3 to 6	A-4 (00)	ML	100	99	98	95	91	56	--	10	7	23	3	2.63	20.0	1.6	1.7
B22t------9 to 15	A-7-6(40)	CH	100	100	100	100	99	94	--	63	59	62	37	2.68	14.0	19.5	1.9
B24t-----25 to 47	A-7-6(44)	CH	100	100	100	100	100	96	--	60	55	62	41	2.69	13.0	20.0	1.9

[1] For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2] Liquid limit and plastic index values were determined by the AASHTO-89 and AASHTO-90 methods, except that soil was added to water.

[3] Attoyac fine sandy loam: 1,600 feet northeast of Stephen F. Austin Experimental Forest headquarters, 150 feet north of fenced plot.

[4] Besner fine sandy loam: 1.2 miles north of Stephen F. Austin Experimental Forest headquarters, 280 feet west of pipeline, and 20 feet south of road.

[5] Bienville loamy fine sand: From junction of Farm Road 225 and Loop 224, 11 miles west, 1.7 miles west southwest, 1.3 miles south, and 50 feet south of road.

[6] Cuthbert fine sandy loam: 1 mile east of the town of Melrose, 6.5 miles south, 400 yards west, and 50 feet south of road.

[7] Lacerda clay loam: From the city of Nacogdoches, 24 miles south on Farm Road 226 to church, 3.7 miles north, 2 miles east, 0.2 mile north, then 100 feet east.

[8] Lilbert loamy fine sand: 6.7 miles south of junction of Loop 224 and Farm to Market Road 1275, 1.8 miles southwest, 0.3 mile west-northwest, and 15 feet southwest of road.

[9] Nacogdoches fine sandy loam: 1.4 miles east of the town of Chireno on Highway 21, and 400 feet north.

[10] Sacul fine sandy loam: From the community of Etoile, 5.5 miles south, 600 feet northwest on dirt road, then 75 feet north of road.

[11] Tuscosso clay loam: From junction of Loop 224 and Texas Highway 7, 6.2 miles east, 0.25 mile north of road, and 200 feet east of creek.

[12] Woodtell very fine sandy loam: 2.5 miles northwest of the community of Etoile on Farm Road 226, 700 feet southwest on dirt road, then 50 feet north.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alto	Fine, kaolinitic, thermic Typic Paleudalfs
Angelina	Fine-loamy, siliceous, acid, thermic Typic Fluvaquents
Attoyac	Fine-loamy, siliceous, thermic Typic Paleudalfs
Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Besner	Coarse-loamy, siliceous, thermic Glossic Paleudalfs
Betis	Sandy, siliceous, thermic Psammentic Paleudults
Bienville	Sandy, siliceous, thermic Psammentic Paleudalfs
Bowie	Fine-loamy, siliceous, thermic Plinthic Paleudults
Briley	Loamy, siliceous, thermic Arenic Paleudults
Bub	Clayey, mixed, thermic, shallow Typic Hapludalfs
Chireno	Fine, montmorillonitic, thermic Typic Hapludolls
Cuthbert	Clayey, mixed, thermic Typic Hapludults
Darco	Loamy, siliceous, thermic Grossarenic Paleudults
Etoile	Fine, montmorillonitic, thermic Vertic Hapludalfs
Hannahatchee	Fine-loamy, mixed, thermic Dystric Fluventic Eutrochrepts
Iuka	Coarse-loamy, siliceous, acid, thermic Aquic Udifluvents
Kirvin	Clayey, mixed, thermic Typic Hapludults
Kullit	Fine-loamy, siliceous, thermic Aquic Paleudults
Lacerda	Very-fine, montmorillonitic, thermic Aquentic Chromuderts
Lilbert	Loamy, siliceous, thermic Arenic Plinthic Paleudults
Mantachie	Fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
Marietta	Fine-loamy, siliceous, thermic Fluvaquentic Eutrochrepts
Mollville	Fine-loamy, mixed, thermic Typic Glossaqualfs
Naclina	Fine, montmorillonitic, thermic Aquentic Chromuderts
Nacogdoches	Fine, kaolinitic, thermic Rhodic Paleudalfs
*Osier	Siliceous, thermic Typic Psammaquents
Percilla	Fine, kaolinitic, thermic Aeric Ochraqualfs
Rentzel	Loamy, siliceous, thermic Arenic Plinthaquic Paleudults
Ruston	Fine-loamy, siliceous, thermic Typic Paleudults
Sacul	Clayey, mixed, thermic Aquic Hapludults
Tenaha	Loamy, siliceous, thermic Arenic Hapludults
Tonkawa	Thermic, coated Typic Quartzipsamments
Trawick	Fine, kaolinitic, thermic Mollic Hapludalfs
Tuscosso	Fine, mixed, thermic Dystric Fluventic Eutrochrepts
Woden	Coarse-loamy, siliceous, thermic Typic Paleudalfs
Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs

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