United States Department of Agriculture

Soil Conservation Service

In cooperation with Texas Agricultural Experiment Station and Texas State Soil and Water Conservation Board

Soil Survey of Smith County, Texas

How To Use This Soil Survey

General Soil Map

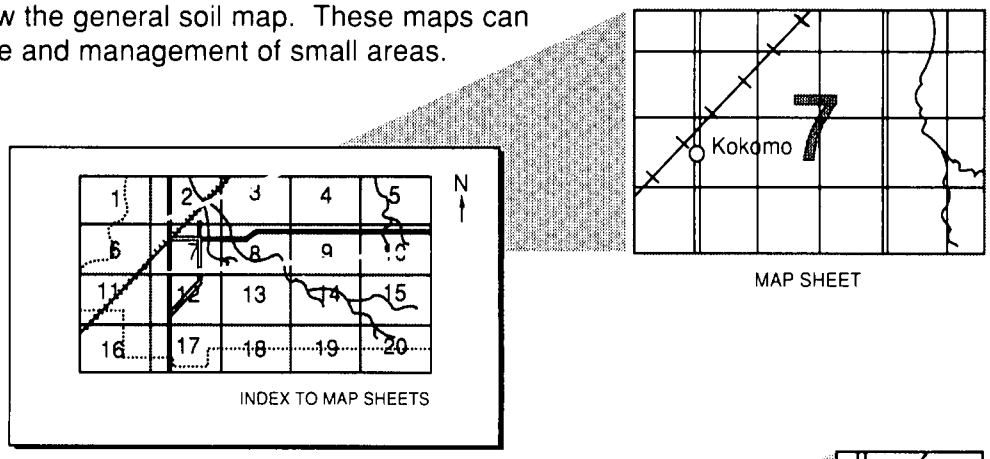
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

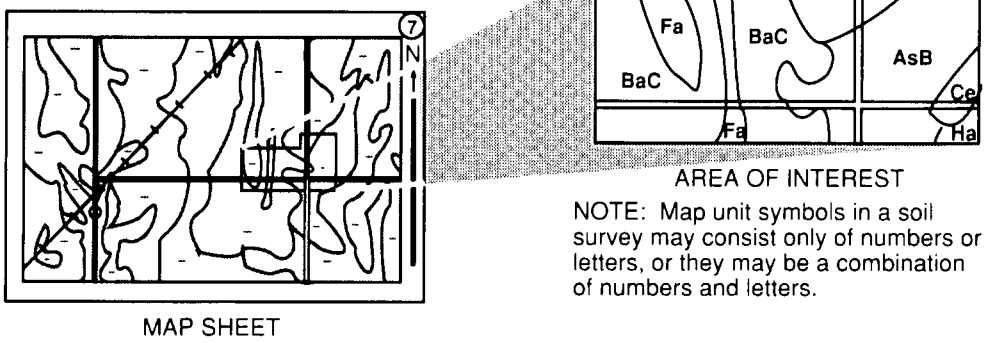
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

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.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This soil survey was made cooperatively by the Soil Conservation Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. It is part of the technical assistance furnished to the Smith County 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.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Roses growing in an area of Wolfpen loamy fine sand, 1 to 6 percent slopes. The production of roses is a major commercial enterprise in Smith County. (Photo courtesy of the Tyler Area Chamber of Commerce, Tyler, Texas.)

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Issued July 1993

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Summary of Tables

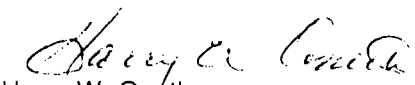
Foreword

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

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

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

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



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Soil Survey of Smith County, Texas

By Don T. Hatherly, Soil Conservation Service

Fieldwork by Don T. Hatherly, Donald J. Sabo, Terry M. Sobecki, and Edward F. Janak, Jr., soil scientists, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Texas Agricultural Experiment Station and the Texas State Soil and Water Conservation Board

SMITH COUNTY is in the central part of northeastern Texas (fig. 1). The total area of the county is 607,853 acres, or about 950 square miles. Elevation ranges from about 270 feet above sea level on the flood plain along the Sabine River in the northeastern part of the county to about 670 feet above sea level near Garden Valley in the northwestern part.

Smith County is in the East Texas Timberlands Land Resource Area. The topography of the county generally is nearly level to steep. The drainage pattern is well defined, and many streams dissect the county. The northern part of the county drains northeasterly into the Sabine River. The western and southwestern parts drain southwesterly into the Neches River and Lake Palestine. The eastern and southeastern parts drain southeasterly into West Mud Creek, Mud Creek, and other major streams.

The soils of the county formed mostly under forest vegetation. Those on uplands are light colored and dominantly sandy or loamy, and in unprotected sloping areas, they are subject to erosion. The soils on flood plains are loamy or clayey. They are mostly along major creeks, the Neches River, and the Sabine River.

Livestock, timber, roses, nursery stock, and peaches are the major agricultural enterprises in the county. According to records of the local field office of the Soil Conservation Service, about 44 percent of the county is pasture and hayland, 31 percent is woodland, 18 percent is urban and built-up areas or water areas, and 7 percent is cropland.

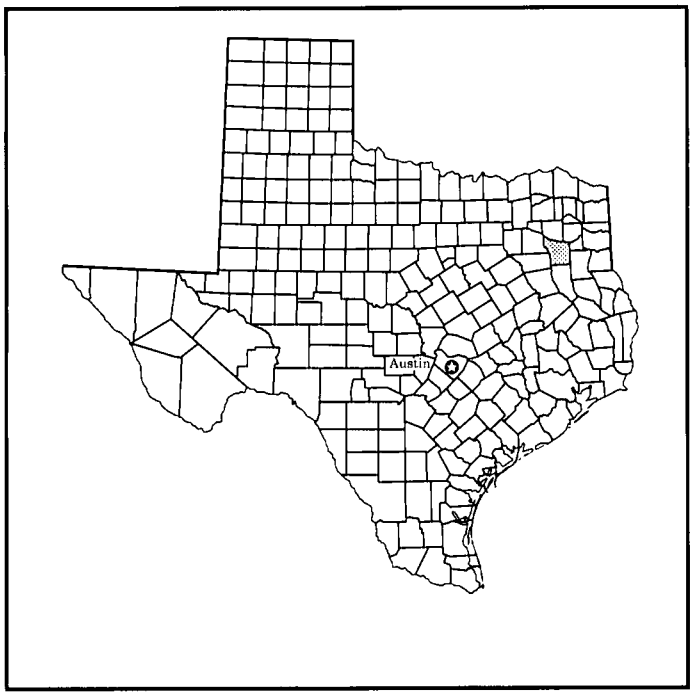

Figure 1.—Location of Smith County in Texas.

This survey supercedes the soil survey of Smith County published in 1917 *(4)*.

General Nature of the County

This section provides general information about Smith County. It describes settlement and population, agriculture, natural resources, and climate.

Settlement and Population

L.J. Gilbert, Smith County Historical Society, helped prepare this section.

Smith County was organized from Nacogdoches County in 1846 by the first Texas Legislature. It is one of the few counties in Texas that has retained its original boundaries. It was named in honor of General James Smith from Rusk County. Tyler, the county seat, is located near the geographic center of the county. It was named in honor of President John Tyler, who led the cause to annex the Republic of Texas to the United States.

The first settlement in the county was at Neches Saline in the 1820's. Other early towns that no longer exist include Flora, Etna, and Canton.

In 1980, Smith County had a population of 128,366, and Tyler had a population of 70,508.

Agriculture

Agriculture has always been significant to the economy of Smith County. It has changed drastically over the years. In the early days it was based on cotton production. Cotton continued as the principal crop until the mid-1930's, when the production of livestock and the discovery of oil drastically changed the county. Fruits and roses were introduced as crops in the latter part of the 19th century. They added much to the economic growth.

Many areas that previously were used as cropland have been converted to pasture or to pine plantations. Most of the livestock in the county are raised in cow-calf operations. They are pastured in summer and fed hay and feed supplements in winter. The main pasture plants are coastal bermudagrass, bahiagrass, and common bermudagrass. The pastures produce large amounts of hay. Cool-season legumes are overseeded in many pastures to improve the fertility of the soils and provide additional forage.

The rose industry has become increasingly important in the area. About 12 million bushes are harvested annually and shipped throughout the United States. The other crops grown in the county are mainly truck crops, especially corn, peas, sweet potatoes, watermelons, and peaches. Christmas trees also are grown. Most farms are small.

Most of the commercial timber production in the county is on small, locally owned tracts. Pines and hardwoods are harvested for pulpwood, saw logs, crossties, posts, and poles.

Natural Resources

Soil is the most important natural resource in Smith County. The livelihood of many people in the county depends on the ability of the soil to produce forage for livestock, timber, and cultivated crops.

Oil and gas also are valuable natural resources in the county. Numerous oil and gas wells are a source of income for many landowners (fig. 2). Exploring for oil and gas, drilling, servicing, and refining provide many jobs in the county.

Sand and gravel are mined in the county. Sand is mined from thick beds, mainly north of Tyler. Gravel is obtained from surface mining of gravelly soils throughout the county. The sand and gravel are used mainly in construction.

Water, fish, and wildlife are important natural resources in the county. Lake Palestine, Lake Tyler, Lake Tyler East, Tyler State Park Lake, and many smaller private lakes and ponds provide water for recreational activities and for domestic, industrial, and agricultural uses.

Climate

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

Smith County has long, hot summers because moist tropical air from the Gulf of Mexico persistently covers the area. Winters are cool and fairly short. Cold waves are rare. They moderate in 1 or 2 days. Precipitation is fairly heavy throughout the year, and prolonged droughts are rare. Summer precipitation, mainly afternoon thunderstorms, is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Tyler, Texas, in the period 1954 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is about 46 degrees F and the average daily minimum temperature is 34 degrees. The lowest temperature on record, which occurred at Tyler on January 12, 1962, is 2 degrees. In summer, the average temperature is 80 degrees and the average daily maximum temperature is 92 degrees. The highest recorded temperature, which occurred at Tyler on July 18, 1980, is 107 degrees.

Growing degree days are shown in table 1. They are

Figure 2.—An oil rig and storage tanks in Smith County. The production of oil and gas is important to the local economy.

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.

The total annual precipitation is about 44 inches. Of this, 23 inches, or 52 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 5.53 inches at Tyler on July 27, 1979. Thunderstorms occur on about 44 days each year.

Short, severe local storms, including tornadoes, occasionally occur. The damage they cause varies and is spotty. In some years, either during summer or autumn, a tropical depression or a remnant of a hurricane that has moved inland causes extremely heavy rains for 1 to 3 days.

The average seasonal snowfall is about 2 inches. The greatest snow depth at any one time during the period of record was 5 inches. On the average, 1 day

has at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

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

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

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

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

The descriptions, names, and delineations of the soils in this survey do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in

series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Map Unit Composition

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

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

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

General Soil Map Units

The general soil map at the back of this publication shows 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, it 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 another but in a different pattern.

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

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a 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.

Eight general soil map units are in Smith County. They make up 98 percent of the total acreage. The rest is covered by water.

Soil Descriptions

Gently Sloping to Steep Soils That Formed Under Dominantly Hardwood Forests on Uplands

This group of general soil map units makes up about 59 percent of Smith County. The major soils in this group are Wolfpen, Pickton, Redsprings, Cuthbert, Elrose, Oakwood, and Freestone soils. They are dominantly on broad interstream divides, convex ridgetops, and side slopes above drainageways. They have a sandy or loamy surface layer and a loamy or clayey subsoil. They are acid throughout.

The dominant native vegetation is hardwoods. The main trees are oak, hickory, and elm. Shortleaf pine and loblolly pine are in scattered areas throughout the units. Many large areas have been cleared of trees and are used mostly as pasture. Some of the less sloping soils are used for crops. Plantations of loblolly pine and slash pine have been established in a few areas that were previously used as cropland. The remaining native woodland is mostly on the steeper soils.

1. Wolfpen-Pickton

Gently sloping to moderately steep, well drained, sandy soils that have a loamy subsoil

This map unit is made up of Wolfpen soils on broad interstream divides and Pickton soils on the slightly higher convex ridgetops.

This unit makes up about 30 percent of the county. It is about 35 percent Wolfpen soils, 32 percent Pickton soils, and 33 percent soils of minor extent (fig. 3).

The Wolfpen soils typically have a surface layer of slightly acid, dark brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 27 inches, is slightly acid, yellowish brown loamy fine sand. The subsoil extends to a depth of 75 inches. It is strongly acid and very strongly acid, yellowish brown sandy clay loam. In the lower part it has red and light brownish gray mottles and has about 10 percent streaks and pockets of pale brown, uncoated sand.

The Pickton soils typically have a surface layer of medium acid, yellowish brown loamy fine sand about 11 inches thick. The subsurface layer, from a depth of 11 to 52 inches, is slightly acid, pale brown loamy fine sand. The subsoil, from a depth of 52 to 72 inches, is medium acid, brownish sandy clay loam that has reddish mottles.

The minor soils in this unit are those in the Bernaldo, Besner, Cuthbert, Derly, Gallime, Keechi, Leagueville, Mantachie, Raino, Redsprings, and Tonkawa series. The loamy Bernaldo, Besner, Derly, Gallime, and Raino soils are on terraces and in the lower uplands. The loamy Cuthbert and Redsprings soils are on side slopes along drainageways and streams. The loamy Keechi and Mantachie soils are on flood plains along streams. The sandy Leagueville soils are on short side slopes along drainageways and at the bottom of drainageways. Tonkawa soils are sandy throughout. They are in the slightly higher positions on the landscape.

Most areas of this unit are used as pasture. The

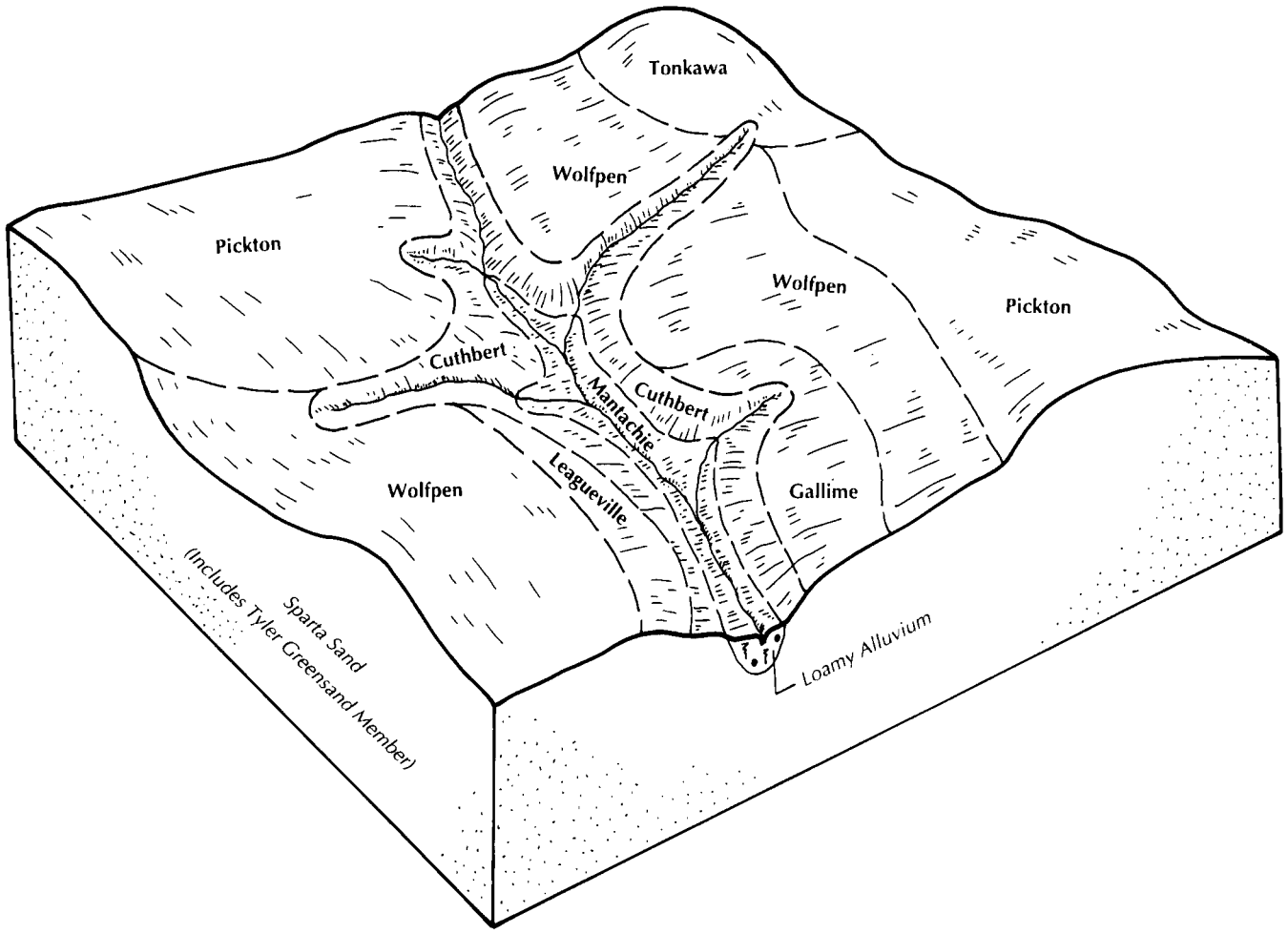

Figure 3.—Typical pattern of soils and parent material in the Wolfpen-Pickton general soil map unit.

main pasture grass is coastal bermudagrass. Many pastures are overseeded with vetch to increase forage production and improve the fertility of the soils. Applications of fertilizer and lime are essential for high yields.

Native hardwoods grow in some areas of this unit. Plantations of loblolly pine and slash pine have been planted in some areas that were previously used as cropland. Droughtiness is the main limitation affecting timber production.

Crops, such as watermelons, roses, peas, and sweet potatoes, are grown in some areas. Applications of fertilizer and lime are necessary for good yields.

The soils in this unit are suited to most urban uses. Seepage is a limitation on sites for most sanitary facilities. Concrete and uncoated steel are subject to corrosion.

2. Redsprings-Cuthbert-Elrose

Gently sloping to steep, well drained, loamy soils that in most areas are gravelly or very gravelly and that have a clayey or loamy subsoil

This map unit is made up of Redsprings soils on high, convex ridgetops and strongly sloping to steep side slopes, Cuthbert soils on the lower side slopes, and Elrose soils on colluvial foot slopes.

This unit makes up about 17 percent of the county. It is about 33 percent Redsprings soils, 27 percent Cuthbert soils, 16 percent Elrose soils, and 24 percent soils of minor extent (fig. 4).

The Redsprings soils are gently sloping to steep. Typically, the surface layer is medium acid, dark reddish brown very gravelly sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 49 inches, is

very strongly acid, red clay that has fragments of glauconite, ironstone, and shale. The underlying material to a depth of 65 inches is very strongly acid, strong brown glauconitic material that has about 10 percent ironstone pebbles.

The Cuthbert soils are strongly sloping to steep. Typically, the surface layer is medium acid, dark brown fine sandy loam about 4 inches thick. In some areas it is gravelly. The subsurface layer, from a depth of 4 to 9 inches, is medium acid, yellowish brown fine sandy loam. The subsoil, from a depth of 9 to 34 inches, is strongly acid and very strongly acid, red clay that becomes less clayey with increasing depth. The underlying material, from a depth of 34 to 60 inches, is very strongly acid, yellowish red, red, and yellowish brown loamy material interbedded with light gray and red shaly material.

The Elrose soils are gently sloping to strongly sloping. Typically, the surface layer is strongly acid, reddish brown fine sandy loam about 2 inches thick. The subsurface layer, from a depth of 2 to 13 inches, is very strongly acid, yellowish red fine sandy loam. The subsoil extends to a depth of 80 inches. It is medium acid, red loam in the upper part and slightly acid clay loam in the lower part.

The minor soils in this unit are those in the Alto,

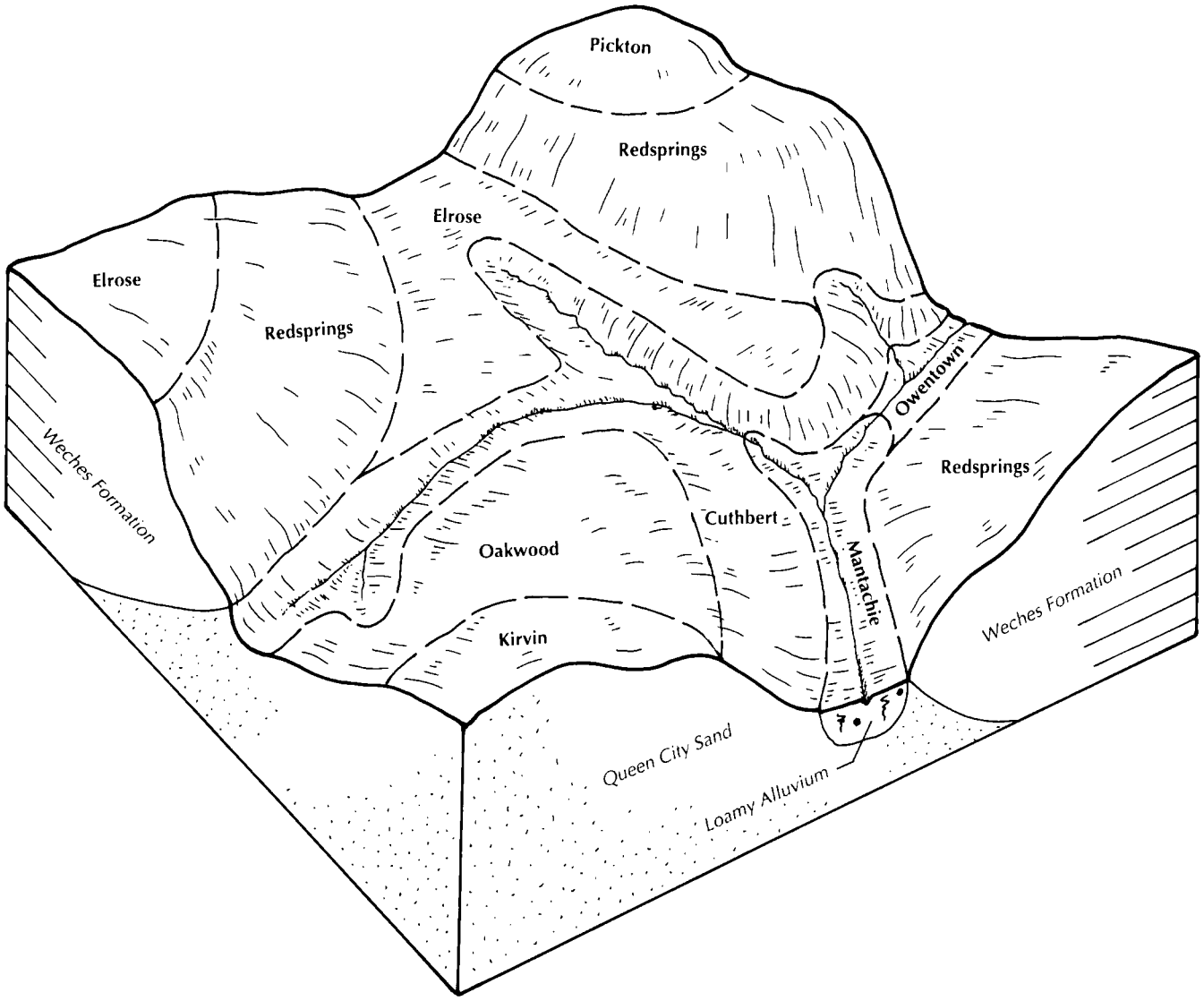

Figure 4.—Typical pattern of soils and parent material in the Redsprings-Cuthbert-Elrose general soil map unit.

Attoyac, Briley, Kirvin, Mantachie, Oakwood, Owentown, Pickton, and Wolfpen series. The loamy Alto soils are in slightly concave areas. The loamy Attoyac soils are on terraces. The sandy Briley, Pickton, and Wolfpen soils are on convex ridgetops. The loamy Kirvin soils are on narrow ridges. The loamy Oakwood soils are on interstream divides in the uplands. The loamy Mantachie and Owentown soils are on flood plains along streams.

Most areas of this unit are used as woodland and wildlife habitat. These soils support native hardwoods, mainly oak, hickory, and elm, and some pine. Shortleaf pine and loblolly pine are the main commercial trees. The slope is the main limitation affecting the production of pine on the Cuthbert and Redsprings soils. The hilly landscape and the trees provide a natural refuge for deer and other wildlife.

Some areas have been cleared of trees and are used as pasture. Bahiagrass, common bermudagrass, and coastal bermudagrass are suitable pasture grasses. Overseeding with arrowleaf clover and crimson clover increases forage production and improves the fertility of the soils. Applications of fertilizer and lime are needed for high yields.

A few of the less sloping soils are used for crops. They are suited to corn and truck crops, such as peas, beans, and sweet potatoes. Farming on the contour and constructing terraces help to control erosion.

The steeper soils in this unit have severe limitations affecting urban uses. The slope and fragments of ironstone are the main limitations. The smoother areas are suited to most urban uses. Concrete and uncoated steel are subject to corrosion. Low strength is a limitation on sites for local roads and streets.

3. Oakwood-Cuthbert

Gently sloping to steep, moderately well drained or well drained, loamy soils that have a loamy or clayey subsoil

This unit is made up of Oakwood soils on broad interstream divides and Cuthbert soils on side slopes above drainageways and flood plains.

This unit makes up about 11 percent of the county. It is about 57 percent Oakwood soils, 19 percent Cuthbert soils, and 24 percent soils of minor extent.

The Oakwood soils are gently sloping to strongly sloping and are moderately well drained. Typically, the surface layer is slightly acid, dark brown fine sandy loam about 7 inches thick. The subsurface layer is about 8 inches of slightly acid, light yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 15 to 34 inches, is strongly acid, yellowish brown sandy clay loam that has reddish mottles. The lower part, from a depth of 34 to 72 inches, is medium acid, brownish yellow sandy clay loam that has plinthite below a depth of 39 inches.

The Cuthbert soils are strongly sloping to steep and are well drained. Typically, the surface layer is medium acid, brown fine sandy loam about 4 inches thick. In some areas it is gravelly fine sandy loam. The subsurface layer, from a depth of 4 to 9 inches, is medium acid, yellowish brown fine sandy loam. The subsoil, from a depth of 9 to 34 inches, is strongly acid and very strongly acid, red clay that becomes less clayey below a depth of 26 inches. The underlying material, from a depth of 34 to 60 inches, is very strongly acid, yellowish red, red, and yellowish brown loamy material interbedded with light gray and red shaly material.

The minor soils in this unit are those in the Bernaldo, Gallime, Kirvin, Mantachie, Pickton, and Wolfpen series. The loamy Bernaldo soils are on stream terraces. The loamy Gallime soils are on stream terraces and in the lower uplands. The loamy Kirvin soils are on the higher ridges and on low hills. The loamy Mantachie soils are on flood plains along streams. The sandy Pickton and Wolfpen soils are in the slightly higher positions on the landscape.

Most areas of this unit are used as pasture. The main pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Many areas have been overseeded with arrowleaf clover, crimson clover, and vetch to increase forage production and to improve the fertility of the soils. Applications of fertilizer and lime are essential for high yields.

A few areas are used as woodland. The main trees are native hardwoods. Shortleaf pine and loblolly pine are in scattered areas. Plantations of loblolly pine have been planted in some areas that were previously used as cropland. In some areas the slope is a limitation affecting timber production.

Some areas are used for crops. The less sloping soils are suited to corn, roses, and vegetables. Applications of fertilizer and lime are needed for high yields. Constructing terraces and farming on the contour help to control erosion in some areas.

Most of this unit is suited to urban uses. Low strength, corrosion of uncoated steel and concrete, and the slope are limitations.

4. Freestone-Oakwood

Gently sloping, moderately well drained soils that are loamy throughout

This map unit is made up of Freestone soils on broad interstream divides and Oakwood soils on the slightly higher convex ridges.

This map unit makes up about 1 percent of the county. It is about 40 percent Freestone soils, 31 percent Oakwood soils, and 29 percent soils of minor extent.

The Freestone soils typically have a surface layer of medium acid, dark yellowish brown fine sandy loam about 8 inches thick. The subsurface layer, from a depth of 8 to 17 inches, is slightly acid, yellowish brown fine sandy loam. The upper part of the subsoil is strongly acid and very strongly acid, brown and brownish yellow, mottled sandy clay loam. The lower part to a depth of 67 inches is very strongly acid, mottled gray, light gray, and red clay.

The Oakwood soils typically have a surface layer of slightly acid, dark brown fine sandy loam about 7 inches thick. The subsurface layer is about 8 inches of slightly acid, light yellowish brown fine sandy loam. The subsoil, from a depth of 15 to 72 inches, is strongly acid and medium acid, yellowish and brownish sandy clay loam that has plinthite below a depth of 39 inches.

The minor soils in this unit are those in the Bernaldo, Cuthbert, Derly, Gallime, Mantachie, Pickton, Raino, and Wolfpen series. The loamy Bernaldo and Gallime soils are on low stream terraces. The loamy Cuthbert soils are on side slopes above streams. The loamy Derly and Raino soils are on flats and low mounds. The loamy Mantachie soils are on flood plains along streams. The sandy Wolfpen and Pickton soils are in the higher positions on the landscape.

Most areas of this unit are used as pasture. The main grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Some areas are overseeded with arrowleaf clover, crimson clover, and vetch to increase forage production and to improve the fertility of the soils. Applications of fertilizer and lime are essential for high yields.

A few areas are used as woodland. The main trees are hardwoods. A few areas that were previously used as cropland have been planted to loblolly pine. Wetness is a limitation affecting pine production on the Freestone soils.

A few areas are used for crops. Corn, roses, and vegetables are suitable crops. Applications of fertilizer and lime are needed for high yields. Constructing terraces and farming on the contour help to control erosion.

The soils in this unit are suited to most urban uses. Wetness and restricted permeability are limitations on sites for sanitary facilities in areas of the Freestone soils. Low strength is a limitation on sites for local roads and streets in areas of the Freestone and Oakwood soils.

Gently Sloping to Steep Soils That Formed Under Dominantly Pine Forests on Uplands

This group of general soil map units makes up about 32 percent of the county. The major soils in this group are Bowie, Cuthbert, Kirvin, Lilbert, Darco, and Tenaha soils. They are dominantly on broad interstream divides, convex ridgetops, and side slopes above drainageways. They have a sandy or loamy surface layer and a loamy or clayey subsoil. They are acid throughout.

The dominant native vegetation is shortleaf pine and loblolly pine. Native hardwoods are in scattered areas throughout the units. Many large areas have been cleared of trees and are used mostly as pasture. Some of the less sloping soils are used for crops. Plantations of loblolly pine and slash pine have been established in a few areas that were previously used as cropland. The remaining native woodland is mostly on the steeper soils.

5. Bowie-Cuthbert-Kirvin

Gently sloping to steep, moderately well drained or well drained, loamy soils that have a loamy or clayey subsoil

This map unit is made up of Bowie soils on stream divides, Cuthbert soils on side slopes adjacent to streams or flood plains, and Kirvin soils on the higher convex ridgetops and on low hills.

This unit makes up about 18 percent of the county. It is about 32 percent Bowie soils, 26 percent Cuthbert soils, 20 percent Kirvin soils, and 22 percent soils of minor extent (fig. 5).

The Bowie soils are gently sloping to strongly sloping and are moderately well drained. Typically, the surface layer is slightly acid, yellowish brown fine sandy loam about 5 inches thick. The subsurface layer, from a depth of 5 to 11 inches, is slightly acid, light yellowish brown fine sandy loam. The subsoil, from a depth of 11 to 80 inches, is strongly acid, yellowish and brownish sandy clay loam. It has reddish mottles and plinthite below a depth of 35 inches.

The Cuthbert soils are strongly sloping to steep and are well drained. Typically, the surface layer is medium acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 9 inches, is medium acid, yellowish brown fine sandy loam. The subsoil, from a depth of 9 to 34 inches, is strongly acid and very strongly acid, red clay. It becomes less clayey with increasing depth. The underlying material, from a depth of 34 to 60 inches, is interbedded loamy and shaly material.

The Kirvin soils are gently sloping to strongly sloping and are well drained. Typically, the surface layer is strongly acid, dark brown very fine sandy loam about 4

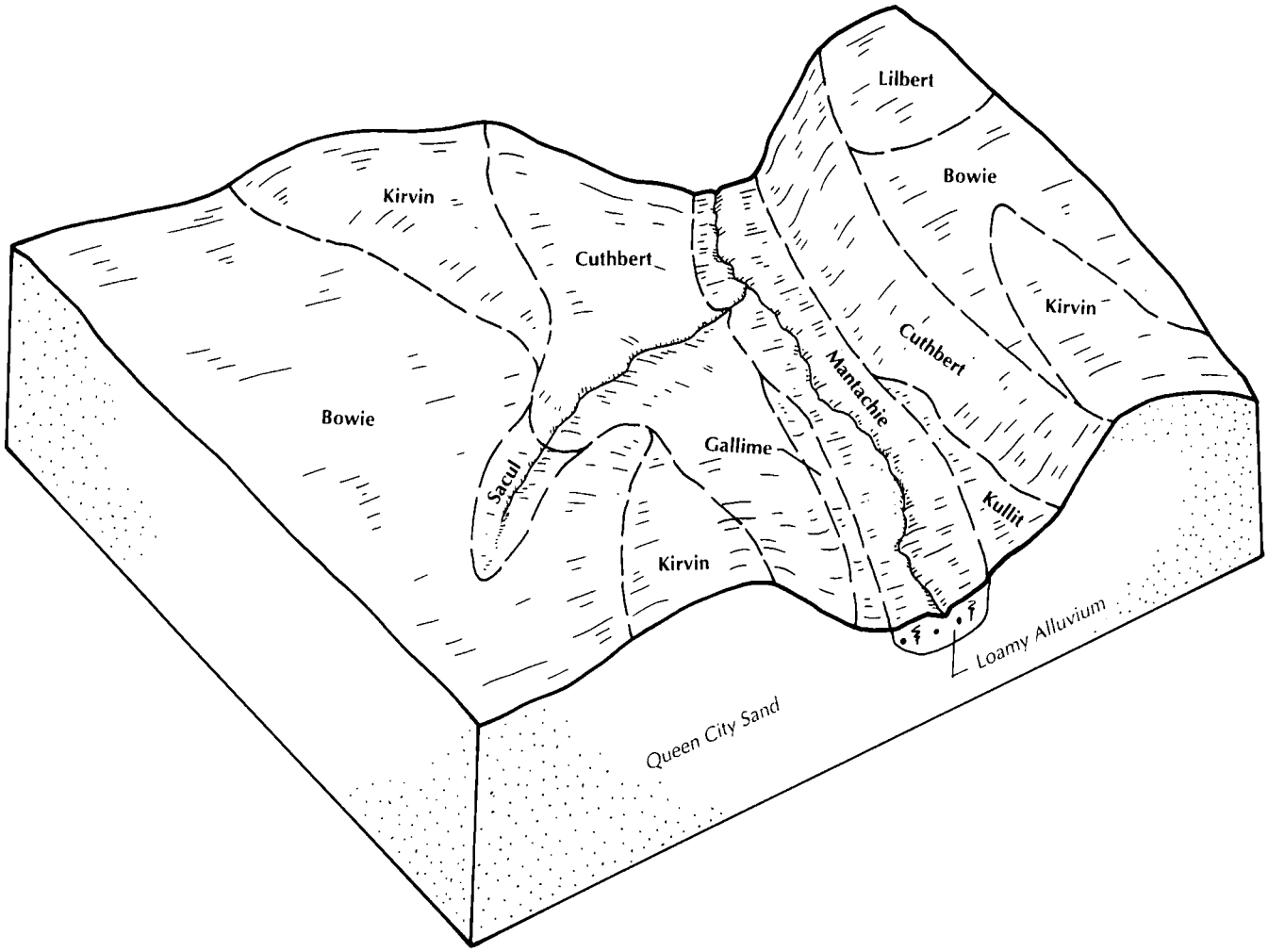

Figure 5.—Typical pattern of soils and parent material in the Bowie-Cuthbert-Kirvin general soil map unit.

inches thick. The subsurface layer, from a depth of 4 to 11 inches, is strongly acid, pale brown very fine sandy loam. The subsoil, from a depth of 11 to 47 inches, is clay. It is very strongly acid and red in the upper part and extremely acid and yellowish red in the lower part. The underlying material, from a depth of 47 to 64 inches, is stratified sandy clay loam and shaly material.

The minor soils in this unit are those in the Briley, Gallime, Kullit, Lilbert, Mantachie, Sacul, and Tenaha series. The sandy Briley, Lilbert, and Tenaha soils are on hills and side slopes along streams. The loamy Gallime soils are on terraces and in the lower uplands. The loamy Kullit and Sacul soils are in slightly concave areas. The loamy Mantachie soils are on flood plains along streams.

Most areas of this unit are used as pasture or woodland. A few are used as cropland.

The main pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Many pastures are overseeded with arrowleaf clover or crimson clover to increase forage production and improve the fertility of the soils. Applications of fertilizer and lime are essential for high yields.

The dominant native woodland species are pines. Loblolly pine and shortleaf pine are the principal commercial trees. In some areas the slope is a limitation affecting timber production.

A few of the smoother areas are used for crops, such as corn, peas, and sweet potatoes. Applications of fertilizer and lime are necessary for good yields. Constructing terraces and farming on the contour help to control erosion.

These soils are suited to most urban uses. Restricted permeability and the slope are limitations on sites for

sanitary facilities. Uncoated steel and concrete are subject to corrosion.

6. Lilbert-Darco-Tenaha

Gently sloping to moderately steep, well drained, sandy soils that have a loamy subsoil

This map unit is made up of Lilbert soils on broad interstream divides, Darco soils on the slightly higher convex ridges, and Tenaha soils on side slopes above drainageways.

This unit makes up about 14 percent of the county. It is about 40 percent Lilbert soils, 16 percent Darco soils, 15 percent Tenaha soils, and 29 percent soils of minor extent.

The Lilbert soils are gently sloping. Typically, the surface layer is strongly acid, brown loamy fine sand about 9 inches thick. The subsurface layer, from a depth of 9 to 24 inches, is slightly acid, pale brown loamy fine sand. The upper part of the subsoil, from a depth of 24 to 67 inches, is medium acid and strongly acid, yellowish brown and brownish yellow sandy clay loam that has plinthite at a depth of about 31 inches. The lower part, from a depth of 67 to 74 inches, is mottled grayish brown, brownish yellow, and red, very strongly acid clay loam.

The Darco soils are gently sloping to moderately steep. Typically, the surface layer is slightly acid, dark brown loamy fine sand about 4 inches thick. The subsurface layer, from a depth of 4 to 53 inches, is slightly acid, yellowish brown loamy fine sand. The upper part of the subsoil, from a depth of 53 to 68 inches, is medium acid, yellowish brown fine sandy loam that has brownish yellow mottles. The lower part, from a depth of 68 to 80 inches, is strongly acid, strong brown sandy clay loam that has red mottles.

The Tenaha soils are strongly sloping to moderately steep. Typically, the surface layer is slightly acid, dark brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 28 inches, is slightly acid, yellowish brown loamy fine sand. The subsoil, from a depth of 28 to 56 inches, is strongly acid and very strongly acid, yellowish red sandy clay loam that has brownish yellow and red mottles. The underlying material, from a depth of 56 to 70 inches, is very strongly acid, red and brownish yellow sandy clay loam and fine sandy loam interbedded with light gray shaly material.

The minor soils in this unit are those in the Bowie, Briley, Cuthbert, Kirvin, and Mantachie series. The loamy Bowie and Kirvin soils are on ridgetops and side slopes. The sandy Briley soils are on low, convex hills. The loamy Cuthbert soils are on side slopes above drainageways and streams. The loamy Mantachie soils are on flood plains along streams.

Most areas of this unit are used as pasture. The main pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Some areas are overseeded with vetch or arrowleaf clover to increase forage production and to improve the fertility of the soils. Applications of fertilizer and lime are needed for high yields.

Some areas are used as woodland. Hardwoods and pine are adapted to these soils. The principal commercial trees are loblolly pine and shortleaf pine. Droughtiness is the main limitation affecting timber production.

A few areas are used as cropland. The main crops are corn, roses, and watermelons. Applications of fertilizer and lime are needed for high yields. In some areas contour farming is needed to help control erosion.

These soils are suited to most urban uses. Uncoated steel and concrete are subject to corrosion. The sandy surface layer is a limitation affecting recreational development.

Nearly Level Soils That Formed Under Dominantly Hardwood Forests on Flood Plains

This group of general soil map units makes up about 9 percent of the county. The major soils in this group are Mantachie, Gladewater, and Estes soils. They are on flood plains along rivers and the major streams. They have a clayey or loamy surface layer and subsoil. They are acid throughout.

The dominant native vegetation is hardwoods. The main trees are water oak, willow oak, sweetgum, and ash. Pine grows in some areas of the sandy minor soils. A few areas have been cleared of trees and are used as pasture. Because of wetness and flooding, the soils in this group are unsuited to crops.

7. Mantachie

Nearly level, somewhat poorly drained soils that are loamy throughout

This map unit is on flood plains along most of the major streams in the county. The Mantachie soils are frequently flooded.

This map unit makes up about 6 percent of the county. It is about 73 percent Mantachie soils and 27 percent soils of minor extent.

Typically, the Mantachie soils have a surface layer of very strongly acid, dark brown loam about 2 inches thick. The subsurface layer is about 6 inches of very strongly acid, dark grayish brown loam that has dark yellowish brown mottles. The subsoil, from a depth of 8

to 60 inches, is very strongly acid and strongly acid and is grayish brown, brownish gray, and dark gray. It is loam to a depth of 39 inches and clay loam below that depth.

The minor soils in this unit are those in the Bernaldo, Gallime, Keechi, and Owentown series. The loamy Bernaldo and Gallime soils are on low stream terraces. The loamy Keechi soils are lower on the landscape than the Mantachie soils and are more poorly drained. The sandy Owentown soils are higher on the landscape than the Mantachie soils and are better drained.

Much of this unit is used as woodland. The dominant trees are hardwoods, such as water oak, willow oak, and sweetgum. The flooding and the wetness are severe limitations affecting the production of pine.

Many areas have been cleared of trees and are used as pasture. Bahiagrass and common bermudagrass are well adapted warm-season grasses. Cool-season tall fescue overseeded with white clover commonly is planted on this unit.

This unit is not suited to cropland or urban uses because of the flooding and the wetness.

8. Gladewater-Estes

Nearly level, poorly drained or somewhat poorly drained, clayey and loamy soils that have a clayey or loamy subsoil

This map unit is on the flood plain along the Sabine River. Gladewater soils are mainly in the western part of the unit, and Estes soils are mainly in the eastern part.

This map unit makes up about 3 percent of the county. It is about 65 percent Gladewater soils, 20 percent Estes soils, and 15 percent soils of minor extent.

The Gladewater soils are poorly drained. Typically, the surface layer is medium acid, very dark gray clay about 6 inches thick. The next 12 inches is medium acid, dark gray clay. Below this to a depth of 69 inches is strongly acid, grayish brown clay that has yellowish red mottles.

The Estes soils are somewhat poorly drained. Typically, the surface layer is medium acid, very dark grayish brown silty clay loam about 3 inches thick. The subsoil, from a depth of 3 to 60 inches, is very strongly acid, grayish brown and brownish gray silty clay loam that becomes more acid and more clayey with increasing depth.

The minor soils in this unit are those in the Gallime, Mantachie, and Owentown series. The loamy Gallime soils are on terraces. The loamy Mantachie soils are at the mouth of creeks. They are intermingled with areas of the Gladewater and Estes soils. The sandy Owentown soils are in the higher positions on the landscape and along natural levees.

Most areas of this unit are used as woodland. The dominant trees are hardwoods, such as water oak, willow oak, sweetgum, and ash. Wetness and flooding are limitations affecting the production of pine.

A few areas are used as pasture. The soils are well suited to common bermudagrass and bahiagrass. Tall fescue and white clover are adapted for cool-season forage. Applications of fertilizer and lime increase production.

The soils in this unit are not suited to crops or urban uses. The frequent flooding and the wetness are the main limitations.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cuthbert fine sandy loam, 5 to 20 percent slopes, is a phase of the Cuthbert series.

Some map units are made up of two or more major soils. These map units are called soil complexes 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. Derly-Raino complex, 0 to 1 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion 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. Cuthbert and Redsprings soils, graded, 3 to 8 percent slopes, is an undifferentiated group in this survey area.

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

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

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

Soil Descriptions

AoB—Alto loam, 1 to 3 percent slopes. This gently sloping soil is on broad interstream divides and in low saddles between the higher areas. Slopes are mainly smooth or slightly concave. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is friable, medium acid, dark yellowish brown loam about 6 inches thick. The subsoil is firm and strongly acid. The upper part, from a depth of 6 to 25 inches, is strong brown sandy clay loam. The next part, from a depth of 25 to 35 inches, is yellowish brown clay loam that has red mottles. The next part, between depths of 35 and 41 inches, is yellowish brown clay that has red mottles. The lower part, from a depth of 41 to 50 inches, is yellowish brown

clay loam that has red mottles. The underlying material is medium acid. The upper part is yellowish brown, weathered glauconitic material. The lower part to a depth of 70 inches is mottled yellowish brown, light gray, and red shale and clayey material.

This soil is moderately well drained. Surface runoff is slow. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion is slight. The seasonal high water table is at a depth of 2.5 to 4.0 feet during winter and early spring.

Included with this soil in mapping are small areas of Elrose and Redsprings soils and areas of a soil that is similar to the Alto soil but is wetter. Elrose soils have a red, loamy subsoil. Redsprings soils have a gravelly surface layer and a red, clayey subsoil. Included soils make up less than 15 percent of the map unit.

Nearly all areas of the Alto soil are used as pasture. A few small areas are used as cropland or woodland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with clover or vetch increases forage production and improves the fertility of the soil. Good grazing management and applications of fertilizer and lime are needed for high yields.

This soil is well suited to crops, such as corn and vegetables. Incorporating crop residue into the soil and planting cover crops help to maintain tilth. Contour farming and terraces help to control erosion.

The woodland species on this soil are mainly hardwoods and some shortleaf pine and loblolly pine. No major limitations affect the production of pine.

The moderately slow permeability and the wetness are limitations on sites for septic tank absorption fields and sanitary landfills. The wetness and the shrink-swell potential are limitations on building sites. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation help to overcome these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 8A.

AtB—Attoyac fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on stream terraces. Slopes are smooth or convex. Areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very friable fine sandy loam about 8 inches thick. It is strongly acid and dark brown in the upper part and medium acid and strong brown in the lower part. The upper part of the subsoil, from a depth of 8 to 12 inches, is very friable, medium acid, yellowish red fine sandy loam. The next part, from a depth of 12 to 37 inches, is firm, slightly acid, red sandy clay loam. The lower part, from a depth of 37 to 60 inches, is friable, slightly acid, red sandy clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Bernaldo and Gallime soils. Bernaldo soils have a yellowish subsoil. Gallime soils have a yellowish subsoil and a surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Attoyac soil is used mainly as pasture or woodland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. It is suited to crimson clover, arrowleaf clover, and vetch, which can increase forage production and improve the fertility of the soil. Good grazing management and applications of fertilizer and lime also increase forage production.

This soil is well suited to woodland. Loblolly pine and shortleaf pine are the main commercial trees. No major limitations affect timber production. Good woodland management practices can increase production.

This soil is well suited to crops, such as corn and vegetables. Erosion is a hazard. Farming on the contour and terracing help to control erosion. Applications of fertilizer and lime are needed for high yields. Incorporating crop residue into the soil and planting cover crops help to maintain tilth.

This soil is well suited to most urban uses. Low strength is a moderate limitation on sites for local roads and streets. The corrosion of uncoated steel and concrete is a moderate limitation. Proper design and careful installation can help to overcome these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 9A.

BeB—Bernaldo fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on stream terraces. Slopes are mainly smooth or slightly convex. Areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very friable, strongly acid, yellowish brown fine sandy loam about 7 inches thick. The subsurface layer is about 5 inches of very friable, strongly acid, pale brown fine sandy loam. The subsoil is friable, strongly acid, yellowish brown sandy clay loam. The upper part, from a depth of 12 to 28 inches, has strong brown mottles. The next part, from a depth of 28 to 47 inches, has red mottles. The lower part, from a depth of 47 to 63 inches, has red mottles and has streaks and pockets of uncoated sand.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight. The seasonal

high water table is at a depth of 4 to 6 feet during winter.

Included with this soil in mapping are areas of Attoyac and Gallime soils and areas of a soil that is similar to the Bernaldo soils but is slightly sandier in the lower part. Attoyac soils have a reddish subsoil. Gallime soils have a surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Bernaldo soil is used mainly as pasture or woodland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with crimson clover, arrowleaf clover, or vetch can increase forage production and improve the fertility of the soil. Applications of fertilizer and lime are needed for high yields.

This soil is well suited to woodland. The main commercial trees are loblolly pine and shortleaf pine. Plantations of loblolly pine or slash pine have been established in some areas that previously were used as cropland. No major limitations affect timber production. Good woodland management practices can increase production.

This soil is well suited to crops, such as corn and vegetables. Applications of fertilizer and lime are needed for high yields. Incorporating crop residue into the soil and planting cover crops help to maintain tilth and control erosion. Contour farming and terraces also help to control erosion.

This soil is suited to most urban uses. The wetness and seepage are limitations on sites for sanitary facilities. The wetness and the moderate shrink-swell potential are limitations on building sites. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can help to overcome these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 10A.

BoB—Bowie fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on broad interstream divides in the uplands. Slopes are mainly smooth or slightly convex. Areas are irregular in shape and range from 10 to 1,000 acres in size.

Typically, the surface layer is very friable, slightly acid, yellowish brown fine sandy loam about 5 inches thick. The subsurface layer is very friable, slightly acid, light yellowish brown fine sandy loam about 6 inches thick. The subsoil is friable, strongly acid sandy clay loam. The upper part, from a depth of 11 to 35 inches, is yellowish brown and has yellowish red mottles. The next part, from a depth of 35 to 64 inches, is brownish yellow and has red mottles and plinthite. The lower part, from a depth of 64 to 80 inches, is brownish yellow and has red mottles, plinthite, and streaks and pockets of uncoated sand.

This soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is moderate. The seasonal high water table is at a depth of 3.5 to 5.0 feet during winter and spring.

Included with this soil in mapping are small areas of Kirvin, Kullit, Lilbert, and Sacul soils. Kirvin soils have a red, clayey subsoil. Kullit and Sacul soils have gray mottles in the upper part of the subsoil. Lilbert soils have a sandy surface layer 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Bowie soil is used mainly as pasture. Some areas are wooded, and a small acreage is used as cropland.

The main pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with clover or vetch can increase forage production and improve the fertility of the soil. Good grazing management and applications of fertilizer and lime also increase forage production.

This soil is well suited to woodland. It has no major limitations. Loblolly pine and shortleaf pine are the main commercial trees.

Corn and truck crops, such as sweet potatoes, watermelons, peas, and onions are the main crops. Applications of fertilizer and lime are needed for good yields. Farming on the contour and constructing terraces help to control erosion.

This soil is suited to most urban uses. The moderately slow permeability and the wetness are limitations on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can overcome most of these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 9A.

BoD—Bowie fine sandy loam, 5 to 8 percent slopes. This strongly sloping soil is on uplands. Slopes are mainly smooth or slightly convex. Areas are long and narrow and range from 10 to 150 acres in size.

Typically, the surface layer is very friable, strongly acid, dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is about 5 inches of very friable, medium acid, light yellowish brown fine sandy loam. The subsoil is friable sandy clay loam. The upper part, from a depth of 11 to 16 inches, is strongly acid, is yellowish brown, and has yellowish red mottles. The next part, between depths of 16 and 34 inches, is

very strongly acid, is brownish yellow, and has red mottles. The next part, between depths of 34 and 45 inches, is very strongly acid, is brownish yellow, and has red mottles and about 3 percent plinthite. The lower part, from a depth of 45 to 63 inches, is very strongly acid, is mottled brownish yellow, light gray, and red, and has about 8 percent plinthite.

This soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is severe. The seasonal high water table is at a depth of 3.5 to 5.0 feet during winter and spring.

Included with this soil in mapping are small areas of Kirvin, Lilbert, Sacul, and Tenaha soils. Kirvin soils have a reddish, clayey subsoil. Lilbert and Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Sacul soils have gray mottles in the upper part of the subsoil. Included soils make up less than 15 percent of the map unit.

The Bowie soil is used mainly as pasture or woodland.

The main pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with clover or vetch can increase forage production and improve the fertility of the soil. Good grazing management and applications of fertilizer and lime also increase forage production.

This soil is well suited to woodland. It has no major limitations. Loblolly pine and shortleaf pine are the main commercial trees.

This soil can be used for crops. The hazard of erosion is the major management concern. Conservation practices, such as cover crops, terraces, and contour farming are needed to help control erosion.

This soil is suited to most urban uses. The moderately slow permeability and the wetness are limitations on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can overcome most of these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 9A.

ByC—Briley loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on high interstream divides in the uplands. Areas are generally less than 50 acres in size.

Typically, the surface layer is very friable, medium acid, dark brown loamy fine sand about 12 inches thick. The subsurface layer, from a depth of 12 to 27 inches, is very friable, slightly acid, brown loamy fine sand. The subsoil, from a depth of 27 to 60 inches, is friable, strongly acid, red sandy clay loam that has a few ironstone pebbles.

This soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Kirvin, Lilbert, and Wolfpen soils. Kirvin soils have a loamy surface layer. Lilbert and Wolfpen soils have a yellow subsoil. Included soils make up less than 15 percent of the map unit.

Most of the acreage of the Briley soil is used as pasture or woodland. A small acreage is used as cropland.

This soil is well suited to coastal bermudagrass, bahiagrass, and lovegrass. Overseeding with clover or vetch can increase forage production and improve the fertility of the soil. Good grazing management and applications of fertilizer and lime also increase forage production.

This soil is suited to commercial trees, such as loblolly pine and shortleaf pine. Droughtiness is the main limitation affecting timber production. Good woodland management practices can increase production.

A few areas of this soil are used for corn, roses, peas, or sweet potatoes. The droughtiness is the main limitation affecting crop production. Applications of lime and fertilizer are needed to increase yields. Contour farming helps to control erosion.

This soil is suited to most urban uses. Seepage on sites for area sanitary landfills and the corrosion of concrete and uncoated steel are limitations. Proper design and careful installation can help to overcome these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 8S.

CfE—Cuthbert fine sandy loam, 5 to 20 percent slopes. This strongly sloping or moderately steep soil is on uplands. It is generally along breaks to drainageways. Slopes are mainly smooth or convex. Areas are oblong and range from 10 to 800 acres in size.

Typically, the surface layer is very friable, medium acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 9 inches, is very friable, medium acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 9 to 17 inches, is very firm, strongly acid, red clay. The next part, from a depth of 17 to 26 inches, is very firm, very strongly acid, red clay that has yellowish mottles. The lower part, from a depth of 26 to 34 inches, is firm, very strongly acid, red sandy clay loam that has many

yellowish red mottles. The underlying material, from a depth of 34 to 60 inches, is very strongly acid, yellowish red, red, and yellowish brown sandy clay loam and fine sandy loam interbedded with light gray and red shaly material.

This soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Kirvin, Redsprings, and Tenaha soils. Kirvin and Redsprings soils are developed to a greater depth than the Cuthbert soil. Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Also included are small areas of Cuthbert soils that are eroded and gravelly. Included soils make up less than 20 percent of the map unit.

The Cuthbert soil is used mainly as woodland. Some areas have been cleared of trees and are used as pasture.

The main woodland species are pine in the eastern part of the county and hardwoods in the western part. Loblolly pine and shortleaf pine are the main commercial trees produced for timber on this soil. The limitations affecting timber production are the slope and the clayey subsoil.

The main pasture plants are coastal bermudagrass and bahiagrass. Overseeding with clover or vetch increases forage production and improves the fertility of the soil. Adequate applications of fertilizer and lime can also increase forage production. The hazard of erosion can be reduced by good grazing management.

This soil has severe limitations as a site for most urban uses. It has a highly corrosive effect on uncoated steel and concrete. Low strength and the slope are limitations on sites for local roads and streets. The slope and the shrink-swell potential are limitations on building sites. Some of these problems can be overcome by proper design and careful installation.

The capability subclass is VIe, and the woodland ordination symbol is 8C.

CgE—Cuthbert gravelly fine sandy loam, 12 to 30 percent slopes. This moderately steep or steep soil is on side slopes in the uplands. It is on breaks to drainageways or on steep hills. Slopes are mainly smooth or slightly convex. Areas are oblong and range from 10 to 300 acres in size.

Typically, the surface layer is very friable, slightly acid, brown gravelly fine sandy loam about 7 inches thick. The subsoil, from a depth of 7 to 28 inches, is very firm, very strongly acid, red clay that has thin strata of yellowish loamy material and soft sandstone between depths of 20 and 28 inches. The underlying material, between depths of 28 and 60 inches, is very firm, very strongly acid, interbedded yellowish and reddish sandy clay loam and fine sandy loam and gray shale.

This soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Redsprings and Tenaha soils and areas of Cuthbert soils that have about 5 percent of the surface covered with stones. Redsprings soils are developed to a greater depth than the Cuthbert soil. Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Cuthbert soil is used mainly as woodland or for wildlife habitat.

The main woodland species are pine in the eastern part of the county and hardwoods in the western part. Loblolly pine and shortleaf pine are the major commercial trees. Because of the slope and fragments of ironstone in the soil, areas are inaccessible to vehicles. Woodland should be managed in such a manner that natural reproduction maintains the number of trees. Wooded areas are a natural refuge for deer and other wildlife.

This soil is unsuited to crops or pasture. The slope, the hazard of erosion, and the fragments of ironstone are the main limitations.

This soil is poorly suited to urban uses. The slope, the fragments of ironstone, and the shrink-swell potential are the major limitations. Some areas used as homesites have scenic views.

The capability subclass is VIIe, and the woodland ordination symbol is 8R.

CrE—Cuthbert-Urban land complex, 5 to 20 percent slopes. This strongly sloping or moderately steep complex is in urban areas on uplands. It is on breaks to drainageways. Areas are oblong and range from about 10 to 300 acres in size.

This complex is 40 to 70 percent Cuthbert soil, 15 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not feasible at the scale selected.

Typically, the Cuthbert soil has a surface layer of very friable, medium acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 9 inches, is very friable, medium acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 9 to 17 inches, is very firm,

strongly acid, red clay. The next part, from a depth of 17 to 26 inches, is very firm, very strongly acid, red clay that has yellowish mottles. The lower part, from a depth of 26 to 34 inches, is firm, very strongly acid, red sandy clay loam that has many yellowish red mottles. The underlying material, from a depth of 34 to 60 inches, is very strongly acid, yellowish red, red, and yellowish brown sandy clay loam and fine sandy loam interbedded with light gray and red shaly material.

The Cuthbert soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion is severe.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Kirvin, Redsprings, and Tenaha soils and small areas of Cuthbert soils that are gravelly. Kirvin and Redsprings soils are developed to a greater depth than the Cuthbert soil. Tenaha soils have a sandy surface layer 20 to 40 inches thick.

The Cuthbert soil has severe limitations as a site for most urban uses. It has a highly corrosive effect on uncoated steel and concrete. Low strength and the slope are limitations on sites for local roads and streets. The slope and the shrink-swell potential are limitations on building sites. Droughtiness is a limitation affecting lawns and landscaping. The slope and the moderately slow permeability are limitations affecting most kinds of recreational development. Good design and proper installation can overcome some of these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

CuC—Cuthbert and Redsprings soils, graded, 3 to 8 percent slopes. These gently sloping to strongly sloping soils are on uplands. They are mainly on ridges on the highest part of the landscape. Slopes are slightly convex. Areas are irregular in shape and range from 5 to 200 acres in size.

This map unit is broadly defined, and thus its composition varies more than that of most other map units in the county. The mapping has been sufficiently controlled, however, for the anticipated use of the soils. Most areas are about 45 to 65 percent Cuthbert soil, 35 to 55 percent Redsprings soil, and 10 percent other soils. The Redsprings soil makes up 0 to 35 percent of some areas.

This map unit has been surface mined for ironstone gravel. Because much of the topsoil has been removed, soil reclamation and revegetation can be difficult. Most areas have sparse stands of grasses, weeds, and trees. Some areas, however, are barren.

Typically, the surface layer of the Cuthbert soil is about 1 inch of friable, very strongly acid, yellowish red fine sandy loam. The subsoil is very firm, very strongly acid, red clay. The upper part, from a depth of 1 to 8 inches, has mottles in shades of yellow. The lower part, between depths of 8 and 22 inches, has yellowish brown mottles. The underlying material, from a depth of 22 to 60 inches, is very firm, extremely acid, light gray shale that has red mottles.

Typically, the surface layer of the Redsprings soil is about 1 inch of very friable, medium acid, dark reddish brown very gravelly sandy loam. The upper part of the subsoil, from a depth of 1 to 40 inches, is very firm, strongly acid, red clay that has yellowish brown mottles below a depth of 20 inches. The lower part, between depths of 40 and 48 inches, is firm, very strongly acid, red clay loam that has yellowish brown mottles. The underlying material to a depth of 60 inches is firm, very strongly acid, yellowish brown, weathered glauconitic material that has red mottles.

These soils are well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion is severe.

Included with these soils in mapping are areas of Elrose and Kirvin soils and areas of Cuthbert and Redsprings soils that have slopes of more than 8 percent. Included soils make up less than 40 percent of the map unit.

Most of the acreage of the Cuthbert and Redsprings soils is idle land. A few areas are used as improved pasture or as woodland.

These soils are suited to bahiagrass, common bermudagrass, and coastal bermudagrass. Because much of the topsoil has been removed, good grazing management and applications of fertilizer and lime are needed for the establishment and maintenance of pasture plants.

A few areas have been planted to loblolly pine. Some are reseeding naturally. The timber on these soils is mostly of low quality. A high seedling mortality rate and droughtiness are the major limitations.

These soils are not suited to cultivation. The severe hazard of erosion is the major management concern.

These soils are suited to most urban uses. Low strength, the corrosion of uncoated steel and concrete, and the moderate shrink-swell potential are limitations. Proper design and careful installation can help to overcome these limitations.

The capability subclass is VIe. The woodland ordination symbol is 5C in areas of the Cuthbert soil and 6C in areas of the Redsprings soil.

DaC—Darco loamy fine sand, 1 to 6 percent slopes. This gently sloping soil is on broad interstream divides in the uplands. Slopes are plane or convex. Areas are irregular in shape and range from 10 to 500 acres in size.

Typically, the surface layer is very friable, slightly acid, dark brown loamy fine sand 4 inches thick. The subsurface layer, from a depth of 4 to 53 inches, is very friable, slightly acid, yellowish brown loamy fine sand. The upper part of the subsoil, from a depth of 53 to 68 inches, is friable, medium acid, yellowish brown fine sandy loam that has many brownish yellow mottles. The lower part, from a depth of 68 to 80 inches, is firm, strongly acid, strong brown sandy clay loam that has few red mottles.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are areas of Briley, Cuthbert, Gallime, Kirvin, Leagueville, Lilbert, and Tenaha soils. Briley, Lilbert, and Tenaha soils have a surface layer that is 20 to 40 inches thick. Cuthbert soils have a loamy surface layer and a red, clayey subsoil. Gallime soils have a loamy surface layer that is 20 to 40 inches thick. Kirvin soils have a loamy surface layer and a red subsoil. Leagueville soils are wetter than the Darco soil. Included soils make up less than 20 percent of the map unit.

The Darco soil is used mainly as pasture or woodland. A small acreage is cropland.

This soil is well suited to coastal bermudagrass and lovegrass. The low available water capacity is a limitation. Overseeding areas of coastal bermudagrass with vetch can increase forage production and improve the fertility of the soil. Frequent applications of fertilizer and lime are needed for high yields.

Mixed hardwoods and pine are the native trees on this soil. Shortleaf pine and loblolly pine are the main commercial trees. Some areas have been planted to loblolly pine and slash pine. Droughtiness is the main limitation.

This soil is suited to watermelons, peas, sweet potatoes, and roses (fig. 6). Applications of fertilizer and lime are essential for good yields. The slope, the hazard of erosion, and the droughtiness are the main limitations. Contour farming and cover crops reduce the hazard of erosion.

This soil is suited to most urban uses. The corrosion of concrete is a limitation. Seepage is a limitation on sites for most sanitary facilities.

The capability subclass is IIIs, and the woodland ordination symbol is 8S.

DaE—Darco loamy fine sand, 8 to 15 percent slopes. This strongly sloping or moderately steep soil is on side slopes along drainageways. Slopes range from concave to convex. Areas are mostly long and narrow and range from 10 to 600 acres in size.

Typically, the surface layer is very friable, medium acid, dark yellowish brown loamy fine sand 8 inches thick. The subsurface layer, from a depth of 8 to 49 inches, is very friable, medium acid, brown loamy fine sand. The subsoil, from a depth of 49 to 72 inches, is firm, very strongly acid, red sandy clay loam that has common brownish yellow mottles.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is moderate.

Included with this soil in mapping are areas of Cuthbert, Leagueville, and Tenaha soils. Cuthbert soils have a loamy surface layer. Leagueville soils are wetter than the Darco soil. Tenaha soils have a sandy surface layer 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Darco soil is used mainly as woodland. Some areas have been cleared of trees and are used as pasture.

Shortleaf pine and loblolly pine are the primary commercial trees on this soil. Some hardwoods also are suited. Good management can increase timber production. Droughtiness is the main limitation affecting timber production.

This soil is well suited to coastal bermudagrass and lovegrass. Proper use of fertilizer and lime is essential for high production. The low available water capacity is the main limitation affecting forage production.

The slope and the hazard of erosion are the major limitations affecting crop production.

This soil is suited to most urban uses. The corrosion of concrete is a limitation. The slope is a limitation on sites for buildings and local roads and streets. Good design and careful installation can overcome these limitations.

The capability subclass is VIe, and the woodland ordination symbol is 8S.

Db—Derly-Besner complex, 0 to 1 percent slopes. These nearly level soils are on old high terraces that have mounds, flats, and weakly depressional areas. The Derly soil is on the flats and in the depressional areas, and the Besner soil is on the mounds, which are 2.5 to 4.0 feet higher than the flats. The mounds are mainly circular and 30 to 225 feet across. In some areas the Besner soil is on ridges that meander through the flats. Areas are irregular in shape and range from 10 to 150 acres in size.

Figure 6.—Watermelons growing in an area of Darco loamy fine sand, 1 to 6 percent slopes.

This complex is about 50 percent Derly soil, 40 percent Besner soil, and 10 percent other soils. The areas of soils that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the surface layer of the Derly soil is friable, very strongly acid silt loam about 8 inches thick. It is dark brown in the upper part and dark grayish brown in the lower part. The subsurface layer, from a depth of 8 to 14 inches, is friable, very strongly acid, light brownish gray silt loam. The upper part of the subsoil, from a depth of 14 to 17 inches, is firm, very strongly acid, dark grayish brown clay loam that has tongues of light brownish gray silt loam. The next part, from a depth of 17 to 45 inches, is very firm, very strongly acid, dark grayish brown clay. The next part, from a depth of 45 to 57 inches, is very firm, slightly acid, dark gray clay. The lower part, from a depth of 57 to 70 inches, is very firm, slightly acid, gray clay that has brownish yellow mottles.

The Derly soil is poorly drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. Water ponds in the shallow depressional areas during periods of heavy rainfall. The seasonal high water table is within a depth of 1.5 feet during winter and spring.

Typically, the Besner soil has a surface layer of very friable, strongly acid, dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is very friable fine sandy loam. The upper part, from a depth of 5 to 20 inches, is strongly acid and brown. The lower part, from a depth of 20 to 37 inches, is very strongly acid and yellowish brown. The upper part of the subsoil, from a depth of 37 to 63 inches, is friable, very strongly acid, brown loam that has streaks and pockets of pale brown and light gray fine sandy loam. The lower part, from a depth of 63 to 72 inches, is firm, very strongly acid, light brownish gray sandy clay loam that has red mottles.

The Besner soil is well drained. Surface runoff is slow. Permeability and available water capacity are

moderate. The seasonal high water table is at a depth of 4 to 6 feet during winter. The hazard of erosion is slight.

Included with these soils in mapping are small areas of Gallime and Raino soils. Gallime soils have a surface layer that is 20 to 40 inches thick. Raino soils are clay in the lower part of the subsoil. Also included are a soil that is similar to the Derly soil but is less clayey and a soil that does not have tongues of sandier material in the subsoil. Included soils make up less than 10 percent of the map unit.

Most areas of this unit support hardwoods. Some areas are used as improved pasture.

The Besner soil is suited to loblolly pine, shortleaf pine, and sweetgum. The dominant trees on the Derly soil are water oak, willow oak, and sweetgum. Loblolly pine is the main commercial tree. The wetness of the Derly soil makes harvesting pine difficult on the higher lying Besner soil.

Common bermudagrass, fescuegrass, and bahiagrass are adapted to these soils. Overseeding with white clover or singletary peas can increase cool-season forage production and improve the fertility of the soils. Applications of lime and fertilizer are needed to increase production.

The Derly soil is too poorly drained for most cultivated crops. A drainage system is needed if cultivated crops are grown. Applications of fertilizer and lime increase yields.

This unit has severe limitations for most urban uses. The wetness, the shrink-swell potential, and the very slow permeability in the Derly soil are limitations on sites for septic tank absorption fields, buildings, and local roads and streets. Proper design and careful installation are needed to overcome these limitations.

The capability subclass is IIIw. The woodland ordination symbol is 4W in areas of the Derly soil and 9A in areas of the Besner soil.

Dr—Derly-Raino complex, 0 to 1 percent slopes. These nearly level soils are on old high terraces that have mounds, flats, and weakly depressional areas. The Derly soil is on the flats and in the depressional areas, and the Raino soil is on the mounds, which are 1.5 to 3.0 feet higher than the flats. The mounds are mainly circular and 40 to 120 feet across. In some areas the Raino soil is on low ridges that meander through the flats. Areas are irregular in shape and range from 10 to 200 acres in size.

This complex is about 55 percent Derly soil, 35 percent Raino soil, and 10 percent other soils. The areas of soils that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the surface layer of the Derly soil is friable, very strongly acid silt loam about 8 inches thick. It is dark brown in the upper part and dark grayish brown in the lower part. The subsurface layer, from a depth of 8 to 14 inches, is friable, very strongly acid, light brownish gray silt loam. The upper part of the subsoil, between depths of 14 and 17 inches, is firm, very strongly acid, dark grayish brown clay loam that has tongues of light brownish gray silt loam. The next part, from a depth of 17 to 45 inches, is very firm, very strongly acid, dark grayish brown clay. The next part, from a depth of 45 to 57 inches, is very firm, slightly acid, dark gray clay. The lower part, from a depth of 57 to 70 inches, is very firm, slightly acid, gray clay that has common brownish yellow and light gray mottles.

The Derly soil is poorly drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. Water ponds in the shallow depressional areas during periods of heavy rainfall. The seasonal high water table is at a depth of 1.5 feet during winter and spring.

Typically, the surface layer of the Raino soil is very friable, medium acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 12 inches, is very friable, medium acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 12 to 20 inches, is very friable, medium acid, yellowish brown loam. The next part, from a depth of 20 to 34 inches, is friable, very strongly acid, mottled yellowish brown, light brownish gray, and red sandy clay loam that has about 10 percent streaks and pockets of light brownish gray fine sandy loam. The lower part, from a depth of 34 to 60 inches, is extremely firm, very strongly acid, mottled light gray, yellowish brown, and red clay.

The Raino soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. A perched water table is at a depth of 2.0 to 3.5 feet during winter and spring. The hazard of erosion is slight.

Included with these soils in mapping are small areas of Besner, Freestone, and Gallime soils. Besner and Gallime soils do not have a clayey subsoil. The clayey lower part of the subsoil in Freestone soils is deeper than in the Raino soils. Also included are a soil that is similar to the Derly soil but is less clayey and a soil that does not have tongues of sandy material in the subsoil. Included soils make up less than 10 percent of the map unit.

Most areas of this unit support hardwoods. Some areas are used as improved pasture.

The Raino soil is suited to loblolly pine, shortleaf

pine, and water oak. The dominant trees on the Derly soil are water oak, willow oak, and sweetgum. Loblolly pine is the main commercial tree. The wetness limits pine production and makes harvesting difficult.

Common bermudagrass, fescuegrass, and bahiagrass are adapted to these soils. Overseeding with white clover or singletary peas can increase cool-season forage production and improve the fertility of the soils. Applications of lime and fertilizer are needed to increase production.

The Derly soil is too poorly drained for most cultivated crops. A drainage system is needed if cultivated crops are grown. Applications of fertilizer and lime increase yields.

This unit has severe limitations for most urban uses. The wetness, the shrink-swell potential, and the very slow permeability are limitations on sites for septic tank absorption fields, buildings, and local roads and streets. Proper design and careful installation are needed to overcome these limitations.

The capability subclass is IIIw. The woodland ordination symbol is 4W in areas of the Derly soil and 9W in areas of the Raino soil.

ErB—Elrose fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or slightly convex. Areas are irregular in shape and range from 10 to about 400 acres in size.

Typically, the surface layer is very friable, strongly acid, yellowish red fine sandy loam about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 28 inches, is friable, medium acid, dark red sandy clay loam. The next part, between depths of 28 and 52 inches, is friable, medium acid, red clay loam. The lower part, from a depth of 52 to 60 inches, is friable, strongly acid, red clay loam that has about 10 percent brownish yellow fragments.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Alto, Bowie, Oakwood, and Redsprings soils. Alto soils have a yellowish subsoil. Bowie and Oakwood soils have a yellowish subsoil and contain plinthite. Redsprings soils have a clayey subsoil. Included soils make up less than 15 percent of the map unit.

The Elrose soil is mostly used as pasture and smaller areas of woodland. A few small areas are used as cropland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with crimson clover, arrowleaf clover, or vetch increases forage production and improves the fertility of the soil. If good grazing management is used, forage yields can be high. Proper use of fertilizer and lime is essential for good yields.

Loblolly pine and shortleaf pine are the main commercial trees. A few areas that previously were used as cropland have been planted to loblolly pine or slash pine for timber production. This is one of the better soils in the survey area for timber production. It has no major limitations.

Corn and truck crops, such as peas, beans, sweet potatoes, and onions are well adapted to this soil. Constructing terraces and farming on the contour help to control erosion.

This soil is suited to most urban uses. Seepage is a limitation on sites for sewage lagoons. Low strength is a limitation on sites for local roads and streets. The corrosion of steel and concrete is a limitation. Proper design and careful installation can overcome these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 10A.

ErD—Elrose fine sandy loam, 3 to 8 percent slopes. This gently sloping to strongly sloping soil is on foot slopes above drainageways in the uplands. Slopes are smooth or slightly convex. Areas are irregular in shape and range from 10 to 250 acres in size.

Typically, the surface layer is very friable, strongly acid, reddish brown fine sandy loam about 2 inches thick. The subsurface layer, from a depth of 2 to 13 inches, is very friable, very strongly acid, yellowish red fine sandy loam. The upper part of the subsoil, from a depth of 13 to 19 inches, is friable, medium acid, red loam. The next part, from a depth of 19 to 26 inches, is firm, medium acid, dark red clay loam. The lower part, from a depth of 26 to 80 inches, is firm, red clay loam. It is medium acid in the upper part and slightly acid in the lower part.

This soil is well drained. Surface runoff is medium or rapid. Permeability is moderate, and available water capacity is high. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Alto, Bowie, Oakwood, and Redsprings soils. Alto soils have a yellowish subsoil. Bowie and Oakwood soils have a yellowish subsoil and contain plinthite. Redsprings soils have a clayey subsoil. Included soils make up less than 20 percent of the map unit.

The Elrose soil is mostly used as pasture or woodland. A few small areas are used for cropland.

This soil is well suited to bahiagrass, common bermudagrass, and coastal bermudagrass. Crimson clover, arrowleaf clover, and vetch are well adapted

legumes. If good grazing management is used, forage yields can be high. Proper use of fertilizer and lime is needed for good production.

Some areas support mixed pine and hardwoods. Loblolly pine and shortleaf pine are the principal commercial trees. A few areas that previously were used as cropland have been planted to loblolly pine or slash pine. This soil is well suited to timber production. It has no major limitations.

This soil is suited to corn and truck crops, such as peas, beans, sweet potatoes, and onions. Planting cover crops, constructing terraces, and farming on the contour help to control erosion.

This soil is suited to most urban uses. Seepage is a limitation on sites for sewage lagoons. Low strength is a limitation on sites for local roads and streets. The corrosion of concrete and uncoated steel is a limitation. Proper design and careful installation can overcome these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 10A.

Es—Estes silty clay loam, frequently flooded. This nearly level soil is on wide flood plains along the Sabine River in the eastern part of the county. Slopes are 0 to 1 percent. Areas are broad and range from 30 to 1,600 acres in size.

Typically, the surface layer is friable, medium acid, very dark grayish brown silty clay loam 3 inches thick. The upper part of the subsoil, from a depth of 3 to 14 inches, is firm, very strongly acid, grayish brown silty clay loam that has red and strong brown mottles. The next part, from a depth of 14 to 29 inches, is very firm, very strongly acid, light brownish gray silty clay loam that has strong brown mottles. The next part, from a depth of 29 to 48 inches, is very firm, extremely acid, grayish brown silty clay that has yellowish brown and brownish yellow mottles. The lower part, from a depth of 48 to 60 inches, is very firm, very strongly acid, grayish brown clay that has yellowish brown mottles.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability also is very slow, and available water capacity is high. The soil is usually flooded at least once each year. The seasonal high water table is 0.5 foot above to 2.0 feet below the surface during winter and spring.

Included with this soil in mapping are areas of Mantachie and Owentown soils. Mantachie soils are less clayey than the Estes soil. Owentown soils are loamy and are better drained than the Estes soil. Included soils make up less than 15 percent of the map unit.

Most areas of the Estes soil support hardwoods. A few areas have been cleared of trees and are used as pasture.

Water oak, willow oak, and sweetgum are the dominant trees on this soil (fig. 7). In some areas the oak trees have been harvested to make crossties. The wetness and the flooding are limitations affecting the production of pine.

This soil is suited to common bermudagrass and bahiagrass, which are warm-season grasses, and to tall fescue and white clover, which are cool-season plants. The flooding and the wetness limit forage production. Applications of fertilizer and lime increase yields.

This soil is not suited to crops. The frequent flooding is the main hazard.

Because of the flooding and the wetness, this soil is not suited to urban uses.

The capability subclass is Vw, and the woodland ordination symbol is 8W.

FrB—Freestone fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on old, high stream terraces. Slopes are mainly smooth. Areas are irregular in shape and range from 5 to 500 acres in size.

Typically, the surface layer is very friable, medium acid, dark yellowish brown fine sandy loam about 8 inches thick. The subsurface layer, from a depth of 8 to 17 inches, is very friable, slightly acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 17 to 24 inches, is friable, strongly acid, yellowish brown sandy clay loam that has common yellowish brown mottles. The next part, between depths of 24 and 33 inches, is friable, strongly acid, brownish yellow sandy clay loam that has many strong brown and common light brownish gray mottles. The next part, from a depth of 33 to 50 inches, is friable, very strongly acid, yellowish brown sandy clay loam that has many red and common light brownish gray mottles and about 15 percent streaks and pockets of light brownish gray uncoated sand. The lower part, from a depth of 50 to 67 inches, is very firm, very strongly acid, mottled gray, light gray, and red clay.

This soil is moderately well drained. Surface runoff is slow. Permeability also is slow, and available water capacity is high. The seasonal high water table is at a depth of 1.5 to 3.0 feet during winter and spring. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Derly, Oakwood, Raino, and Wolfpen soils. Derly soils have a clayey subsoil and are wetter than the Freestone soil. Oakwood soils do not have a clayey layer in the lower part of the subsoil. Raino soils have a clayey layer that is closer to the surface than that of the Freestone soil. Wolfpen soils have a sandy surface

Figure 7.—Water-tolerant hardwoods, mainly water oak and willow oak, in an area of Estes silty clay loam, frequently flooded.

layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Freestone soil is used mainly as pasture. A few small areas have been planted to loblolly pine or are used as cropland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with clover or vetch increases forage production and improves the fertility of the soil. Good grazing management and applications of fertilizer and lime are needed for high forage production.

The woodland species on this soil are mainly mixed hardwoods and pine. Loblolly pine or shortleaf pine can be planted for commercial timber production. The wetness and the equipment limitation are the main limitations affecting timber production.

Corn and vegetable crops, such as peas, sweet potatoes, beans, and turnips are well suited to this soil.

Applications of lime and fertilizer are essential for good yields. Constructing terraces and farming on the contour help to control erosion.

The wetness and the slow permeability are limitations on sites for septic tank absorption fields and sanitary landfills. The wetness and low strength are limitations on sites for buildings and local roads and streets. Proper design and careful installation can overcome most of these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 8W.

GaB—Gallime fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on terraces above drainageways. Slopes are mainly smooth or slightly convex. Areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very friable, medium acid, yellowish brown fine sandy loam about 10 inches thick. The subsurface layer, from a depth of 10 to 22 inches, is very friable, slightly acid, light yellowish brown fine sandy loam. The subsoil is friable, yellowish brown sandy clay loam. The upper part, from a depth of 22 to 31 inches, is medium acid and has red mottles. The next part, between depths of 31 and 50 inches, is strongly acid and has yellowish red mottles and a few streaks and pockets of pale brown uncoated sand. The lower part, from a depth of 50 to 63 inches, is strongly acid and has red mottles and about 5 percent streaks and pockets of pale brown uncoated sand.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of erosion is moderate. The seasonal high water table is at a depth of 4 to 6 feet during winter.

Included with this soil in mapping are small areas of Attoyac, Bernaldo, Lilbert, and Wolfpen soils. Attoyac soils have a red subsoil. Bernaldo soils have a thinner surface layer than that of the Gallime soil. Lilbert and Wolfpen soils have a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 15 percent of the map unit.

The Gallime soil is used mainly as pasture or woodland. A few small areas are used as cropland.

This soil is well suited to bahiagrass, common bermudagrass, coastal bermudagrass, crimson clover, arrowleaf clover, and vetch. If good grazing management is used, forage yields can be high. Proper use of fertilizer and lime is essential for good production.

Loblolly pine and shortleaf pine are the principal commercial trees. A few areas that previously were used as cropland have been planted to loblolly pine or slash pine. This is one of the better soils in the survey area for timber production. It has no major limitations.

Corn, roses, and vegetables, such as peas, beans, and sweet potatoes are well suited to this soil. Applications of lime and fertilizer are essential for good yields. Planting cover crops, terracing, and farming on the contour help to control erosion.

This soil is suited to most urban uses. Seepage is a limitation on sites for sewage lagoons and area sanitary landfills. The wetness is a limitation on sites for septic tank absorption fields and trench sanitary landfills. Proper design and careful installation can overcome these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 9A.

Gw—Gladewater clay, frequently flooded. This nearly level soil is on wide flood plains along the Sabine River in the western part of the county. Slopes are 0 to 1 percent. Areas are broad and long and range from 200 to 6,000 acres in size.

Typically, the surface layer is very firm, medium acid, very dark gray clay about 6 inches thick. The subsoil is very firm clay. The upper part, from a depth of 6 to 18 inches, is medium acid and dark gray. The lower part, from a depth of 18 to 35 inches, is strongly acid, is grayish brown, and has yellowish red mottles. The underlying material, from a depth of 35 to 69 inches, is very firm, strongly acid, grayish brown clay that has yellowish red mottles.

This soil is poorly drained. Surface runoff is very slow. Permeability also is very slow, and available water capacity is high. The hazard of erosion is slight. Flooding occurs at least once each year (fig. 8). The seasonal high water table is within a depth of 3.5 feet during winter and spring.

Included with this soil in mapping are small areas of Mantachie and Owentown soils. Mantachie soils are less clayey than the Gladewater soil. Owentown soils are loamy and are better drained than the Gladewater soil. Included soils make up less than 15 percent of the map unit.

Most areas of the Gladewater soil support hardwoods. A few areas have been cleared of trees and are used as pasture.

Water oak, willow oak, sweetgum, and green ash are the dominant trees on this soil. In some areas the oak trees have been harvested to make crossties. Because of the flooding and the wetness, this soil is unsuited to the production of pine.

Common bermudagrass and bahiagrass are suitable warm-season grasses. Tall fescue and white clover are adapted cool-season plants. The flooding and the wetness limit forage production on this soil. Applications of fertilizer and lime increase production.

Figure 8.—An area of Gladewater clay, frequently flooded, along the Sabine River during a flood.

This soil is not suited to crops. The frequent flooding is the main hazard. This soil is not suited to urban uses because of the flooding and the wetness.

The capability subclass is Vw, and the woodland ordination symbol is 6W.

Ke—Keechi loam, frequently flooded. This nearly level soil is on flood plains. Slopes are mainly smooth or concave. Areas are long and narrow and range from 10 to 350 acres in size.

Typically, the surface layer is very friable, strongly acid, dark brown loam about 2 inches thick. The subsurface layer, from a depth of 2 to 7 inches, is friable, medium acid, grayish brown loam. Between depths of 7 and 20 inches are stratified layers of strongly acid, light brownish gray, very friable loamy fine sand and friable loam that have common yellowish red mottles. From a depth of 20 to 35 inches, the soil is friable, strongly acid, gray loam that has thin strata of light brownish gray silty material. From a depth of 35 to

60 inches, it is very friable, medium acid, dark gray fine sandy loam that has few light yellowish brown mottles.

This soil is poorly drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is slight. The seasonal high water table is at or near the surface during winter and spring and within a depth of 4 feet throughout the rest of the year. Flooding generally occurs two or three times a year and usually lasts 1 to 3 days. It is most likely to occur from December through May.

Included with this soil in mapping are small areas of Mantachie and Owentown soils. Mantachie soils are more clayey than the Keechi soil and not so wet. Owentown soils are loamy and are better drained than the Keechi soil. Also included is a soil that is similar to the Keechi soil but has organic layers near the surface. Included soils make up less than 25 percent of the map unit.

In most areas this soil is in its natural state and is used for wildlife habitat. A few small areas are used as pasture.

This soil is well suited to wetland plants and to shallow water areas. These habitat elements make it a natural refuge for waterfowl, such as wood ducks, and for other wildlife.

Common bermudagrass and bahiagrass could be grown on this soil. However, the seasonal high water table and the wetness make establishment of pastures difficult.

Sweetgum and water oak are the main native commercial trees on this soil. River birch and willow are common noncommercial trees. The equipment limitation, seedling mortality, and plant competition make commercial timber production difficult.

Because of the flooding and the wetness, this soil is not suited to cropland or to urban uses.

The capability subclass is Vw, and the woodland ordination symbol is 9W.

KfC—Kirvin very fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on ridges and stream divides in the uplands. Slopes are mainly slightly convex. Areas are oval to oblong and range from 10 to 300 acres in size.

Typically, the surface layer is very friable, strongly acid, dark brown very fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 11 inches, is very friable, strongly acid, pale brown very fine sandy loam. The subsoil is firm clay. The upper part, between depths of 11 and 41 inches, is very strongly acid and red. It has strong brown mottles from a depth of 23 to 41 inches. The lower part, from a depth of 41 to 47 inches, is extremely acid, is yellowish red, and has light brownish gray and yellowish brown mottles. The underlying material, from a depth of 47 to 64 inches, is stratified friable, extremely acid, red and yellowish red sandy clay loam and light brownish gray shaly material.

This soil is well drained. Surface runoff is medium or rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Bowie, Briley, Lilbert, and Sacul soils. Bowie soils have a yellow, loamy subsoil. Briley and Lilbert soils have a sandy surface layer that is 20 to 40 inches thick. Sacul soils are wetter than the Kirvin soil and have gray mottles in the upper part of the subsoil. Included soils make up less than 20 percent of the map unit.

The Kirvin soil is used mainly as pasture (fig. 9). Some areas are used as woodland, and a small acreage is cropland.

This soil is well suited to coastal bermudagrass, bahiagrass, and common bermudagrass. Overseeding with crimson clover, arrowleaf clover, or vetch can increase forage production and improve the fertility of the soil. Good grazing management and proper use of fertilizer and lime are essential for high yields.

Shortleaf pine and loblolly pine are the main commercial trees. Good woodland management practices can increase timber yields. No major limitations affect timber production.

Corn and vegetable crops grow well on this soil. Applications of fertilizer and lime are essential for good yields. Planting cover crops, constructing terraces, and farming on the contour help to control erosion.

This soil is suited to most urban uses. The moderately slow permeability is a limitation on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can overcome these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 8A.

KgC—Kirvin gravelly fine sandy loam, 2 to 8 percent slopes. This gently sloping to strongly sloping soil is on uplands. It generally is on oval ridges and stream divides. Slopes are mainly convex. Areas range from 5 to 150 acres in size.

Typically, the surface layer is very friable, strongly acid, dark brown gravelly fine sandy loam about 5 inches thick. The subsurface layer, from a depth of 5 to 14 inches, is very friable, medium acid, brown gravelly fine sandy loam. The subsoil, from a depth of 14 to 45 inches, is very firm, very strongly acid, red clay that has brownish yellow mottles. The underlying material to a

Figure 9.—A well managed meadow of coastal bermudagrass in an area of Kirvin very fine sandy loam, 1 to 5 percent slopes.

depth of 64 inches is stratified friable, extremely acid, red, brownish yellow, and light brownish gray loamy, sandy, and shaly materials.

This soil is well drained. Surface runoff is medium or rapid. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Bowie, Briley, Cuthbert, and Lilbert soils. Bowie soils have a yellow, loamy subsoil. Briley and Lilbert soils have a sandy surface layer that is 20 to 40 inches thick. Cuthbert soils are not so thick as the Kirvin soil. Also included are areas of Kirvin soils where as much as 5 percent of the surface is covered with stones. Included soils make up less than 20 percent of the map unit.

The Kirvin soil is used mainly as woodland. Some areas are used as pasture. A few very small areas are used as cropland.

Loblolly pine and shortleaf pine are the main commercial trees on this soil. The gravel on the surface is a limitation affecting timber production. Proper woodland management can increase woodland yields.

Bahiagrass, common bermudagrass, and coastal bermudagrass are suitable pasture plants. Overseeding areas of grasses with crimson clover, arrowleaf clover, or vetch can increase forage production and improve

the fertility of the soil. Good grazing management and applications of fertilizer and lime also can increase forage production.

The hazard of erosion is the main management concern if crops are grown on this soil. Cover crops, terraces, and contour farming are needed to help control erosion.

This soil is suited to most urban uses. The moderately slow permeability is a limitation on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can help to overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 8F.

KuB—Kullit fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on stream divides and foot slopes and at the head of drainageways. Slopes are mainly smooth or concave. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is friable fine sandy loam about 9 inches thick. It is medium acid and dark grayish brown in the upper 3 inches and strongly acid and dark brown in the lower 6 inches. The subsurface layer, from a depth of 9 to 19 inches, is friable, strongly acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 19 to 39 inches, is firm, very strongly acid, yellowish brown sandy clay loam that has common mottles in shades of gray, brown, and red. The next part, from a depth of 39 to 59 inches, is firm, very strongly acid, yellowish brown sandy clay loam that has many grayish brown, yellowish red, and red mottles and 2 to 3 percent streaks and pockets of light gray uncoated sand. The lower part, from a depth of 59 to 70 inches, is very firm, very strongly acid, grayish brown clay that has common red mottles and 3 percent streaks and pockets of light gray uncoated sand.

This soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The seasonal high water table is within a depth of 2 to 3 feet during winter and spring. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bowie, Kirvin, Lilbert, and Sacul soils. Bowie soils do not have gray mottles in the upper part. Kirvin soils have a red, clayey subsoil. Lilbert soils have a sandy surface layer that is 20 to 40 inches thick. Sacul soils have a red, clayey subsoil that has gray mottles in the upper part. Included soils make up less than 15 percent of the map unit.

The Kullit soil is used mostly as pasture. Some areas are wooded, and a very small area is used for crops.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding areas of grasses with clover or vetch increases forage production and improves the fertility of the soil. Good grazing management and applications of fertilizer and lime produce high yields.

The woodland species on this soil are mainly mixed pine and hardwoods. Loblolly pine and shortleaf pine are the main commercial trees. Proper woodland management practices can increase timber production.

This soil is suited to cultivation. Corn and vegetables grow well on this soil. Applications of fertilizer and lime are essential for high yields. Farming on the contour and constructing terraces help to control erosion.

This soil is suited to most urban uses. The moderately slow permeability and the wetness are limitations on sites for septic tank absorption fields. The Kullit soil has a highly corrosive effect on steel and concrete. Low strength is a limitation on sites for local roads and streets. The shrink-swell potential is a limitation on sites for building foundations. Good design and proper installation are needed to overcome these limitations.

The capability subclass is IIe, and the woodland ordination symbol is 9W.

KvC—Kirvin-Urban land complex, 1 to 5 percent slopes. This gently sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to 450 acres in size.

This complex is 40 to 70 percent Kirvin soil, 20 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Kirvin soil has a surface layer of very friable, strongly acid, dark brown very fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 11 inches, is very friable, strongly acid, pale brown very fine sandy loam. The upper part of the subsoil, between depths of 11 and 41 inches, is firm, very strongly acid, red clay that has strong brown mottles. The lower part, from a depth of 41 to 47 inches, is friable, extremely acid, yellowish red clay that has light brownish gray and yellowish brown mottles. The underlying material, from a depth of 47 to 64 inches, is stratified friable, extremely acid, red and yellowish red sandy clay loam and light brownish gray shaly clay.

The Kirvin soil is well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion also is moderate.

In areas of Urban land, the soils have been so

altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Cuthbert, Oakwood, and Redsprings soils and areas of Kirvin soils that are gravelly.

The Kirvin soil is suited to most urban uses. It has a highly corrosive effect on uncoated steel and concrete. Low strength is a limitation on sites for local roads and streets. The shrink-swell potential is a limitation on building sites. No major limitations affect lawns and landscaping. The moderately slow permeability is a limitation affecting some kinds of recreational development. Proper design and careful installation are needed to overcome these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

LgB—Leagueville loamy fine sand, 0 to 5 percent slopes. This nearly level to gently sloping soil is at the bottom of narrow drainageways and on short side slopes along drainageways. Slopes are mainly smooth or concave. Areas are long and narrow and range from about 10 to 200 acres in size.

Typically, the surface layer is very friable, strongly acid loamy fine sand about 15 inches thick. It is very dark gray in the upper 8 inches and dark gray in the lower part. The subsurface layer, from a depth of 15 to 28 inches, is very friable, very strongly acid, grayish brown loamy fine sand. The subsoil is friable, very strongly acid sandy clay loam. The upper part, from a depth of 28 to 44 inches, is gray and has yellowish brown and reddish brown mottles. The lower part, from a depth of 44 to 63 inches, is light gray and has many reddish brown and yellowish brown mottles.

This soil is poorly drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is slight. The seasonal high water table is at a depth of 6 to 18 inches during winter and spring.

Included with this soil in mapping are small areas of Pickton, Raino, and Wolfpen soils. Pickton soils have a sandy surface layer that is 40 to 80 inches thick, and they are better drained than the Leagueville soil. Raino soils have a loamy surface layer. Wolfpen soils have a yellowish subsoil. Included soils make up less than 20 percent of the map unit.

The Leagueville soil is used mainly as woodland. A few small areas are used as pasture.

The main woodland species on this soil are hardwoods. Water oak and sweetgum are dominant. A few loblolly pine are in some areas. The equipment limitation, seedling mortality, and severe plant competition make commercial timber production difficult.

This soil is suited to bahiagrass, common bermudagrass, and fescue grass. The seasonal high water table and the wetness make establishment of pastures difficult. Applications of fertilizer and lime increase forage production.

This soil is not suited to cropland. The wetness is the main limitation. This soil also is not suited to urban uses because of the wetness.

The capability subclass is IVw, and the woodland ordination symbol is 8W.

LtC—Lilbert loamy fine sand, 1 to 6 percent slopes. This gently sloping soil is on interstream divides in the uplands. Slopes are slightly convex or smooth. Areas are irregular in shape and range from 5 to 600 acres in size.

Typically, the surface layer is very friable, strongly acid, brown loamy fine sand about 9 inches thick. The subsurface layer, from a depth of 9 to 24 inches, is very friable, slightly acid, pale brown loamy fine sand. The upper part of the subsoil, from a depth of 24 to 31 inches, is firm, medium acid, yellowish brown sandy clay loam. The next part, from a depth of 31 to 47 inches, is friable, medium acid, yellowish brown sandy clay loam that has red and brown mottles and about 8 percent plinthite. The next part, from a depth of 47 to 67 inches, is firm, strongly acid, brownish yellow sandy clay loam that has red and brownish yellow mottles and about 5 percent plinthite. Streaks and pockets of uncoated sand make up about 8 percent of this layer. The lower part, from a depth of 67 to 74 inches, is mottled grayish brown, brownish yellow, and red, very strongly acid clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow, and available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Bowie, Briley, and Darco soils. Bowie soils have a surface layer that is thinner than that of the Lilbert soil and are less sandy. Briley soils have a red subsoil. Darco soils have a surface layer that is 40 to 80 inches thick. Included soils make up less than 20 percent of the map unit.

Most of areas of the Lilbert soil are used as pasture. Some areas are woodland. A small acreage is used as cropland.

This soil is suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with crimson clover, arrowleaf clover, or vetch can increase forage production and improve the fertility of the soil. Good grazing management and proper use of fertilizer and lime also can increase production.

Figure 10.—A field of roses in an area of Lilbert loamy fine sand, 1 to 6 percent slopes. A grassed waterway is beside the roses.

The woodland species on this soil are mainly mixed pine and hardwoods. Loblolly pine and shortleaf pine are the main commercial trees. Plantations of loblolly pine and slash pine have been established in some areas that previously were used as cropland. Seedling mortality and droughtiness are the main limitations affecting timber production.

This soil is suited to crops, such as corn, watermelons, peas, roses, and sweet potatoes (fig. 10). Proper use of fertilizer and lime is needed for high yields. Contour farming and cover crops help to control erosion.

This soil is suited to most urban uses. The moderately slow permeability is a limitation on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Careful design and installation can overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 8S.

Ma—Mantachie loam, frequently flooded. This soil is on nearly level flood plains along the meander of streams. Slopes are mainly smooth or concave and range from 0 to 1 percent. Areas range from about 200 feet to 0.5 mile in width and from about 20 acres to several thousand acres in size.

Typically, the surface layer is friable, very strongly acid, dark brown loam about 2 inches thick. The subsurface layer is about 6 inches of friable, very strongly acid, dark grayish brown loam that has dark

Figure 11.—An area of Mantachie loam, frequently flooded, along a major creek bottom during a flood.

yellowish brown mottles. The upper part of the subsoil, from a depth of 8 to 13 inches, is friable, very strongly acid, grayish brown loam that has dark yellowish brown mottles. The next part, from a depth of 13 to 29 inches, is friable, very strongly acid, mottled light brownish gray and grayish brown loam. The next part, from a depth of 29 to 39 inches, is friable, very strongly acid, dark gray loam that has yellowish red and strong brown mottles. The lower part, from a depth of 39 to 60 inches, is firm, strongly acid, dark gray clay loam that has yellowish brown and strong brown mottles.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight. On the average this soil is flooded one or two times a year (fig. 11), usually for 2 to 7 days. Flooding is most likely to occur from November through May. The seasonal high water table is at a depth of 12 to 18 inches during winter.

Included with this soil in mapping are areas of Keechi and Owentown soils and areas of a soil that is similar to the Mantachie soil but has less clay. Keechi soils are grayer and wetter than the Mantachie soil. Owentown soils are better drained than the Mantachie soil. Included soils make up less than 30 percent of the map unit.

The Mantachie soil is used mainly as woodland and pasture.

The woodland species on this soil are dominantly hardwoods. Water oak, willow oak, and sweetgum are the principal trees. The flooding and the wetness severely limit pine production. The hardwoods provide excellent wildlife habitat.

This soil is suited to bahiagrass, dallisgrass, and

cool-season tall fescue. Overseeding with white clover increases forage production and improves the fertility of the soil. Applications of fertilizer and lime and good grazing management are essential for high production.

This soil is unsuited to cultivation because of the frequent flooding. It is also unsuited to urban uses because of the frequent flooding and because of the wetness.

The capability subclass is Vw, and the woodland ordination symbol is 8W.

OkB—Oakwood fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on interstream divides in the uplands. Slopes are mainly smooth or slightly convex. Areas are irregular in shape and range from 10 to 500 acres in size.

Typically, the surface layer is very friable, slightly acid, dark brown fine sandy loam about 7 inches thick. The subsurface layer is about 8 inches of very friable, slightly acid, light yellowish brown fine sandy loam. The subsoil is friable sandy clay loam. The upper part, from a depth of 15 to 34 inches, is strongly acid, is yellowish brown, and has few yellowish red mottles. The next part, between depths of 34 and 39 inches, is medium acid, is brownish yellow, and has red mottles and about 3 percent streaks and pockets of light yellowish brown uncoated sand. The next part, from a depth of 39 to 52 inches, is medium acid, is brownish yellow, and has red mottles, about 4 percent streaks and pockets of very pale brown uncoated sand, and about 8 percent plinthite. The lower part, from a depth of 52 to 72 inches, is medium acid, is brownish yellow, and has red mottles, about 10 percent streaks and pockets of very pale brown uncoated sand, and about 5 percent plinthite.

This soil is moderately well drained. Surface runoff is medium or slow. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is moderate. The seasonal high water table is at a depth of 3.5 to 5.0 feet during winter and spring.

Included with this soil in mapping are small areas of Freestone, Gallime, Raino, and Wolfpen soils. Freestone soils have a clayey layer in the lower part of the subsoil. Gallime soils have a surface layer that is 20 to 40 inches thick. Raino soils have a clayey layer within 40 inches of the surface. Wolfpen soils have a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Oakwood soil is used mainly as pasture or woodland. Some small areas are used for crops.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with arrowleaf clover, crimson clover, or vetch increases forage production and improves the fertility of the soil. Good grazing management and applications of fertilizer and lime also increase production.

The main woodland species on this soil are hardwoods and some pine. The dominant hardwoods are southern red oak and sweetgum. Loblolly pine and shortleaf pine are the main commercial trees (fig. 12). No major limitations affect timber production. Proper woodland management practices can increase production.

This soil is suited to crops, such as corn, roses, and vegetables. Applications of fertilizer and lime are essential for good yields. Use of cover crops, green manure crops, terraces, and contour farming help to control erosion and improve fertility.

This soil is suited to most urban uses. The wetness and the moderately slow permeability are limitations on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can overcome these limitations.

The capability subclass is IIIe, and the woodland ordination symbol is 9A.

OkD—Oakwood fine sandy loam, 5 to 8 percent slopes. This strongly sloping soil is on uplands. It is generally along breaks to drainageways. Slopes are mainly smooth or slightly convex. Areas are mainly oblong and range from 5 to 150 acres in size.

Typically, the surface layer is very friable, slightly acid, brown fine sandy loam about 6 inches thick. The subsoil is friable sandy clay loam. The upper part, from a depth of 6 to 18 inches, is medium acid and dark yellowish brown. The next part, between depths of 18 and 26 inches, is very strongly acid and yellowish brown. The next part, from a depth of 26 to 48 inches, is very strongly acid, is yellowish brown, and has red mottles and 2 to 7 percent plinthite. The lower part, from a depth of 48 to 70 inches, is very strongly acid, is yellowish brown, and has red and light brownish gray mottles and about 12 percent streaks and pockets of pale brown uncoated sand.

This soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is severe. The seasonal high water table is within a depth of 3.5 to 5.0 feet during winter and spring.

Included with this soil in mapping are small areas of Cuthbert, Kirvin, and Wolfpen soils. Cuthbert and Kirvin soils have a reddish, clayey subsoil. Wolfpen soils have

Figure 12.—A well managed plantation of loblolly pine in an area of Oakwood fine sandy loam, 1 to 5 percent slopes.

a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Oakwood soil is used mainly as woodland and pasture.

The main woodland species are mixed hardwoods and some pine. The dominant hardwoods are southern red oak and sweetgum. Loblolly pine and shortleaf pine are the main commercial trees. No major limitations affect timber production. Proper woodland management practices can increase production.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with arrowleaf clover, crimson clover, or vetch increases forage production and improves the fertility of the soil. Good grazing management and applications of fertilizer and lime also can increase production.

Erosion is a major limitation affecting crop production. Terracing and farming on the contour help to control erosion.

This soil is suited to most urban uses. The wetness and the moderately slow permeability are limitations on

sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. Proper design and careful installation can overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 9A.

OuC—Oakwood-Urban land complex, 2 to 6 percent slopes. This gently sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 40 to 70 percent Oakwood soil, 15 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Oakwood soil has a surface layer of very friable, slightly acid, dark brown fine sandy loam about 7 inches thick. The subsurface layer is about 8 inches of very friable, slightly acid, light yellowish brown fine sandy loam. The subsoil is friable sandy clay loam. The upper part, from a depth of 15 to 34 inches, is strongly acid, is yellowish brown, and has few yellowish red mottles. The next part, between depths of 34 and 39 inches, is medium acid, is brownish yellow, and has red mottles and about 3 percent streaks and pockets of light yellowish brown uncoated sand. The next part, from a depth of 39 to 52 inches, is medium acid, is brownish yellow, and has red mottles, about 4 percent streaks and pockets of very pale brown uncoated sand, and about 8 percent plinthite. The lower part, to a depth of 72 inches, is medium acid, is brownish yellow, and has red mottles, about 10 percent streaks and pockets of very pale brown uncoated sand, and about 5 percent plinthite.

The Oakwood soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is moderate. The seasonal high water table is at a depth of 3.5 to 5.0 feet during winter and spring.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Cuthbert, Kirvin, and Wolfpen soils. Cuthbert and Kirvin soils have a reddish, clayey subsoil. Wolfpen soils have a sandy surface layer that is 20 to 40 inches thick.

The Oakwood soil is suited to most urban uses. The wetness and the moderately slow permeability are limitations on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. The soil is well suited to lawns and landscaping and to most kinds of recreational development. The slope, however, is a limitation affecting sites for playgrounds.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

Ow—Owentown loamy fine sand, occasionally flooded. This nearly level soil is on flood plains, natural stream levees, and alluvial fans. Areas are long and narrow or irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is very friable, strongly acid, dark yellowish brown loamy fine sand about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 11 inches, is very friable, strongly acid, yellowish brown loamy fine sand that has strong brown mottles. The next part, from a depth of 11 to 20 inches, is very friable, strongly acid, brownish yellow loamy fine sand that has few strata of yellowish brown fine sandy loam. The next part, from a depth of 20 to 33 inches, is friable, strongly acid, yellowish brown fine sandy loam that has pockets of strong brown slightly more clayey fine sandy loam. The next part, from a depth of 33 to 53 inches, is friable, medium acid, dark brown fine sandy loam that has light brownish gray mottles. The lower part, from a depth of 53 to 80 inches, is friable, medium acid, mottled dark yellowish brown and light brownish gray fine sandy loam.

This soil is moderately well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is slight. Flooding occurs less than once in 2 years and usually lasts for less than 2 days. The seasonal high water table is at a depth of 2.5 to 4.0 feet during winter and spring.

Included with this soil in mapping are small areas of Keechi and Mantachie soils and a soil that is similar to the Owentown soil but is slightly wetter. Keechi and Mantachie soils are wetter than the Owentown soil. Included soils make up less than 20 percent of the map unit.

The Owentown soil is used mainly as woodland. Some areas have been cleared of trees and are used as pasture.

Southern red oak, sweetgum, and loblolly pine are the dominant trees on this soil. Loblolly pine is the main commercial tree. A few areas have been established as plantations of loblolly pine. This soil has no major limitations for timber production. Proper woodland management practices can increase production.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding

with legumes increases forage production and improves the fertility of the soil. Proper use of fertilizer and lime also increase forage production.

This soil is suited to most crops, such as corn and vegetables. Cover crops and green manure crops can help to maintain tilth. Applications of fertilizer and lime are needed for high yields.

This soil is not suited to most urban uses. The corrosion of uncoated steel and concrete, the wetness, seepage, and the flooding are the main limitations.

The capability subclass is IIw, and the woodland ordination symbol is 11A.

PkC—Pickton loamy fine sand, 1 to 6 percent slopes. This gently sloping soil is on broad interstream divides in the uplands. Slopes are mainly slightly convex. Areas are irregular in shape and range from 5 to 2,000 acres in size.

Typically, the surface layer is very friable, medium acid, yellowish brown loamy fine sand about 11 inches thick. The subsurface layer, from a depth of 11 to 52 inches, is very friable, slightly acid, pale brown loamy fine sand. The subsoil is friable, medium acid sandy clay loam. The upper part, from a depth of 52 to 64 inches, is yellowish brown and has strong brown mottles. The lower part, from a depth of 64 to 72 inches, is strong brown and has yellowish red mottles.

This soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is slight. During wet periods in winter, the seasonal high water table is at a depth of 4 to 6 feet.

Included with this soil in mapping are areas of Briley, Tonkawa, and Wolfpen soils. Briley soils have a surface layer that is 20 to 40 inches thick and a red subsoil. Tonkawa soils are sandy to a depth of more than 80 inches. Wolfpen soils have a surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Pickton soil is used mainly as pasture. Some areas are used as woodland, and a small acreage is used as cropland.

This soil is well suited to coastal bermudagrass and lovegrass. Overseeding areas of grasses with vetch increases forage production and improves the fertility of the soil. Applications of fertilizer and lime are essential for high production. The low available water capacity is the main limitation.

The main woodland species on this soil are hardwoods and some loblolly pine and shortleaf pine. Post oak, blackjack oak, and hickory are common noncommercial hardwoods. Loblolly pine and shortleaf pine are the main commercial trees. Plantations of loblolly pine and slash pine have been established in some areas that previously were used as cropland (fig. 13). Droughtiness limits the growth of trees and also decreases the survival rate of seedlings.

This soil is suited to watermelons, roses, peas, and sweet potatoes. Applications of fertilizer and lime are essential for good yields. Erosion, the slope, and the droughtiness are the main limitations. Cover crops, high residue crops, and green manure crops help to control erosion and maintain fertility.

This soil is suited to most urban uses. Seepage is a limitation on sites for most sanitary facilities. The corrosion of concrete and uncoated steel is a limitation.

The capability subclass is IIIs, and the woodland ordination symbol is 8S.

PkE—Pickton loamy fine sand, 8 to 15 percent slopes. This strongly sloping or moderately steep soil is on side slopes along drainageways. Areas are commonly long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is very friable, medium acid, brown loamy fine sand 4 inches thick. The subsurface layer, from a depth of 4 to 59 inches, is very friable, medium acid, pale brown loamy fine sand. The subsoil, from a depth of 59 to 72 inches, is firm, very strongly acid, strong brown sandy clay loam that has few reddish brown mottles.

This soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is moderate. During wet periods in winter, the seasonal high water table is at a depth of 4 to 6 feet.

Included with this soil in mapping are areas of Cuthbert, Tenaha, Tonkawa, and Wolfpen soils. Cuthbert soils have a loamy surface layer. Tenaha and Wolfpen soils have a surface layer that is 20 to 40 inches thick. Tonkawa soils are sandy to a depth of more than 80 inches. Included soils make up less than 20 percent of the map unit.

The Pickton soil is used mainly as woodland. Some areas have been cleared of trees and are used as pasture.

The main woodland species are hardwoods. Shortleaf pine and loblolly pine are the main commercial trees. Post oak and hickory are common noncommercial hardwoods. Good management can increase timber production. Droughtiness is the main limitation affecting timber production.

This soil is well suited to coastal bermudagrass and weeping lovegrass. Frequent applications of lime and fertilizer are essential for high production. The low available water capacity is a limitation affecting forage production. The slope and the hazard of erosion are the major limitations affecting crop production.

Figure 13.—A stand of young loblolly pine in an area of Pickton loamy fine sand, 1 to 6 percent slopes.

Seepage and the slope are limitations on sites for sanitary facilities. The slope is the main limitation on sites for dwellings and local roads and streets. Proper design and careful installation can overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 8S.

PuC—Pickton-Urban land complex, 1 to 6 percent slopes. This gently sloping to sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 35 to 70 percent Pickton soil, 15 to 55 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Pickton soil has a surface layer of very friable, medium acid, yellowish brown loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 52 inches, is very friable, slightly acid, pale brown loamy fine sand. The subsoil is friable, medium acid sandy clay loam. The upper part, from a depth of 52 to 64 inches, is yellowish brown and has

strong brown mottles. The lower part, from a depth of 64 to 72 inches, is strong brown and has yellowish red mottles.

The Pickton soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is slight. During wet periods in winter, the seasonal high water table is at a depth of 4 to 6 feet.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Briley, Tonkawa, and Wolfpen soils. Briley and Wolfpen soils have a surface layer that is 20 to 40 inches thick. Also, Briley soils have a red subsoil. Tonkawa soils are sandy to a depth of more than 80 inches.

The Pickton soil is suited to most urban uses. Seepage and a poor filtering capacity are limitations on sites for sanitary facilities. The instability of cutbanks is a limitation on sites for shallow excavations. Droughtiness is a limitation affecting lawns and landscaping. The sandy surface layer is a limitation affecting recreational development. Proper design and careful installation are needed to overcome most of these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

PuE—Pickton-Urban land complex, 8 to 15 percent slopes. This strongly sloping or moderately steep complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 40 to 75 percent Pickton soil, 15 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Pickton soil has a surface layer of very friable, medium acid, brown loamy fine sand 5 inches thick. The subsurface layer, from a depth of 5 to 59 inches, is very friable, medium acid, pale brown loamy fine sand. The subsoil, from a depth of 59 to 72 inches, is firm, very strongly acid, strong brown sandy clay loam that has few reddish brown mottles.

The Pickton soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is low. The hazard of erosion is moderate. During wet periods in winter, the seasonal high water table is at a depth of 4 to 6 feet.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Cuthbert, Tenaha, Tonkawa, and Wolfpen soils. Cuthbert soils have a loamy surface layer. Tenaha and Wolfpen soils have a surface layer that is 20 to 40 inches thick. Tonkawa soils are sandy to a depth of more than 80 inches.

The instability of cutbanks is a limitation on sites for shallow excavations. The slope is a limitation on sites for buildings and local roads and streets. The corrosion of uncoated steel and concrete is a limitation. Droughtiness is a limitation affecting lawns and landscaping. The slope and the sandy surface layer are limitations affecting recreational development. Good design and proper installation are needed to overcome most of these features.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

Px—Pits. This unit consists mainly of sand pits and clay pits. Areas range from about 5 to 100 acres in size.

This unit is located throughout the county. The largest pit is about 100 acres in size and averages about 10 feet deep. It is located near Lindale. The clay from this pit is used in manufacturing brick. The clay pits are mainly in areas of Bernaldo, Pickton, and Wolfpen soils. The sandy and loamy materials are removed to expose the clayey materials, which are used in making brick.

The smaller pits in the county are sand pits, which were dug as a source of building material and fill material. They are as large as about 20 acres in size and average about 10 feet deep. The sand pits are mainly in areas of Pickton and Tonkawa soils.

This map unit has not been assigned a capability subclass or a woodland ordination symbol.

Ra—Raino fine sandy loam, 0 to 2 percent slopes. This nearly level to gently sloping soil is on old terraces. Slopes are smooth or slightly concave. Areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface layer is very friable, medium acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 12 inches, is very friable, medium acid, yellowish brown fine sandy loam. The upper part of the subsoil, from a depth of 12 to 20 inches, is very friable, medium acid, yellowish brown loam. The next part, from a depth of 20 to 34 inches, is friable, very strongly acid, mottled yellowish brown, light brownish gray, and red sandy clay loam that has about 15 percent streaks and pockets of light

brownish gray fine sandy loam. The lower part, from a depth of 34 to 60 inches, is extremely firm, very strongly acid, mottled light gray, yellowish brown, and red clay.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight. The seasonal high water table is perched at a depth of 2.0 to 3.5 feet during winter and spring.

Included with this soil in mapping are small areas of Derly, Freestone, Oakwood, and Wolfpen soils. Derly soils are wetter than the Raino soil. Freestone soils have a clayey layer in the subsoil that is deeper than that of the Raino soil. Oakwood soils do not have a clayey layer in the subsoil. Wolfpen soils have a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Raino soil is used mainly as pasture. A few small areas are used as woodland or cropland.

This soil is well suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with clover increases cool-season forage production and improves the fertility of the soil. Applications of lime and fertilizer increase forage production. The wetness is a limitation affecting pasture production.

The main woodland species are mixed hardwoods and pine. Loblolly pine and shortleaf pine are the principal commercial trees. Good woodland management practices increase timber production. Because of the wetness, the equipment limitation and plant competition are the main limitations affecting timber production.

This soil is suited to corn and vegetable crops. The wetness is the main limitation. Applications of fertilizer and lime are needed to increase yields. A drainage system can also increase crop production.

This soil is suited to some urban uses but has severe limitations for others. The wetness, the very slow permeability, and the shrink-swell potential are limitations on sites for sanitary facilities, buildings, and local roads and streets. Proper design and installation are essential to overcome these limitations.

The capability subclass is IIIs, and the woodland ordination symbol is 9W.

RdC—Redsprings very gravelly sandy loam, 2 to 5 percent slopes. This gently sloping soil is on uplands. It is in narrow interstream divides and on low foot slopes. Slopes are mainly convex. Areas are irregular in shape and range from 10 to 300 acres in size.

Typically, the surface layer is very friable, medium acid, dark reddish brown very gravelly sandy loam about 5 inches thick. The subsoil is strongly acid and red. The upper part, from a depth of 5 to 38 inches, is very firm clay. The lower part, between depths of 38 and 56 inches, is firm clay loam that has glauconitic material and shale fragments. The underlying material to a depth of 63 inches is friable, strongly acid, red, unconsolidated loamy material interbedded with strong brown glauconitic material and light brownish gray and red shale.

This soil is well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Briley, Elrose, and Kirvin soils. Briley soils have a sandy surface layer 20 to 40 inches thick. Elrose soils have a loamy subsoil. Kirvin soils do not have glauconitic material in the subsoil. Also included are Redsprings soils that have as much as 5 percent of the surface covered with stones. Included soils make up less than 25 percent of the map unit.

The Redsprings soil is used mainly as pasture or woodland. A very small acreage is used as cropland.

The main woodland species are mixed hardwoods and pine. Shortleaf pine and loblolly pine are the main commercial trees. The gravel in the surface layer reduces the available water capacity and limits timber production. Proper woodland management practices increase woodland yields.

Bahiagrass, common bermudagrass, and coastal bermudagrass are adapted to this soil. Overseeding with crimson clover, arrowleaf clover, or vetch can increase forage production and improve the fertility of the soil. Applications of fertilizer and lime and good grazing management also increase forage production.

The hazard of erosion is the main management concern if crops are grown on this soil. Cover crops, terraces, and contour farming help to control erosion.

This soil is suited to most urban uses. The corrosion of uncoated steel and concrete is a limitation. Low strength is a limitation on sites for local roads and streets. The moderately slow permeability is a limitation on sites for septic tank absorption fields. Proper design and careful installation can overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 8F.

RdE—Redsprings very gravelly sandy loam, 8 to 25 percent slopes. This strongly sloping to steep soil is on hillslopes above drainageways in the uplands. Slopes are slightly convex. Areas are oblong and range from 20 to several hundred acres in size.

Typically, the surface layer is friable, medium acid, dark reddish brown very gravelly sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 49 inches, is firm, very strongly acid, red clay. From a depth of 24 to 37 inches, it has about 5 percent

fragments of ironstone. Between depths of 37 and 49 inches, it has about 35 percent glauconitic fragments, 10 percent fragments of ironstone, and 5 percent shale fragments. The underlying material, from a depth of 49 to 65 inches, is friable, very strongly acid, strong brown glauconitic material that has about 10 percent ironstone pebbles.

This soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Briley, Cuthbert, Elrose, and Tenaha soils. Briley and Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Cuthbert soils are shallower than the Redsprings soil. Elrose soils have a loamy subsoil. Also included are small areas of Redsprings soils that have 5 to 10 percent of the surface covered with stones. Included soils make up less than 15 percent of the map unit.

The Redsprings soil is used mainly as woodland and for wildlife habitat. A few areas have been cleared of trees and are used as pasture.

The main woodland species are mixed hardwoods and pine. Shortleaf pine and loblolly pine are the main commercial trees. Woodland should be managed in such a manner that natural reproduction maintains the number of trees. The slope and the gravelly surface make planting seedlings difficult. Wooded areas are a natural refuge for deer, squirrel, and other wildlife.

This soil is suited to bahiagrass, common bermudagrass, and coastal bermudagrass. The slope and the gravelly surface layer are limitations affecting forage production. Applications of fertilizer and lime increase production.

Because of the slope and the hazard of erosion, this soil is unsuitable as cropland.

This soil has severe limitations as a site for most urban uses. The slope is the main limitation. Some areas used as homesites have scenic views.

The capability subclass is VIe, and the woodland ordination symbol is 8F.

RuD—Redsprings-Urban land complex, 4 to 12 percent slopes. This gently sloping to strongly sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 40 to 70 percent Redsprings soil, 15 to 55 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Redsprings soil has a surface layer of very friable, medium acid, dark reddish brown very gravelly sandy loam about 5 inches thick. The subsoil is strongly acid and red. The upper part, from a depth of 5 to 38 inches, is very firm clay. The lower part, between depths of 38 and 56 inches, is firm clay loam that has glauconitic material and shale fragments. The underlying material to a depth of 63 inches is friable, strongly acid, red, unconsolidated loamy material interbedded with strong brown glauconitic material and light brownish gray and red shale.

The Redsprings soil is well drained. Surface runoff is medium or rapid. Permeability is moderately slow, and available water capacity is high. The hazard of erosion is severe.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Briley, Cuthbert, Elrose, and Tenaha soils. Briley and Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Cuthbert soils are underlain by shaly material between depths of 20 and 40 inches. Elrose soils have a loamy subsoil.

The Redsprings soil has some limitations for most urban uses. The corrosion of uncoated steel and concrete is a limitation. The slope and the shrink-swell potential are limitations on building sites. Low strength is a limitation on sites for local roads and streets. The slope and small stones are limitations affecting lawns and landscaping. The slope, the moderately slow permeability, and small stones are limitations affecting recreational development. Careful design and installation help to overcome these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

SaC—Sacul very fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. It is in slight depressional areas and at the head of drainageways. Slopes are smooth to slightly concave. Areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very friable, strongly acid very fine sandy loam 9 inches thick. It is dark brown in the upper 3 inches and brown in the lower 6 inches. The subsurface layer, from a depth of 9 to 11 inches, is friable, very strongly acid, strong brown loam. The upper part of the subsoil, from a depth of 11 to 30 inches, is firm, very strongly acid, dark red clay that has brownish mottles. The next part, from a depth of 30 to 35 inches, is firm, very strongly acid, red clay that has grayish and brownish mottles. The next part, from a

depth of 35 to 41 inches, is firm, very strongly acid, grayish brown clay that has red and brownish mottles. The next part, from a depth of 41 to 51 inches, is firm, very strongly acid, light brownish gray clay that has reddish and brownish mottles. The lower part, from a depth of 51 to 58 inches, is firm, extremely acid, light brownish gray clay loam that has brownish and reddish mottles. The underlying material, from a depth of 58 to 80 inches, is firm, extremely acid, light brownish gray clay loam that has yellowish, reddish, and brownish mottles.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and available water capacity is high. Erosion is a severe hazard. The seasonal high water table is at a depth of 2 to 4 feet in winter and early spring.

Included with this soil in mapping are areas of Bowie, Kirvin, and Kullit soils. Bowie soils are loamy throughout and contain plinthite. Kirvin soils do not have gray mottles in the upper part of the subsoil. The upper part of the subsoil of the Kullit soils is yellowish. Included soils make up less than 15 percent of the map unit.

The Sacul soil is used mostly as pasture. Some areas are used as woodland or cropland.

The major pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with crimson clover, arrowleaf clover, or vetch increases forage production and improves the fertility of the soil. Proper use of fertilizer and lime are needed for high yields.

The main woodland species are mixed hardwoods and pine. Shortleaf pine and loblolly pine are the principal commercial trees. The clayey subsoil is the main limitation affecting timber production. Good management practices increase timber production.

Most areas of this soil that are used as cropland are home vegetable gardens. The hazard of erosion and wetness are the main limitations. Contour farming, terracing, cover crops, and green manure crops help to control erosion and maintain fertility. Applications of fertilizer and lime increase yields.

This soil has severe limitations as a site for most urban uses. The shrink-swell potential is a limitation on sites for dwellings. The slow permeability and the wetness are limitations on sites for septic tank absorption fields. The corrosion of uncoated steel and concrete and low strength are limitations on sites for local roads and streets. Special design and careful installation help to overcome these limitations.

The capability subclass is IVe, and the woodland ordination symbol is 8C.

SaD—Sacul very fine sandy loam, 5 to 15 percent slopes. This strongly sloping or moderately steep soil is on uplands along drainageways above streams. Slopes range from convex to concave. Areas are mainly long and narrow or irregular in shape and range from 5 to 70 acres in size.

Typically, the surface layer is very friable, strongly acid, brown or yellowish brown very fine sandy loam 7 inches thick. The upper part of the subsoil, from a depth of 7 to 22 inches, is very firm, strongly acid, red clay that has common light brownish gray mottles. The lower part, from a depth of 22 to 38 inches, is similar to the upper part but has more light brownish gray mottles and also has brownish yellow mottles. The underlying material, from a depth of 38 to 60 inches, is very firm, very strongly acid, gray unconsolidated shale that has a texture of clay loam and many coarse red mottles.

This soil is moderately well drained. Surface runoff is rapid. Permeability is slow, and available water capacity is high. The hazard of erosion is severe. The seasonal high water table is at a depth of 2 to 4 feet during winter and early spring.

Included with this soil in mapping are small areas of Bowie, Cuthbert, and Tenaha soils. Bowie soils have a loamy subsoil. Cuthbert soils do not have gray mottles in the upper part of the subsoil. Tenaha soils have a sandy surface layer that is 20 to 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Sacul soil is used mostly as woodland. A few areas have been cleared of trees and are used as pasture.

The common woodland species on this soil are hardwoods, shortleaf pine, and loblolly pine. Shortleaf pine and loblolly pine are the main commercial trees. The slope and the clayey subsoil are the main limitations affecting timber production. Good woodland management increases timber production.

Coastal bermudagrass, common bermudagrass, and bahiagrass are the major pasture grasses on this soil. Overseeding with crimson clover, arrowleaf clover, or vetch increases forage production and improves the fertility of the soil. Proper use of fertilizer and lime are needed for high yields.

Because of the slope and the hazard of erosion, this soil is unsuitable as cropland.

This soil has severe limitations as a site for most urban uses. The slope and shrink-swell potential are limitations on building sites. The slow permeability is a limitation on sites for septic tank absorption fields. Low strength is a limitation on sites for local roads and streets. The corrosion of uncoated steel and concrete is a limitation. Proper design and careful installation are needed to overcome these problems.

The capability subclass is VIe, and the woodland ordination symbol is 8C.

TeE—Tenaha loamy fine sand, 8 to 20 percent slopes. This strongly sloping or moderately steep soil is on uplands above drainageways. Slopes range from smooth to slightly convex. Areas are mainly long and narrow and range from 10 to 250 acres in size.

Typically, the surface layer is very friable, slightly acid, dark brown loamy fine sand 6 inches thick. The subsurface layer, from a depth of 6 to 28 inches, is very friable, slightly acid, yellowish brown loamy fine sand. The subsoil, from a depth of 28 to 56 inches, is firm, strongly acid or very strongly acid, yellowish red sandy clay loam that has distinct brownish yellow and red mottles. The underlying material, from a depth of 56 to 70 inches, is firm, very strongly acid, red and brownish yellow sandy clay loam and fine sandy loam interbedded with light gray shaly material.

This soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is severe.

Included with this soil in mapping are areas of Cuthbert, Darco, Lilbert, Pickton, and Wolfpen soils. Cuthbert soils have a loamy surface layer. Darco and Pickton soils have a surface layer that is thicker than that of the Tenaha soil. Lilbert and Wolfpen soils are developed to a greater depth than the Tenaha soil. Included soils make up less than 20 percent of the map unit.

Most areas of the Tenaha soil are used as woodland. A smaller acreage is used as improved pasture.

The main woodland species are mixed hardwoods and pine. Loblolly pine and shortleaf pine are the principal commercial trees. The high seedling mortality rate and the slope are the main limitations affecting timber production.

Coastal bermudagrass, common bermudagrass, and bahiagrass are the main pasture grasses on this soil. Overseeding with clover or vetch increases forage production and improves the fertility of the soil. Applications of fertilizer and lime are needed to increase production.

This soil is unsuitable as cropland. The slope and hazard of erosion are the main limitations.

This soil is suited to some urban uses. The slope and seepage are limitations affecting most uses. Proper design and careful installation are needed to overcome these limitations.

The capability subclass is VIe, and the woodland ordination symbol is 8S.

ToC—Tonkawa fine sand, 1 to 6 percent slopes. This gently sloping soil is on broad interstream divides. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to 350 acres in size.

Typically, the surface layer is very friable, medium acid, dark brown fine sand about 10 inches thick. The next layer, from a depth of 10 to 56 inches, is very friable, medium acid, yellowish brown fine sand. The next layer, from a depth of 56 to 76 inches, is very friable, slightly acid, light yellowish brown fine sand. Between depths of 76 and 80 inches is very friable, slightly acid, very pale brown fine sand.

This soil is excessively drained. Surface runoff is very slow. Permeability is rapid, and available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Pickton and Wolfpen soils. Pickton soils have a surface layer that is 40 to 72 inches thick. Wolfpen soils have a surface layer that is 20 to 40 inches thick. Included soils make up less than 15 percent of the map unit.

The Tonkawa soil is used mainly as woodland. Some areas are used as pasture. A very small area is used as cropland.

The main woodland species on this soil are hardwoods. Sandjack oak, hickory, and post oak are the dominant trees. Loblolly pine and shortleaf pine are the main commercial trees. Droughtiness and the low available water capacity limit pine growth. A high seedling mortality rate is the main limitation affecting pine production.

This soil is suited to coastal bermudagrass and lovegrass. Good grazing management and proper use of fertilizer and lime increase forage production. The droughtiness is the main limitation affecting grass production.

This soil is poorly suited to most cultivated crops. Watermelons, however, grow well on this soil. Crop residue and green manure crops are needed to maintain tilth. The droughtiness and the low available water capacity are the main limitations affecting crop production.

This soil is suited to most urban uses. Seepage and the rapid permeability are limitations on sites for sanitary facilities. The instability of cutbanks is a limitation on sites for shallow excavations.

The capability subclass is IVs, and the woodland ordination symbol is 5S.

ToE—Tonkawa fine sand, 8 to 15 percent slopes. This strongly sloping or moderately steep soil is on side slopes above drainageways. Slopes are mainly smooth or convex. Areas are oblong and range from about 10 to 60 acres in size.

Typically, the surface layer is very friable, slightly acid, brown fine sand about 6 inches thick. From a depth of 6 to 53 inches, the soil is very friable, medium acid, yellowish brown fine sand. From a depth of 53 to 70 inches, it is very friable, slightly acid, light yellowish

brown fine sand. From a depth of 70 to 80 inches, it is very friable, slightly acid, very pale brown fine sand.

This soil is excessively drained. Surface runoff is very slow. Permeability is rapid, and available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Pickton and Tenaha soils. Pickton soils a have subsoil within a depth of 80 inches. Tenaha soils have a surface layer that is 20 to 40 inches thick. Included soils make up less than 15 percent of the map unit.

Nearly all areas of the Tonkawa soil are used as woodland.

The main woodland species are hardwoods and some shortleaf pine and loblolly pine. Sandjack oak, post oak, and hickory are the main trees. Droughtiness, the low available water capacity, and a high seedling mortality rate are the main limitations affecting commercial pine production.

This soil is suited to coastal bermudagrass and lovegrass. Good grazing management and proper use of fertilizer and lime increase forage production. The droughtiness is the main limitation affecting grass production.

This soil is not suited to most crops. Watermelons, however, grow well on this soil. Green manure crops and crop residue are needed to maintain tilth. Erosion, the droughtiness, and the low available water capacity are the main limitations affecting crop production.

This soil is suited to most urban uses. The slope, seepage, and the rapid permeability are limitations on sites for sanitary facilities. The slope and the instability of cutbanks are limitations on sites for shallow excavations.

The capability subclass is IVe, and the woodland ordination symbol is 5S.

TuC—Tonkawa-Urban land complex, 1 to 6 percent slopes. This gently sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 35 to 70 percent Tonkawa soil, 20 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Tonkawa soil has a surface layer of very friable, medium acid, dark brown fine sand about 11 inches thick. The next layer, from a depth of 11 to 56 inches, is very friable, medium acid, yellowish brown fine sand. From a depth of 56 to 76 inches is very friable, slightly acid, light yellowish brown fine sand. From a depth of 76 to 80 inches is very friable, slightly acid, very pale brown fine sand.

The Tonkawa soil is excessively drained. Surface runoff is very slow. Permeability is rapid, and available water capacity is low. The hazard of erosion is slight.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are areas of Pickton and Wolfpen soils. Pickton soils have a sandy clay loam subsoil between depths of 40 and 72 inches. Wolfpen soils have a sandy clay loam subsoil between depths of 20 and 40 inches.

The Tonkawa soil is suited to most urban uses. The instability of cutbanks is a severe limitation on sites for shallow excavations. A poor filtering capacity and seepage are limitations on sites for sanitary facilities. Droughtiness is a limitation affecting lawns and landscaping. The sandy surface layer is a limitation affecting recreational development. Proper design and careful installation can overcome these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

Ur—Urban land. This unit consists of areas where 85 to 100 percent of the surface is covered by works or structures, such as streets, sidewalks, paved parking lots, office buildings, hotels, railroad yards, multiple-unit dwellings, shopping centers, churches, and schools. Most of the unit is located in or near the downtown area of the city of Tyler.

In areas of Urban land, the soils have been so altered and obscured that classification of the soils is not practical.

Most of the rainfall in this unit runs off and reaches major drainageways rapidly.

Included in mapping are some built-up areas on which works or structures cover less than 85 percent of the surface and small areas of soils that have been covered by fill material. Included areas make up as much as 20 percent of the map unit.

This map unit has not been assigned a capability subclass.

WoC—Wolfpen loamy fine sand, 1 to 6 percent slopes. This gently sloping soil is on broad interstream divides in the uplands. Slopes are mainly slightly convex. Areas are irregular in shape and range from 10 to 1,200 acres in size.

Typically, the surface layer is very friable, slightly acid, dark brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 27 inches, is very friable, slightly acid, yellowish brown loamy fine sand. The subsoil is friable, yellowish brown sandy clay

loam. The upper part, from a depth of 27 to 38 inches, is strongly acid. The next part, from a depth of 38 to 61 inches, is very strongly acid and has red mottles and about 3 percent streaks and pockets of pale brown uncoated sand. The lower part, from a depth of 61 to 75 inches, is very strongly acid and has red and light brownish gray mottles and about 10 percent streaks and pockets of pale brown uncoated sand.

This soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is slight. The seasonal high water table is at a depth of 4 to 6 feet during winter and spring.

Included with this soil in mapping are small areas of Briley, Gallime, Leagueville, Oakwood, and Pickton soils. Briley soils have a reddish subsoil. Gallime and Oakwood soils have a loamy surface layer. Leagueville soils are wetter than the Wolfpen soil. Pickton soils have a sandy surface layer that is 40 to 72 inches thick. Included soils make up less than 20 percent of the map unit.

The Wolfpen soil is used mainly as pasture. A smaller acreage is used as woodland or cropland.

The major pasture grasses are coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with arrowleaf clover, crimson clover, or vetch can increase forage production and improve the fertility of the soil. Applications of fertilizer and lime are needed to increase forage yields.

The main woodland species are mixed hardwoods and pine. Shortleaf pine and loblolly pine are the main commercial trees. Plantations of loblolly pine and slash pine have been established in some areas that previously were used as cropland. A moderate rate of seedling mortality and droughtiness are the main limitations affecting timber production.

The main crops on this soil are corn, roses, sweet potatoes, and watermelons. Contour farming, cover crops, high residue crops, and green manure crops help to control erosion and maintain fertility.

This soil is suited to most urban uses. Seepage and the wetness are limitations on sites for sanitary facilities. The corrosion of uncoated steel and concrete is a limitation. Proper design and careful installation can overcome these limitations.

The capability subclass is IIIs, and the woodland ordination symbol is 9S.

WoE—Wolfpen loamy fine sand, 8 to 15 percent slopes. This sloping to moderately steep soil is on side slopes above drainageways. Slopes are mainly slightly convex. Areas are long and narrow or oblong and range from 10 to 400 acres in size.

Typically, the surface layer is very friable, strongly acid, brown loamy fine sand about 11 inches thick. The subsurface layer, from a depth of 11 to 31 inches, is very friable, slightly acid, light yellowish brown loamy fine sand. The subsoil is friable, yellowish brown sandy clay loam. The upper part, from a depth of 31 to 41 inches, is strongly acid and has yellowish red mottles. The lower part, from a depth of 41 to 67 inches, is very strongly acid and has yellowish red and light brownish gray mottles and about 10 percent streaks and pockets of pale brown, uncoated sand.

This soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is moderate or severe. The seasonal high water table is at a depth of 4 to 6 feet during winter and spring.

Included with this soil in mapping are small areas of Cuthbert, Pickton, and Tenaha soils. Cuthbert soils have a loamy surface layer. Pickton soils have a surface layer that is 40 to 72 inches thick. Tenaha soils are not developed to so great a depth as the Wolfpen soil. Included soils make up less than 20 percent of the map unit.

The Wolfpen soil is used mainly as pasture or woodland.

Coastal bermudagrass, common bermudagrass, and bahiagrass are the main pasture grasses. Overseeding with arrowleaf clover, crimson clover, or vetch can increase forage production and improve the fertility of the soil. Applications of fertilizer and lime are needed to increase grass production.

The main woodland species are mixed hardwoods and pine. Shortleaf pine and loblolly pine are the main commercial trees. A moderate rate of seedling mortality and droughtiness are the main limitations affecting timber production.

Because of the slope and the severe hazard of erosion, this soil is unsuitable as cropland.

This soil is suited to most urban uses. The slope is a limitation on sites for local roads and streets and for dwellings. The slope and seepage are limitations on sites for sanitary facilities. The corrosion of uncoated steel and concrete is a limitation. Careful design and installation can overcome these limitations.

The capability subclass is VIe, and the woodland ordination symbol is 9S.

WuC—Wolfpen-Urban land complex, 1 to 6 percent slopes. This gently sloping complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 35 to 70 percent Wolfpen soil, 15 to 55 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that

separating them in mapping was not practical at the scale selected.

Typically, the Wolfpen soil has a surface layer of very friable, slightly acid, brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 27 inches, is very friable, slightly acid, yellowish brown loamy fine sand. The subsoil is friable, yellowish brown sandy clay loam. The upper part, from a depth of 27 to 38 inches, is strongly acid. The next part, from a depth of 38 to 61 inches, is very strongly acid and has red mottles and about 3 percent streaks and pockets of pale brown uncoated sand. The lower part, from a depth of 61 to 75 inches, is very strongly acid and has red and light brownish gray mottles and about 10 percent streaks and pockets of pale brown uncoated sand.

The Wolfpen soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion also is moderate. The seasonal high water table is at a depth of 4 to 6 feet during winter and spring.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, driveways, sidewalks, schools, and churches.

Included in this unit in mapping are small areas of Briley, Kirvin, Oakwood, and Pickton soils. Briley soils have a red subsoil. Kirvin soils have a loamy surface layer and a red, clayey subsoil. Oakwood soils have a loamy surface layer. Pickton soils have a sandy surface layer that is 40 to 72 inches thick.

The Wolfpen soil is suited to most urban uses. The corrosion of uncoated steel and concrete is a limitation. The instability of cutbanks is a limitation affecting shallow excavations. Droughtiness is a limitation affecting lawns and landscaping. The sandy surface layer is a limitation affecting recreational development. Proper design and careful installation help to overcome these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

WuE—Wolfpen-Urban land complex, 8 to 15 percent slopes. This sloping to moderately steep complex is in urban areas on uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

This complex is 40 to 75 percent Wolfpen soil, 15 to 50 percent Urban land, and as much as 15 percent other soils. The areas of soils and Urban land that make up this complex are so intricately mixed that separating them in mapping was not practical at the scale selected.

Typically, the Wolfpen soil has a surface layer of very friable, strongly acid, brown loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 31 inches, is very friable, slightly acid, light yellowish brown loamy fine sand. The subsoil is friable and yellowish brown. The upper part, from a depth of 31 to 41 inches, is strongly acid sandy loam that has yellowish red mottles. The lower part, from a depth of 41 to 67 inches, is very strongly acid sandy clay loam that has yellowish red and light brownish gray mottles and about 10 percent streaks and pockets of pale brown uncoated sand.

The Wolfpen soil is well drained. Surface runoff is slow. Permeability and available water capacity are moderate. The hazard of erosion is severe. The seasonal high water table is at a depth of 4 to 6 feet during winter and spring.

In areas of Urban land, the soils have been so altered or covered by buildings or other structures that classification of the soils is not practical. The areas are sites for single-unit dwellings, apartments, streets, sidewalks, driveways, schools, and churches.

Included in this unit in mapping are small areas of Cuthbert, Oakwood, Pickton, and Tenaha soils. Cuthbert soils have a loamy surface layer. Pickton soils have a surface layer that is 40 to 72 inches thick. Tenaha soils are not developed to so great a depth as the Wolfpen soil. They have stratified loamy and shaly material between depths of 40 and 60 inches.

The Wolfpen soil has limitations for most urban uses. The corrosion of uncoated steel and concrete is a limitation. The instability of cutbanks is a limitation affecting shallow excavations. The slope is a limitation on sites for buildings and local roads and streets. The slope and droughtiness are limitations affecting lawns and landscaping. The sandy surface layer and the slope are limitations affecting recreational development. Good design and proper installation help to overcome these limitations.

This complex has not been assigned a capability subclass or a woodland ordination symbol.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. The moisture supply must be adequate, and the growing season must be sufficiently long. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, or commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, or water-control structures.

Prime farmland soils usually receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 5 percent.

Prime farmland makes up about 17 percent of the total acreage in Smith County. It is in scattered areas throughout the county. The largest areas are in general soil map units 2, 5, and 8, and substantial areas are in general soil map unit 3.

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

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 behavioral 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 for 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 recreational 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 that is in harmony with nature.

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

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

Crops and Pasture

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

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

The paragraphs that follow describe the management needed on the cropland and pasture in the county. Management concerns include fertility, reaction, plant competition, and the hazard of erosion.

Crops

The main row crops in Smith County are those produced by truck cropping and gardening. They are roses, peaches, corn, watermelons, sweet potatoes, and peas and small grain for pasture. Applications of fertilizer and lime and weed control are required for high yields. Good management practices, such as farming on the contour, terracing, and managing crop residue, are essential for high production and for erosion control.

Pasture

Areas of improved pasture and hayland are the main source of forage for livestock in the county. Improved or tame pastures support improved varieties of grasses and legumes established to increase forage production. Most of the tame pastures are in areas that previously were used as cropland. The main grasses are coastal bermudagrass, common bermudagrass, and Pensacola bahiagrass. Weeping lovegrass and tall fescue also are well suited. Arrowleaf clover, crimson clover, white clover, and vetch are the main legumes planted with the perennial grasses.

Applications of fertilizer and lime, weed and brush control, and rotation grazing are necessary to achieve and maintain high yields of good-quality forage.

Yields Per Acre

The average yields per acre that can be expected of the principal crops and pasture grasses under a high

level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

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

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

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(7)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless a 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.

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

Woodland Management and Productivity

About 196,700 acres, or 33 percent of the total land area, of Smith County is forest land. Most of the commercial forest land is in the eastern half of the county and along the Sabine and Neches Rivers. In the uplands the main commercial trees are loblolly pine and shortleaf pine. Many areas that previously were used as

cropland have been planted to loblolly pine. On flood plains the main commercial trees are sweetgum, water oak, and willow oak. Timber products, such as lumber, pulpwood, poles, and crossties, are a major source of income in the county.

Soils vary in their ability to produce trees. Available water capacity and depth of the root zone have major effects on tree growth. Soil permeability, fertility, texture, drainage, and position on the landscape also influence tree growth.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to applications of fertilizer than others, and some are more susceptible to erosion after roads are built and timber is harvested. Some soils require special reforestation efforts. In the section "Detailed Soil Map Units," the description of each map unit in the survey area suitable for timber includes information about productivity and major limitations in harvesting timber. Table 7 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

Table 7 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species based on a site index. The larger the number, the greater the potential productivity.

The second part of the ordination symbol, a letter, indicates the major kind of soil limitation affecting use and management. The letter *R* indicates a soil that has a significant limitation because of steepness of slope. The letter *W* indicates a soil in which excess water, either seasonal or year-round, causes a significant limitation. The letter *C* indicates a soil that has a limitation because of the kind or amount of clay in the upper part of the profile. The letter *S* indicates a dry, sandy soil. The letter *F* indicates a soil that has a large amount of coarse fragments. The letter *A* indicates a soil having no significant limitations that affect forest use and management. If a soil has more than one limitation, the priority is as follows: R, W, C, S, and F.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation or harvesting activities expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion-control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of moderate or severe indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning harvesting and reforestation activities, or the use of special equipment.

Ratings of *equipment limitations* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, or surface texture. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment may be needed. The rating is *slight* if equipment use is restricted by soil wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are so steep that wheeled equipment may not be operated safely across the slope, if wetness restricts equipment use from 2 to 4 months per year, or if sandy or clayey extremes in surface texture restrict the use of ground-based equipment. The rating is *severe* if slopes are so steep that wheeled equipment cannot be operated safely across the slope, if wetness restricts equipment use for more than 4 months per year, or if the surface is loose sand that severely restricts the use of ground-based equipment. Ratings of moderate or severe indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management activities.

Ratings of *seedling mortality* refer to the probability of the death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall, as influenced by kinds of soil or topographic features. Seedling mortality is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, and rooting depth. The mortality rate generally is highest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of moderate or severe indicate that it may be necessary to increase the planting rate per acre, to use containerized or larger than usual planting stock, or to make special site preparations, such as bedding, furrowing, installing a surface drainage system, and providing artificial shade for seedlings. Reinforcement planting is often needed if the risk is moderate or severe.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. In Smith County plant competition is more severe on the more droughty soils and on poorly drained soils. The risk is *slight* if competition from undesirable plants hinders adequate natural or artificial reforestation but does not

necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants hinders natural or artificial reforestation to the extent that some type of site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A moderate or severe rating indicates the need for site preparation to minimize competition and to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The *potential productivity* of *common trees* on a soil is expressed as a *site index* and a *volume* number. Common trees that have commercial value are listed in the order of their observed general occurrences. Generally, only two or three tree species dominate. The first tree listed for each soil is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Loblolly pine is the indicator species for soils that support pine in Smith County. Soils that have a very high potential productivity have a site index of 92 or higher. They have a number that is 10 or more as the first part of the ordination symbol. Soils that have a low potential productivity have a site index of 70 or less. They have a number that is 6 or less as the first part of the ordination symbol.

Sweetgum is the indicator species for soils that normally only support hardwoods. Soils that have a very high potential productivity have a site index of 91 or higher. They have a number that is 8 or more as the first part of the ordination symbol. Soils that have a low potential productivity have a site index of less than 80. They have a number that is 5 or less as the first part of the ordination symbol.

The *site index* is determined by taking height measurements and determining the age of dominant and codominant trees within stands of a given species. This index is the average height, in feet, that the trees attain in a 50-year period. This index applies to fully stocked, even-aged, unmanaged stands. The estimates of the productivity of the soils in this survey are based on published data *(5, 9)*.

The *volume* is the yield likely to be produced by the indicator species, expressed in board feet per acre per year.

Trees to plant are those that are used for reforestation or, under suitable conditions, natural regeneration. They are suited to the soils and can produce a commercial wood crop. The desired product, topographic position (such as a low, wet area), and personal preference are three factors among many that can influence the choice of trees for use in reforestation.

Woodland Understory Vegetation

John Patterson, forester, Soil Conservation Service, helped prepare this section.

Understory vegetation consists of grasses, forbs, shrubs, and other plants. If well managed, some woodland can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

Livestock farming is a major agricultural enterprise in Smith County. Cow-calf enterprises are the most common systems of cattle production. Most of the forage is supplied by improved pastures; however, many farmers have woodland that is grazed.

Forage production is highest after an area has been clearcut. Annual herbage yields average about 1,500 pounds (air dry) per acre. On some soils the yield can exceed 3,000 pounds. Grasses make up at least 80 percent of the understory vegetation on grazed woodland that is periodically burned. Sedges, forbs, and shrubs make up the rest.

The density of the canopy determines the amount of light that reaches the understory plants. The canopy cover is a major factor affecting the production of vegetation that is within reach of livestock and large game animals. Livestock management and good silviculture practices, such as thinning timber stands, removing cull trees, and controlled burning, are necessary to maintain moderate or good production of understory vegetation. Without the proper management practices, the canopy cover increases drastically because of the growth of shrubs and hardwoods in the midstory. A site that has a closed canopy of 75 percent or more may not have sufficient carrying capacity for a profitable livestock operation. Use of the area by big game animals will be limited because sufficient browse plants are not available.

The quantity and quality of understory vegetation also 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.

In addition to proper woodland management, proper woodland grazing, deferred grazing, planned grazing systems, and prescribed burning can help to achieve high levels of forage production in a manner consistent with good forest management.

Proper woodland grazing at an intensity that maintains or improves the quantity and quality of desirable plants increases vigor and reproduction of key forage plants, conserves soil and water, improves the

condition of the vegetation, increases forage production, maintains natural beauty, and reduces the hazard of wildfires. The grazing intensity is generally no more than one-half, by weight, of the annual growth of key forage plants in preferred grazing areas.

Deferred grazing consists of postponing grazing or resting the site from grazing for a prescribed period. The rest period promotes the growth of natural vegetation by increasing the vigor of forage and permitting desirable plants to seed. It also provides food reserves for fall and winter grazing, improves the appearance of lands that have adequate cover, improves hydrologic conditions, and reduces the amount of soil loss.

Planned grazing systems increase production of desirable forage plants and trees. Generally, two or more grazing units are rested from grazing in a planned sequence throughout the year or during the growing season of key forage plants.

Prescribed burning is the controlled application of fire to the land. It can help to control undesirable vegetation, increase forage production by removing part of an organic layer, reduce the hazard of wildfires, and destroy old, unpalatable, rough growth.

Table 8 shows, for each soil suitable for woodland, 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 4.5 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 8 also lists the common names of the characteristic vegetation on each soil and the *composition*, by percentage of 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.

Recreation

Ed M. Schwille, biologist, Soil Conservation Service, helped prepare this section.

About 70 percent of the survey area is suited to commercial or noncommercial recreational activities. It has medium to high potential for recreational development because of the suitable soils, climate, water, and vegetation, especially coniferous, flowering shrubs and hardwoods.

Lake Palestine, Lake Tyler, Lake Tyler East, Tyler State Park Lake (fig. 14), about 32 private club lakes, and several other smaller lakes provide fishing and other water-related activities. Areas for extended camping, overnight camping, and picnics are available in the county in addition to those areas in Tyler State Park. Many areas along the Sabine River, which is located on the northern boundary of the county, the Neches River, which is located on the western boundary, and the larger creeks, such as Mud, West Mud, Harris, Black Fork, and Duck creeks, are suited to recreational uses. Private water areas are abundant and range in size from 3 to 150 acres.

White-tailed deer, squirrel, and waterfowl inhabit the county and provide many hunting opportunities. Numerous residential developments also provide recreational sites, such as parks, playgrounds, swimming pools, golf courses, and tennis courts. Several state historical markers and sites are in Smith County. Limited accessibility reduces the potential for development of some scenic areas.

In table 9, the soils of the survey area are rated according to the 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 sewer lines. 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 recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping

Figure 14.—A recreational area at Tyler State Park.

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 gentle 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, stones, or boulders that increase the cost of shaping

sites or of building access roads and parking areas.

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

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

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

Wildlife Habitat

Ed M. Schwille, biologist, Soil Conservation Service, and John D. Wallace, wildlife biologist, Texas Parks and Wildlife Department, helped prepare this section.

Interest in wildlife management has increased in the county. Special consideration is given to the improvement of habitat, especially for game species.

Squirrels, white-tailed deer, furbearers, and waterfowl are the most utilized wildlife resources in the county. Other wildlife species are bobwhite quail, mourning dove, raccoon, opossum, striped skunk, cottontail rabbit, swamp rabbit, bobcat, coyote, armadillo, beaver, nutria, shore birds, hawks, owls, and numerous songbirds.

Forested soils on the flood plains along the Sabine and Neches Rivers and Mud, West Mud, Harris, and Saline Creeks provide excellent habitat for gray squirrels. Fox squirrels are throughout the county. Mature hardwoods help to maintain desirable squirrel habitat in which a population density of one squirrel per acre can be expected during good years. White-tailed deer inhabit all parts of the county. Their population density is highest in the eastern part of the county, on flood plains along the Sabine and Neches Rivers, and along major creeks. It is estimated at 30 to 40 deer per 1,000 acres in these areas.

In the past, good habitat for quail was in abundance in the survey area; however, the extent of this habitat has been reduced because areas that were previously used as cropland have been reforested or converted to improved pasture. Sufficient numbers of quail for hunting are in some areas that have the proper mixture of food, cover, and nesting habitat. Mourning dove inhabit weedy patches and cultivated fields where crop residue is left on the surface. The number of dove in the county fluctuates throughout the year, especially during fall and winter, because of migration.

Furbearers, such as raccoon, bobcat, and fox, are harvested in the county for their pelts. Beaver and nutria have become a nuisance throughout the county. Several hundred acres of cropland, improved pasture, and woodland are inundated each year by beaver. Nutria weaken stock pond dams by burrowing.

Migratory game are commonly hunted in the county. During fall and winter migration, wood duck, mallard, pintail, gadwall, teal, canvasback, and other ducks use area lakes and flooded bottom land as feeding and resting areas. Wood ducks are also resident ducks that can be found in sloughs, beaver ponds, and backwater areas of lakes throughout the year. Small wetland areas and marshes provide additional feeding places for waterfowl.

Numerous reptiles and amphibians, such as frogs and toads, inhabit the county. Poisonous snakes include rattlesnake, copperhead, cottonmouth, and coral snake. Nonpoisonous species include water snakes, king snakes, coachwhips, rat snakes, and bull snakes. Some species help to control the population of rodents. Alligators, which are a threatened species, are along the Sabine River and in other wetland areas in the county. The number of alligators has increased in some private lakes.

Several other endangered or threatened wildlife species inhabit the county. Bald eagles winter around Lake Palestine and the larger surrounding lakes. Although no colonies of red-cockaded woodpeckers are known to exist in the county, areas of good habitat for this species are available. Some of these woodpeckers have been spotted in the county. Other lesser known endangered species that may inhabit the county include the interior least tern, American peregrine falcon, and Louisiana pine snake.

Lake Palestine, numerous small lakes and ponds, the Sabine and Neches Rivers, and various creeks provide good to excellent fishing. Major warm-water species are largemouth black bass, crappie, various sunfish, channel catfish, flathead catfish, bullhead catfish, buffalo, carp, bowfin, and gar. Channel catfish and fathead minnows have been stocked in many small ponds. The Texas Parks and Wildlife Department has a fish hatchery near Tyler. Commercial catfish operations are near Jamestown and Flint.

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

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

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

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

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, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bahiagrass, crimson clover, and arrowleaf 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 flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are Florida paspalum, partridge pea, lespedeza, beaked panicum, and tickclover.

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, ash, pecan, sweetgum, elm, hawthorn, dogwood, hickory, blackberry, and grape. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are yaupon, plum, and honeysuckle.

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

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, Japanese millet, buttonbush, 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. Wildlife attracted to these areas include bobwhite quail, mourning dove, meadowlark, mockingbird, cottontail, and coyote.

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, cardinal, woodcock, thrushes, woodpeckers,

squirrels, armadillo, 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, nutria, mink, and beaver.

Engineering

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

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

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should 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 or 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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 11 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 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. Depth to 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 or 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, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

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

Sanitary Facilities

Table 12 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 12 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 that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to 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 filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

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

Table 12 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, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in 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 groundwater pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a 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 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to 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, a 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 a 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 depth to the water table is less than 1 foot. These soils 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. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source

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

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

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

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

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

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

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

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant nutrients as it decomposes.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for 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 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.

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, to a cemented pan, 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; susceptibility to flooding; subsidence of organic layers; and potential frost action. 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 control 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.

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 21.

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 classification, 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 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, 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 21.

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

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index generally 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 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil 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 in each major soil layer is stated in inches of water per inch of soil. 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 a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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

others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

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

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These 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 0.02 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 over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 17 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 are assigned to one of four groups. They are grouped according to the infiltration 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.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

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

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, 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. The time of year that floods are most likely to occur is expressed in months.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons characteristic of soils

that are not subject to flooding.

Also considered is 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 17 are the depth to the seasonal high water table; the kind of water table—that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

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. 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.

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

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

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

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several pedons in the survey area are given in table 18, the results of chemical analysis in table 19, and the results of mineralogical analysis in table 20. The data are for soils sampled at carefully selected sites. The pedons are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory Staff, Soil Conservation Service, Lincoln, Nebraska.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(10).*

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).

Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material; ⅓ or 1/10 (3/10) bar (4B1), 15 bars (4B2).

Moist bulk density—of less than 2 mm material, saran-coated clods (4A1).

Linear extensibility—change in clod dimension based on less than 2 mm material (4D).

Organic carbon—dichromate, ferric sulfate titration (6A1c).

Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).

Cation-exchange capacity—sum of cations (5A3a).

Base saturation—sum of cations, TEA, pH 8.2 (5C3).

Reaction (pH)—1:1 water dilution (8C1f).

Clay mineralogy—X-ray diffraction (7A2i).

Engineering Index Test Data

Table 21 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 Their Morphology." The soil samples were tested by the

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), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle density), Method A—T 100 (AASHTO), D 653 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(8)*. 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 on laboratory measurements. Table 22 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, 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 clayey, mixed, thermic Typic Hapludults. Cuthbert soils are in this family.

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. There can be some variation in the texture of the surface layer or of the underlying material within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. 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" *(6)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(8)*. Unless otherwise stated, colors in the descriptions are for moist soil. All soils in the county are deep. Following the pedon description is the range of important characteristics of the soils in the series.

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

Alto Series

The Alto series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in marine sediments. Slope ranges from 1 to 3 percent.

Typical pedon of Alto loam, 1 to 3 percent slopes;

from the intersection of Farm Road 2868 and Farm Road 346 in Flint, 2.1 miles south on Farm Road 346 and 200 feet east, in a pasture:

A—0 to 6 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; slightly hard, friable; common fine and medium roots; medium acid; clear wavy boundary.

Bt1—6 to 25 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; very hard, firm; patchy clay films on faces of peds; common fine roots; strongly acid; gradual wavy boundary.

Bt2—25 to 35 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium prominent red (2.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; very hard, firm; many clay films on faces of peds; about 10 percent ironstone pebbles as much as 5 millimeters in diameter; few fine roots; strongly acid; gradual wavy boundary.

Bt3—35 to 41 inches; yellowish brown (10YR 5/6) clay; many fine and medium prominent red (2.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; very hard, firm; many clay films on faces of peds; about 10 percent ironstone pebbles as much as 5 millimeters in diameter; few fine soft black masses; strongly acid; gradual wavy boundary.

Bt4—41 to 50 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium prominent red (2.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; hard, firm; about 5 percent ironstone pebbles as much as 5 millimeters in diameter; common fine soft black masses; strongly acid; gradual wavy boundary.

C1—50 to 54 inches; yellowish brown (10YR 5/6), weathered glauconitic material having a texture of sandy clay loam; massive; very hard; many fine and medium soft black masses; medium acid; clear wavy boundary.

C2—54 to 70 inches; mottled yellowish brown (10YR 5/6), weathered glauconitic material, light gray (10YR 6/1), weathered shale having a clayey texture, and red (2.5YR 4/8) clay; massive; extremely hard; common fine and medium soft black masses; medium acid.

The solum is 50 to 60 inches thick. The content of ironstone pebbles ranges from about 5 to 15 percent, by volume, in part of the subsoil in most pedons.

The A horizon is brown, dark brown, dark yellowish brown, or reddish brown. Reaction is medium acid or slightly acid.

The Bt horizon is dark yellowish brown, yellowish brown, or strong brown. It has few to many red mottles and in some pedons has grayish mottles in the lower part. This horizon is sandy clay loam, clay, or clay loam. The content of clay in the upper 20 inches of the horizon ranges from 20 to 30 percent. Reaction ranges from strongly acid to slightly acid.

The C horizon is dominantly weathered glauconitic material having a texture of sandy clay loam or clay loam. In some pedons, however, the lower part contains massive clay and weathered shale having a clayey texture. Reaction ranges from medium acid to neutral.

Attoyac Series

The Attoyac series consists of very deep, well drained, loamy soils on terraces. These soils formed in loamy alluvial deposits under forest vegetation. Slope ranges from 1 to 3 percent.

Typical pedon of Attoyac fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 155 and Farm Road 16 in Winona, 3.3 miles north on Texas Highway 155, about 0.9 mile east on a private road, and 50 feet north, in a pasture:

A1—0 to 4 inches; dark brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; soft, very friable; many fine and medium roots; strongly acid; clear smooth boundary.

A2—4 to 8 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; soft, very friable; common fine and medium roots; medium acid; clear wavy boundary.

EB—8 to 12 inches; yellowish red (5YR 5/8) fine sandy loam; moderate medium subangular blocky structure; soft, very friable; common fine and medium roots; medium acid; clear wavy boundary.

Bt1—12 to 37 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, firm; few fine roots; thin patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt2—37 to 60 inches; red (2.5YR 4/8) sandy clay loam; moderate medium subangular blocky structure; hard, friable; few fine roots; thin patchy clay films on faces of peds; slightly acid.

The solum is more than 60 inches thick.

The A horizon is dark brown, brown, or strong brown. It has a few ironstone pebbles in some pedons. Reaction ranges from strongly acid to slightly acid.

The EB horizon, or the BA horizon, if it occurs, is yellowish red. It is fine sandy loam or loam. It has a few ironstone pebbles in some pedons. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is red, yellowish red, or strong brown. The browner colors are in the lower part. This horizon is

sandy clay loam or loam. It has few or common ironstone pebbles in some pedons. Reaction ranges from strongly acid to slightly acid.

Bernaldo Series

The Bernaldo series consists of very deep, well drained, loamy soils on terraces (fig. 15). These soils formed in loamy, unconsolidated sediments under mixed pine and hardwood forest vegetation. Slope ranges from 1 to 3 percent.

Typical pedon of Bernaldo fine sandy loam, 1 to 3 percent slopes; from the intersection of Spur 248 and Farm Road 848 directly east of Tyler, 3.85 miles south on Farm Road 848 to Northwest Road, 1.0 mile east on Northwest Road to the end of the road, 300 feet west on a dirt road, and 200 feet south, in a pine plantation:

A—0 to 7 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable; common very fine to coarse roots; strongly acid; clear wavy boundary.

E—7 to 12 inches; pale brown (10YR 6/3) fine sandy loam; massive; slightly hard, very friable; few fine and medium roots; few fine pores; strongly acid; clear wavy boundary.

Bt1—12 to 28 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; few fine pebbles; patchy thin clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—28 to 47 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pebbles; thin patchy clay films on faces of peds and along root channels; strongly acid; gradual wavy boundary.

B/E—47 to 63 inches; yellowish brown (10YR 5/6) sandy clay loam (B); many medium prominent red (2.5YR 4/8) mottles; weak medium and coarse subangular blocky structure; hard, friable; few fine roots; about 15 percent streaks and pockets of pale brown (10YR 6/3) uncoated sand (E); strongly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A or Ap horizon is dark yellowish brown, yellowish brown, dark brown, or brown. The E horizon is pale brown, yellowish brown, or light yellowish brown. The combined thickness of the A and E horizons ranges from 10 to 20 inches. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is yellowish brown, brownish yellow, or strong brown. The number of mottles in shades of brown or red ranges from none to many. This horizon is sandy clay loam or loam. Reaction ranges from very strongly acid to slightly acid.

The B/E horizon is yellowish brown, brownish yellow, or strong brown or is mottled in these colors and in shades of red and gray. It is dominantly sandy clay loam or loam. Streaks and pockets of light gray, light yellowish brown, very pale brown, pale brown, or light brownish gray, uncoated sand make up 5 to 15 percent of this horizon. Reaction ranges from very strongly acid to medium acid.

Besner Series

The Besner series consists of very deep, well drained, loamy soils on low mounds on old terraces. These soils formed in alluvial deposits. Slope is 0 to 1 percent.

Typical pedon of Besner fine sandy loam, in an area of Derly-Besner complex, 0 to 1 percent slopes; from the intersection of Spur 248 and Farm Road 848 in Tyler, 1.8 miles south on Farm Road 848, about 5.0 miles southeast on Old Omen Road, 0.7 mile south on a county road, and 100 feet west, on a mound:

A—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine and medium subangular blocky structure; slightly hard, very friable; many fine and medium roots; strongly acid; clear smooth boundary.

E1—5 to 20 inches; brown (10YR 5/3) fine sandy loam; weak medium subangular blocky structure; slightly hard, very friable; common fine to coarse roots; strongly acid; gradual wavy boundary.

E2—20 to 37 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; slightly hard, very friable; few fine roots; very strongly acid; gradual wavy boundary.

Bt—37 to 54 inches; brown (7.5YR 5/4) loam; weak medium subangular blocky structure; hard, friable; about 4 percent streaks and pockets of pale brown (10YR 6/3) fine sandy loam; sand grains coated with clay; very strongly acid; gradual wavy boundary.

Bt/E—54 to 63 inches; brown (7.5YR 5/4) loam (Bt); weak medium subangular blocky structure; hard, friable; about 15 percent interfingering of light gray (10YR 7/2) fine sandy loam (E); about 10 percent of the matrix is yellowish red (5YR 5/8) and brittle; sand grains coated with clay; very strongly acid; gradual wavy boundary.

Btg—63 to 72 inches; light brownish gray (10YR 6/2) sandy clay loam; many medium and coarse

prominent red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; very hard, firm; sand grains coated with clay; very strongly acid.

The solum is more than 60 inches thick. Reaction ranges from very strongly acid to slightly acid throughout the profile.

The combined thickness of the A and E horizons is 20 to 40 inches. The A horizon is dark grayish brown, brown, or dark brown. The E horizon is brown or yellowish brown.

The Bt horizon is brown, strong brown, or yellowish brown. It is loam or fine sandy loam.

The Bt/E horizon is yellowish brown or brown. It has red and yellowish red mottles. It is loam or fine sandy loam. Interfingers of light gray or pale brown E material make up 5 to 15 percent of the horizon.

The Btg horizon is light brownish gray or light gray or is mottled in these colors and reds, yellows, and browns. It is sandy clay loam or loam. Some pedons do not have a Btg horizon.

Bowie Series

The Bowie series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in loamy, unconsolidated sediments under mixed pine and hardwood forest vegetation. Slope ranges from 1 to 8 percent.

Typical pedon of Bowie fine sandy loam, 1 to 5 percent slopes; about 12 miles northeast of Tyler, from the intersection of Farm Road 2767 and Farm Road 757, about 2.0 miles north on Farm Road 757, about 1,300 feet east on an oil well road, and 150 feet north, in a pasture:

A—0 to 5 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium and coarse granular structure; slightly hard, very friable; many fine and medium roots; slightly acid; clear wavy boundary.

E—5 to 11 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak medium subangular blocky structure; slightly hard, very friable; common fine roots; slightly acid; clear wavy boundary.

Bt1—11 to 35 inches; yellowish brown (10YR 5/8) sandy clay loam; common fine distinct yellowish red (5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; thin patchy clay films on faces of peds and thin continuous clay films along root channels; strongly acid; clear wavy boundary.

Bt2—35 to 49 inches; brownish yellow (10YR 6/8) sandy clay loam; common fine and medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; very hard, friable; common fine roots; thin patchy clay films on faces of peds; 2 or 3 percent plinthite; strongly acid; gradual wavy boundary.

Btv—49 to 64 inches; brownish yellow (10YR 6/8) sandy clay loam; many medium and coarse prominent red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; very hard, friable; common fine roots; about 2 percent skeletans 2 or 3 millimeters wide; thin discontinuous clay films on faces of peds; about 5 percent fragments of ironstone 5 to 20 millimeters long; about 10 percent plinthite; about 15 percent of the matrix is brownish and brittle; strongly acid; clear wavy boundary.

Btv/E—64 to 80 inches; brownish yellow (10YR 6/8) sandy clay loam (Btv); many medium and coarse prominent red (2.5YR 4/6) mottles; 10 percent light brownish gray (10YR 6/2) and light gray (10YR 7/1) skeletans (E) 3 to 5 millimeters thick; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, friable; common fine roots; thin discontinuous clay films on faces of peds; about 5 percent plinthite; strongly acid.

The solum is more than 80 inches thick.

The A horizon is dark grayish brown, brown, or yellowish brown. The E horizon is brown, yellowish brown, or light yellowish brown. Reaction ranges from strongly acid to slightly acid in the A and E horizons.

The Bt horizon is yellowish brown or brownish yellow. In most pedons it has few or common red, yellowish red, or strong brown mottles. It is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

The Btv horizon has the same matrix colors as the Bt horizon, or it is mottled in the same colors. In most pedons it has gray mottles in the lower part and contains 5 to 10 percent plinthite. It is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

The Btv/E horizon contains 5 to 10 percent plinthite and 5 to 15 percent skeletans. It is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

Briley Series

The Briley series consists of very deep, well drained, sandy soils on uplands. These soils formed in loamy sediments under mixed pine and hardwood forest vegetation. Slope ranges from 1 to 5 percent.

Typical pedon of Briley loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 155 and Farm Road 16 in Winona, 3.3 miles north on

Texas Highway 155, about 0.3 mile east on a private road, 2.2 miles south on a pasture road to a hay barn on top of a ridge, 0.3 mile north along a fence to a wooded area, and 150 feet east, in a pasture:

Ap—0 to 5 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; soft, very friable; common fine roots; medium acid; clear wavy boundary.
A—5 to 12 inches; dark brown (7.5YR 4/4) loamy fine sand; weak medium subangular blocky structure; soft, very friable; common fine roots; medium acid; clear wavy boundary.
E—12 to 27 inches; brown (7.5YR 5/4) loamy fine sand; massive; soft, very friable; few fine roots; few fine ironstone pebbles; slightly acid; clear wavy boundary.
Bt1—27 to 36 inches; red (2.5YR 4/8) sandy clay loam; weak coarse subangular blocky structure; very hard, friable; few fine roots; patchy clay films on faces of peds; few ironstone pebbles; strongly acid; gradual wavy boundary.
Bt2—36 to 60 inches; red (2.5YR 4/6) sandy clay loam; weak medium and coarse subangular blocky structure; very hard, friable; patchy clay films on faces of peds; few fine ironstone pebbles; strongly acid.

The solum is more than 60 inches thick. Some pedons have a few ironstone pebbles.

The Ap and A horizons are dark brown, brown, or dark yellowish brown. The E horizon is brown, strong brown, yellowish red, yellowish brown, or light yellowish brown. The combined thickness of the A and E horizons ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is red or yellowish red. In some pedons the lower part of the horizon has a few streaks and pockets of pale brown sandy material. Reaction ranges from very strongly acid to medium acid.

Cuthbert Series

The Cuthbert series consists of very deep, well drained, loamy soils on uplands (fig. 16). These soils formed in interbedded loamy, clayey, and sandy sediments under mixed pine and hardwood forest vegetation. Slope ranges mainly from 5 to 30 percent but is as gentle as 3 percent in some graded areas.

Typical pedon of Cuthbert fine sandy loam, 5 to 20 percent slopes; from the intersection of Loop 323 North and U.S. Highway 271 in Tyler, 13.25 miles northeast on U.S. Highway 271, about 100 feet west on Farm Road 16, about 1.7 miles north on a county road, 0.75 mile east on a county road, and 75 feet north, in a wooded area:

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure parting to weak fine granular; hard, very friable; common fine and medium roots; few fine ironstone pebbles; medium acid; clear wavy boundary.
E—4 to 9 inches; yellowish brown (10YR 5/4) fine sandy loam; weak coarse subangular blocky structure; hard, very friable; common fine, medium, and coarse roots; few fine ironstone pebbles; about 5 percent flat fragments of ironstone as much as 1 inch thick and 6 inches across; medium acid; clear wavy boundary.
Bt1—9 to 17 inches; red (2.5YR 4/6) clay; moderate fine and medium angular and subangular blocky structure; extremely hard, very firm; common fine, medium, and coarse roots; continuous clay films on faces of peds; strongly acid; clear wavy boundary.
Bt2—17 to 26 inches; red (2.5YR 4/6) clay; common fine faint yellowish mottles; moderate medium and coarse angular and subangular blocky structure; extremely hard, very firm; common fine, medium, and coarse roots; continuous clay films on faces of peds; common fine grayish fragments of shale; very strongly acid; clear wavy boundary.
BC—26 to 34 inches; red (2.5YR 4/6) sandy clay loam; many fine, medium, and coarse prominent yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; very hard, firm; common fine, medium, and coarse roots; patchy clay films on faces of peds; common thin discontinuous strata of light gray (10YR 7/2) shale having a clayey texture; very strongly acid; clear wavy boundary.
C—34 to 60 inches; stratified yellowish red (5YR 5/8), red (2.5YR 4/8), and yellowish brown (10YR 5/8) clay, sandy clay loam, and fine sandy loam and about 15 percent light gray (10YR 7/2) shale having a clayey texture; shaly layers range from ¼ to ¾ inch thick; about 5 percent thin discontinuous layers of ironstone; very strongly acid.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is very dark grayish brown, dark brown, brown, or dark yellowish brown. In pedons that have value of 3, the thickness of the horizon is 6 inches or less. The E horizon is yellowish brown, brown, or pale brown. The A and E horizons are fine sandy loam or gravelly fine sandy loam. The content of ironstone gravel ranges as much as 35 percent, by volume, in these horizons. Reaction ranges from very strongly acid to slightly acid.

The Bt horizon is dark red, red, or yellowish red. In

most pedons the lower part of the horizon has strong brown, reddish yellow, yellowish brown, pale brown, or very pale brown mottles and gray, light brownish gray, or light gray fragments of shale. This horizon is clay or clay loam in the upper part and clay, clay loam, or sandy clay loam in the lower part. Reaction ranges from extremely acid to strongly acid.

The BC horizon is red, reddish yellow, yellowish red, or strong brown or is mottled in these colors and grayish colors. It is sandy clay loam, clay, or clay loam. In some pedons it has fragments of sandstone and strata of clayey shale. Reaction ranges from extremely acid to strongly acid.

The C horizon is stratified red, yellowish red, reddish yellow, strong brown, yellowish brown, or brownish yellow, sandy, clayey, and loamy material and thin bands of gray, light brownish gray, or light gray shale having a clayey texture. In some pedons it has thin discontinuous layers of ironstone. This horizon is extremely acid or very strongly acid.

Darco Series

The Darco series consists of very deep, well drained, sandy soils on uplands. These soils formed in loamy sediments under mixed pine and hardwood forests. Slope ranges from 1 to 15 percent.

Typical pedon of Darco loamy fine sand, 1 to 6 percent slopes; from the intersection of Farm Roads 344 and 756, about 4 miles southwest of Whitehouse, 1.1 miles east on Farm Road 344 to Yarborough Lane, 3.7 miles south and east to Lapyere Lane, 0.7 mile south to the county line road, 1.6 miles west to the intersection with an unpaved road, 0.9 mile north and west on the unpaved road, and 450 feet south of the road, in a previously cropped area near a large persimmon tree:

Ap—0 to 4 inches; dark brown (10YR 4/3) loamy fine sand; weak medium granular structure; soft, very friable; many fine and medium roots; slightly acid; clear wavy boundary.

E—4 to 53 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose, very friable; few fine and medium roots; slightly acid; clear wavy boundary.

Bt1—53 to 68 inches; yellowish brown (10YR 5/6) fine sandy loam; many medium faint brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; few fine roots; medium acid; clear wavy boundary.

Bt2—68 to 80 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine prominent red (2.5YR 5/8) mottles; weak coarse subangular blocky structure parting to weak medium subangular blocky; hard, firm; strongly acid.

The solum is more than 80 inches thick.

The A horizon is dark brown, brown, dark yellowish brown, yellowish brown, or grayish brown. The E horizon is yellowish brown, light yellowish brown, pale brown, or brown. The combined thickness of the A and E horizons ranges from 40 to 72 inches. In unlimed areas reaction ranges from very strongly acid to slightly acid.

The Bt horizon is red, yellowish red, strong brown, reddish yellow, or brownish yellow. It is sandy clay loam or fine sandy loam. In some pedons it has common or many red, yellowish red, strong brown, reddish yellow, or brownish yellow mottles. In unlimed areas reaction is very strongly acid or strongly acid. In limed areas reaction is medium acid.

Derly Series

The Derly series consists of very deep, poorly drained, loamy soils on old high terraces. These soils formed in clayey sediments under hardwood forest vegetation. Slope is 0 to 1 percent.

Typical pedon of Derly silt loam, in an area of Derly-Raino complex, 0 to 1 percent slopes; from the intersection of Texas Highway 110 and Interstate 20 in Carroll, 3.6 miles west on Interstate 20, about 1.3 miles north on a county road, and 300 feet east, in a wooded area:

A1—0 to 4 inches; dark brown (10YR 4/3) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; common reddish brown stains along root channels; moderate medium subangular blocky structure; hard, friable; common fine and medium roots; very strongly acid; clear wavy boundary.

A2—4 to 8 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct grayish brown (10YR 5/2) mottles; common reddish brown stains along root channels; moderate fine and medium subangular blocky structure; hard, friable; common fine and medium roots; very strongly acid; clear wavy boundary.

E—8 to 14 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct brownish yellow (10YR 6/6) and dark yellowish brown (10YR 4/4) mottles; common yellowish stains along root channels; weak medium subangular blocky structure; hard, friable; common fine and medium roots; few soft black masses; very strongly acid; clear wavy boundary.

Btg/E—14 to 17 inches; dark grayish brown (10YR 4/2) clay loam; about 20 percent tongues of light brownish gray (10YR 6/2) E material about 8

centimeters long and 12 to 14 millimeters wide; weak medium subangular blocky structure; very hard, firm; common fine roots; common brownish stains along root channels; few soft black masses; very strongly acid; clear wavy boundary.

Btg1—17 to 30 inches; dark grayish brown (10YR 4/2) clay; weak medium and coarse subangular blocky structure; extremely hard, very firm; common fine roots; few sand and silt coatings on faces of peds; few slickensides 0.5 to 1.0 inch wide; very strongly acid; gradual wavy boundary.

Btg2—30 to 45 inches; dark grayish brown (10YR 4/2) clay; weak coarse subangular blocky structure; extremely hard, very firm; few sand and silt coatings on faces of peds; few soft black masses; common slickensides as much as 2 inches across; few fine roots; very strongly acid; gradual wavy boundary.

Btg3—45 to 57 inches; dark gray (10YR 4/1) clay; weak coarse subangular blocky structure; extremely hard, very firm; common sand and silt coatings on faces of peds; common soft black masses; few fine white salts; common slickensides as much as 2 inches across; slightly acid; gradual wavy boundary.

Btg4—57 to 70 inches; gray (10YR 5/1) clay; common fine and medium distinct brownish yellow (10YR 6/6) and light gray (10YR 6/1) mottles; weak coarse subangular blocky structure; extremely hard, very firm; common soft black masses; few fine white salts; slightly acid.

The solum is more than 60 inches thick.

The A horizon is dark brown, brown, or dark grayish brown. The number of mottles in shades of gray, brown, and yellow ranges from none to common. The E horizon is grayish brown or light brownish gray and in most pedons has mottles in shades of brown or yellow. Reaction is very strongly acid or strongly acid in the A and E horizons.

The Btg/E horizon is dark grayish brown, grayish brown, or light brownish gray. The number of mottles in shades of brown, yellow, and red ranges from none to common. Tongues of E material make up 15 to 25 percent of the horizon. This horizon is clay loam or clay. Reaction is very strongly acid or strongly acid.

The Btg horizon is dark gray, gray, dark grayish brown, grayish brown, or light brownish gray. The number of mottles in shades of brown, yellow, and red ranges from none to common. This horizon is clay or silty clay. Reaction ranges from very strongly acid to slightly acid.

Elrose Series

The Elrose series consists of very deep, well drained, loamy soils on uplands. These soils formed in marine sediments, mainly under a mixed hardwood forest and some pine. Slope ranges from 1 to 8 percent.

Typical pedon of Elrose fine sandy loam, 3 to 8 percent slopes; from the intersection of Farm Road 16 and County Road 431 in Lindale, 6.8 miles northwest on County Road 431, about 0.8 mile west on County Road 452, about 0.2 mile south on County Road 445, about 0.2 mile south on County Road 482, and 200 feet east, in a pasture:

A1—0 to 2 inches; reddish brown (5YR 4/4) fine sandy loam; weak fine and medium granular structure; soft, very friable; many fine and medium roots; strongly acid; clear smooth boundary.

A2—2 to 13 inches; yellowish red (5YR 4/6) fine sandy loam; weak medium and coarse granular structure; soft, very friable; common fine and medium roots; few pebbles as much as 5 millimeters in diameter; common soft black concretions; very strongly acid; clear smooth boundary.

Bt1—13 to 19 inches; red (2.5YR 4/6) loam; moderate fine and medium subangular blocky structure; hard, friable; common fine and medium roots; discontinuous clay films on faces of peds and bridging sand grains; few pebbles as much as 5 millimeters in diameter; medium acid; gradual wavy boundary.

Bt2—19 to 26 inches; dark red (2.5YR 3/6) clay loam; moderate medium subangular blocky structure; very hard, firm; common fine and medium roots; continuous clay films on faces of peds; few pebbles as much as 5 millimeters in diameter; medium acid; gradual wavy boundary.

Bt3—26 to 35 inches; red (10R 4/6) clay loam; moderate medium and coarse subangular blocky structure; very hard, firm; few fine and medium roots; continuous clay films on faces of peds and along root channels; few pebbles 5 to 15 millimeters in diameter; few fine and medium fragments of yellowish, weathered glauconitic material as much as 1 centimeter in diameter; medium acid; gradual wavy boundary.

Bt4—35 to 53 inches; red (10R 4/8) clay loam; moderate medium subangular blocky structure; hard, firm; discontinuous clay films on faces of peds and bridging sand grains; few pebbles as much as 5 millimeters in diameter; few fine soft black masses; few fine fragments of yellowish, weathered glauconitic material as much as 5 millimeters in diameter; medium acid; gradual wavy boundary.

Bt5—53 to 80 inches; red (2.5YR 4/8) clay loam; moderate medium subangular blocky structure; hard, firm; discontinuous clay films on faces of peds and bridging sand grains; few pebbles as much as

5 millimeters in diameter; few fine soft black masses; few fine fragments of yellowish, weathered glauconitic material as much as 5 millimeters in diameter; few areas of yellowish red (5YR 5/8) sandy loam surrounding pebbles; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is red, reddish brown, yellowish red, brown, dark brown, or dark reddish brown. In pedons that have value of less than 3.5, the horizon is less than 6 inches thick. Reaction is very strongly acid to slightly acid.

The upper part of the Bt horizon is dark red, red, dark reddish brown, reddish brown, or yellowish red. Texture is sandy clay loam, clay loam, or loam. Reaction is strongly acid to slightly acid.

The lower part of the Bt horizon is red, dark red, or yellowish red. Texture is clay loam or sandy clay loam. The number of fragments of weathered glauconitic material in shades of yellow is few or common. Reaction is very strongly acid to slightly acid.

Estes Series

The Estes series consists of very deep, somewhat poorly drained, loamy soils on flood plains. These soils formed in loamy and clayey alluvium under native hardwood vegetation. Slope is 0 to 1 percent.

Typical pedon of Estes silty clay loam, frequently flooded; from the intersection of Farm Road 16 and Texas Highway 155 in Winona, 3.1 miles north on Highway 155, about 1.75 miles west on a paved county road, 0.1 mile south on County Road 356, about 0.7 mile east on unpaved County Road 352, about 0.5 mile north on County Road 3161, and 800 feet east, in a wooded area on the edge of a pasture:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium granular structure; friable; common fine and medium roots; medium acid; clear wavy boundary.

Bg1—3 to 14 inches; grayish brown (10YR 5/2) silty clay loam; many coarse distinct strong brown (7.5YR 4/6) and common fine prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure parting to weak medium granular; firm; common medium and coarse roots; very strongly acid; clear wavy boundary.

Bg2—14 to 29 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; very firm; common medium roots; very strongly acid; gradual wavy boundary.

Bg3—29 to 48 inches; grayish brown (10YR 5/2) silty clay; many medium distinct brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) mottles; massive; very firm; extremely acid; clear wavy boundary.

Bg4—48 to 60 inches; grayish brown (10YR 5/2) clay; many fine and medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very firm; very strongly acid.

The solum is more than 60 inches thick.

The A horizon is very dark grayish brown or very dark gray. Reaction is strongly acid or medium acid.

The Bg horizon is grayish brown or light brownish gray. It has common or many brownish yellow, yellowish brown, light yellowish brown, strong brown, or yellowish red mottles and common red mottles. This horizon is clay loam, silty clay loam, clay, or silty clay. Reaction is extremely acid or very strongly acid.

Freestone Series

The Freestone series consists of very deep, moderately well drained, loamy soils on old high terraces. These soils formed in clayey unconsolidated sediments, mainly under hardwood forest. Slope ranges from 1 to 3 percent.

Typical pedon of Freestone fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 110 and Interstate 20 in Carroll, 5.8 miles west on Interstate 20, about 1.0 mile south on a county road, and 100 feet east, in a pasture:

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) fine sandy loam; common fine faint brownish mottles; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; few fine pebbles; medium acid; clear wavy boundary.

E—8 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint brownish mottles; massive; slightly hard, very friable; common fine roots; slightly acid; gradual wavy boundary.

Bt1—17 to 24 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium faint strong brown mottles; moderate fine and medium subangular blocky structure; hard, friable; common fine roots; patchy clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—24 to 33 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium distinct strong brown (7.5YR 5/6) and common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; patchy clay films on faces of

peds; about 3 percent streaks and pockets of light brownish gray (10YR 6/2) uncoated sand; strongly acid; gradual wavy boundary.

Bt/E—33 to 50 inches; yellowish brown (10YR 5/6) sandy clay loam; many medium prominent red (2.5YR 4/8) and common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; patchy clay films on faces of peds; about 15 percent streaks and pockets of light brownish gray (10YR 6/2) uncoated sand; very strongly acid; clear wavy boundary.

Btg—50 to 67 inches; mottled gray (10YR 5/1), light gray (10YR 6/1), and red (2.5YR 4/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; patchy clay films on faces of peds; few streaks of uncoated sand; very strongly acid.

The solum is more than 60 inches thick.

The A or Ap horizon is dark brown, dark yellowish brown, or dark grayish brown. The E horizon is yellowish brown, brown, pale brown, or light yellowish brown. The number of faint mottles in shades of brown and red ranges from none to common in the A and E horizons. Reaction ranges from strongly acid to slightly acid in the A and E horizons.

The Bt horizon is yellowish brown or brownish yellow. It has few or common yellowish brown, strong brown, or yellowish red mottles in some part of the horizon and has light brownish gray or gray mottles within a depth of 30 inches. This horizon is sandy clay loam. Reaction is very strongly acid or strongly acid.

The Bt/E horizon has dominantly the same colors, textures, and reaction as the Bt horizon. It has 5 to 15 percent streaks and pockets of light brownish gray or pale brown, uncoated sand. In some pedons it has as much as 3 percent plinthite.

The Btg horizon is mottled gray, light gray, red, strong brown, or yellowish brown. Reaction is very strongly acid or strongly acid. The depth to this horizon ranges from 40 to 56 inches.

Gallime Series

The Gallime series consists of very deep, well drained, loamy soils on terraces and uplands. These soils formed in loamy, unconsolidated sediments under mixed pine and hardwood forest vegetation. Slope ranges from 1 to 5 percent.

Typical pedon of Gallime fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 14 and Farm Road 16 in Red Springs, 0.7 mile south on Farm Road 14, about 200 feet east on a dirt road, and 150 feet south, in an area of pine forest:

A—0 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; soft, very friable; common fine, medium, and coarse roots; few fine pebbles; medium acid; clear wavy boundary.

E—10 to 22 inches; light yellowish brown (10YR 6/4) fine sandy loam; few fine faint brownish mottles; massive; soft, very friable; common fine, medium, and coarse roots; slightly acid; clear wavy boundary.

Bt1—22 to 31 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine faint reddish mottles; weak medium subangular blocky structure; hard, friable; few fine and medium roots; patchy clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—31 to 50 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; patchy clay films on faces of peds; few fine pebbles; few streaks of uncoated sand; strongly acid; gradual wavy boundary.

Bt/E—50 to 63 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium and coarse prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; about 5 percent streaks and pockets of pale brown (10YR 6/3) uncoated sand; about 2 percent plinthite; strongly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is brown, dark brown, yellowish brown, or dark grayish brown. The E horizon is yellowish brown, light yellowish brown, or pale brown. The combined thickness of the A and E horizons is 20 to 40 inches. In unlimed areas reaction ranges from strongly acid to slightly acid.

The Bt horizon is yellowish brown, brownish yellow, or strong brown. The number of mottles in shades of red ranges from none to common. This horizon is sandy clay loam or loam. Reaction ranges from very strongly acid to medium acid.

The Bt/E horizon is yellowish brown or brownish yellow or is mottled in these colors and in shades of red and gray. It is dominantly sandy clay loam or loam. Streaks and pockets of light brownish gray, pale brown, or light yellowish brown, uncoated sand make up 5 to 15 percent of the horizon. Reaction ranges from very strongly acid to medium acid.

Gladewater Series

The Gladewater series consists of very deep, poorly drained, clayey soils on flood plains. These soils formed in clayey alluvium under native vegetation consisting of hardwoods and water-tolerant grasses. Slope is 0 to 1 percent.

Typical pedon of Gladewater clay, frequently flooded; from the intersection of Farm Road 16 and U.S. Highway 69 in Lindale, 7.15 miles north on U.S. Highway 69, about 0.35 mile west along power line right-of-way, and 100 feet north, in a wooded area:

A—0 to 6 inches; very dark gray (10YR 3/1) clay; moderate medium blocky structure; extremely hard, very firm, sticky and plastic; common fine and medium roots; common yellowish red stains along root channels; common sand grains along faces of peds; medium acid; clear wavy boundary.

Bg1—6 to 18 inches; dark gray (10YR 4/1) clay; weak medium blocky structure; extremely hard, very firm, sticky and plastic; common fine and medium roots; common yellowish red stains along root channels; few sand grains along faces of peds; few fine black concretions; medium acid; gradual wavy boundary.

Bg2—18 to 35 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish red (5YR 5/8) mottles; weak coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine crystals of neutral salts; few fine black concretions; common slickensides; strongly acid; gradual wavy boundary.

Cg—35 to 69 inches; grayish brown (10YR 5/2) clay; common fine distinct yellowish red (5YR 5/8) mottles; massive; extremely hard, very firm, sticky and plastic; few fine roots; few fine crystals of neutral salts; few fine black concretions; common slickensides; strongly acid.

The solum ranges from 30 to 60 inches in thickness.

The A horizon is very dark gray. In some pedons it has mottles in shades of brown and red. Reaction ranges from medium acid to neutral.

The Bg horizon is grayish brown, dark grayish brown, dark gray, or light brownish gray. The number of mottles in shades of brown, gray, and red ranges from few to many. Reaction ranges from very strongly acid to slightly acid.

The Cg horizon is gray, dark gray, or grayish brown and has mottles in shades of brown, red, and gray, or it is mottled in these colors. It is dominantly clay or stratified clay and clay loam. In some pedons it has thin strata of sandier material. Reaction ranges from strongly acid to mildly alkaline.

Keechi Series

The Keechi series consists of very deep, poorly drained, loamy soils on flood plains. These soils formed in stratified sandy and loamy alluvium under hardwoods and water-tolerant grasses and shrubs. Slope is 0 to 1 percent.

Typical pedon of Keechi loam, frequently flooded; from the intersection of Loop 323 West and Texas Highway 31 in Tyler, 1.5 miles west on Texas Highway 31, about 1.1 miles south on a county road to the end of the road, 0.2 mile east on a park trail, and 20 feet north, in a creek bottom:

A—0 to 2 inches; dark brown (10YR 3/3) loam; moderate fine granular structure; hard, very friable; common fine, medium, and coarse roots; about 5 percent organic materials in various stages of decomposition; strongly acid; clear wavy boundary.

Ag—2 to 7 inches; grayish brown (10YR 5/2) loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable; common fine and medium roots; many yellowish red coatings on faces of peds; medium acid; clear wavy boundary.

Cg1—7 to 20 inches; strata of light brownish gray (10YR 6/2) loamy fine sand and loam 1 to 4 inches thick (55 percent loose, very friable loamy fine sand and 45 percent hard, friable loam); common medium prominent yellowish red (5YR 4/6) mottles; massive; common fine and medium roots; strongly acid; clear wavy boundary.

Cg2—20 to 35 inches; gray (10YR 5/1) loam; massive; hard, friable; common fine and medium roots; common reddish stains along root channels; about 30 percent thin strata of light brownish gray (10YR 6/2) material that has a slightly higher silt content; strongly acid; gradual wavy boundary.

Cg3—35 to 60 inches; dark gray (10YR 4/1) fine sandy loam; few medium distinct light yellowish brown (2.5YR 6/4) mottles; massive; slightly hard, very friable; few fine roots; medium acid.

The A and Ag horizons are dark grayish brown, dark brown, or grayish brown. Reaction ranges from strongly acid to slightly acid. Some pedons on the flood plains along streams draining areas of recent urban development have an overwash of recently deposited material as much as 10 inches thick. These layers of overwash vary highly in color and texture.

The Cg horizon is gray, dark gray, very dark gray, or light brownish gray. In some pedons it has mottles in shades of brown, yellow, red, and gray. Texture ranges from loamy fine sand to sandy clay loam. Generally the

Figure 15.—Profile of Bernaldo fine sandy loam, 1 to 3 percent slopes. The yellowish brown sandy clay loam subsoil begins at a depth of about 11 inches.

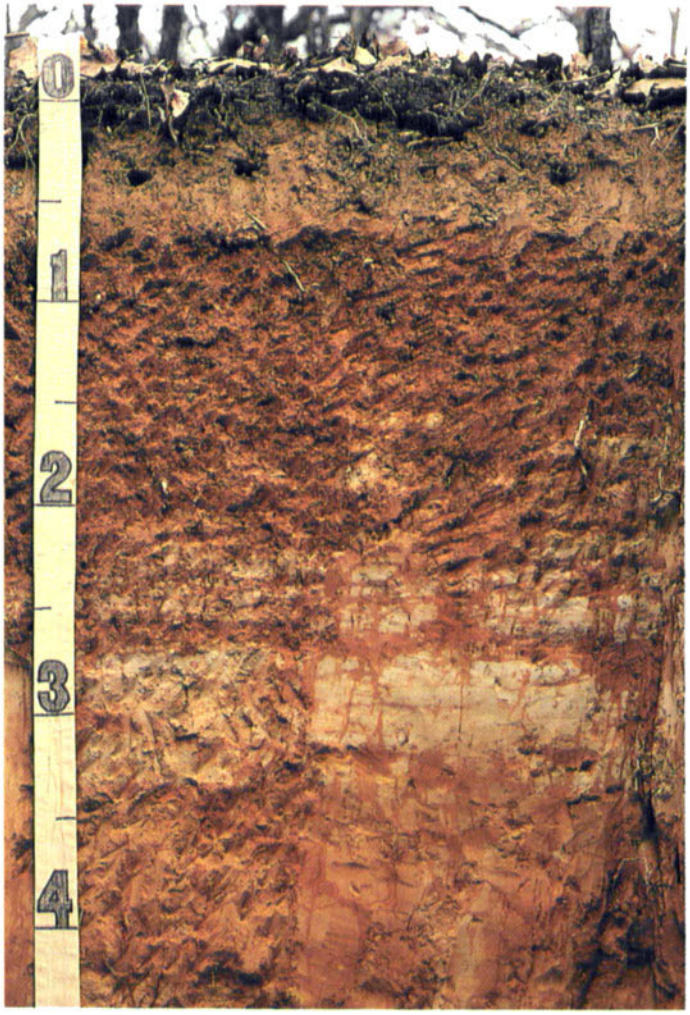

Figure 16.—Profile of Cuthbert fine sandy loam, 5 to 20 percent slopes. The parent material of interbedded loamy, clayey, and sandy sediments begins at a depth of about 26 inches. Depth is marked in feet.

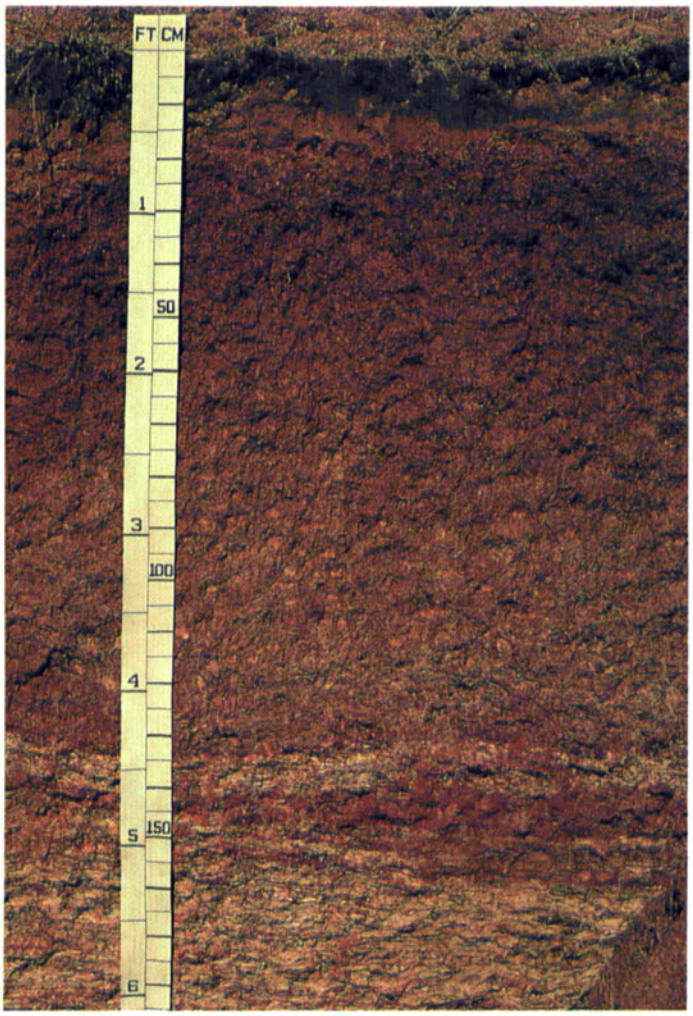

Figure 17.—Profile of Kirvin very fine sandy loam, 1 to 5 percent slopes. The parent material of interbedded loamy and clayey sediments begins at a depth of 53 inches. Depth is marked in feet and centimeters.

Figure 18.—Profile of Mantachie loam, frequently flooded. The gray colors are an indication of intermittent saturation. Depth is marked in feet.

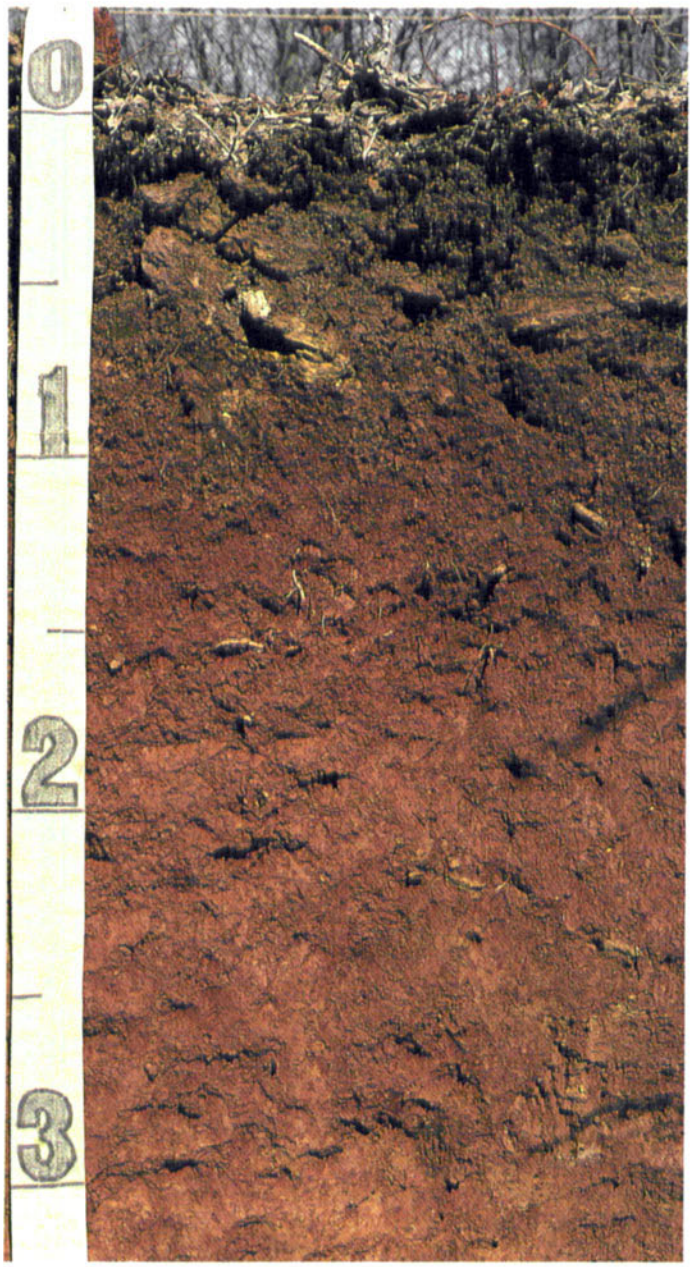

Figure 19.—Profile of Redsprings very gravelly sandy loam, 8 to 25 percent slopes. The red clay subsoil contains fragments of glauconite and ironstone derived from the parent material. Depth is marked in feet.

Figure 20.—Profile of Tonkawa fine sand, 1 to 6 percent slopes. This soil is sandy throughout. Depth to the bottom on the spade is about 70 inches.

Figure 21.—Profile of Wolfpen loamy fine sand, 1 to 6 percent slopes. Eluviation of clay in the lower part of the Bt horizon is indicated by the light-colored vertical streaks. Depth is marked in feet.

horizon is highly stratified, and the average content of clay in the 10- to 40-inch control section ranges from 10 to 18 percent. Reaction ranges from strongly acid to slightly acid.

Kirvin Series

The Kirvin series consists of very deep, well drained, loamy soils on uplands (fig. 17). These soils formed in interbedded loamy and clayey sediments under mixed pine and hardwood forest vegetation. Slope ranges from 1 to 8 percent.

Typical pedon of Kirvin very fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, 6.8 miles southeast on Farm Road 346 and 100 feet north, in a wooded area:

A—0 to 4 inches; dark brown (10YR 4/3) very fine sandy loam; weak fine granular structure; soft, very friable; common fine and few medium and coarse roots; about 10 percent ironstone pebbles; strongly acid; clear smooth boundary.

E—4 to 11 inches; pale brown (10YR 6/3) very fine sandy loam; massive; soft, very friable; common fine and few medium and coarse roots; about 5 percent ironstone pebbles; strongly acid; clear wavy boundary.

Bt1—11 to 23 inches; red (2.5YR 4/6) clay; moderate fine and medium subangular blocky structure; firm, hard; few fine and medium roots; thin continuous clay films on faces of peds; about 3 percent ironstone gravel; very strongly acid; clear wavy boundary.

Bt2—23 to 41 inches; red (2.5YR 4/6) clay; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm, hard; few fine and medium roots; thin continuous clay films on faces of peds; very strongly acid; clear wavy boundary.

BC—41 to 47 inches; yellowish red (5YR 5/8) clay; common fine distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; friable; slightly hard; few fine and medium roots; red clay flows between peds; few flakes of mica; few weathered fragments of sandstone and shale; extremely acid; clear wavy boundary.

C—47 to 64 inches; stratified red (2.5YR 4/6) and yellowish red (5YR 5/8) sandy clay loam and light brownish gray (10YR 6/2) platy, weathered shale having a clayey texture; layers are mainly less than 1 inch thick; friable; few fine and medium roots mainly along vertical fractures; few flakes of mica; extremely acid.

The solum ranges from 40 to 60 inches in thickness. The content of ironstone gravel ranges as much as 35 percent, by volume, in the A horizon and as much as 10 percent in the B and C horizons. In some pedons coarse fragments 3 to 20 inches across are on or embedded in the surface layer. They cover less than 1 percent of the surface area.

The A horizon is brown, dark brown, yellowish brown, or dark grayish brown. It is very fine sandy loam or gravelly fine sandy loam. Reaction is strongly acid to slightly acid.

The E horizon is pale brown, light yellowish brown, light brown, yellowish brown, or brown. It is very fine sandy loam or gravelly fine sandy loam. Reaction is strongly acid to slightly acid.

The Bt horizon is red or dark red. The number of mottles in shades of yellow or brown ranges from none to common. Gray fragments of shale are in the lower part of this horizon in some pedons. This horizon is clay or clay loam. Reaction ranges from extremely acid to strongly acid.

The BC horizon is in shades of red, yellow, brown, and gray. In some pedons it is mottled in these colors. This horizon is clay, clay loam, or sandy clay loam. The number of thin strata and fragments of sandstone and shaly materials ranges from none to common. Reaction is extremely acid or very strongly acid. Some pedons do not have a BC horizon.

The C horizon is stratified sandy clay loam or clay loam, consolidated sandstone, and weathered shale having a clayey texture. The loamy materials and the sandstone are in shades of red, yellow, or brown, and the shaly materials are mainly grayish. The amount of sandstone or shaly materials varies. Some pedons do not have sandstone or shaly materials. Roots penetrate the materials. They are concentrated along fractures or cleavage planes. In most pedons this horizon has clay flows along some vertical fractures. In some pedons it has a discontinuous, fractured, strongly cemented or indurated sandstone layer or stone line about 1 to 4 inches thick. Reaction is extremely acid or very strongly acid.

Kullit Series

The Kullit series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in unconsolidated stratified loamy sediments under mixed pine and hardwood vegetation. Slope ranges from 1 to 3 percent.

Typical pedon of Kullit fine sandy loam, 1 to 3 percent slopes; from the intersection of Interstate 20 and U.S. Highway 271 about 12 miles northeast of Tyler, 0.7 mile east on Interstate 20, about 0.3 mile north on Farm Road 757, about 1.2 miles east on Farm Road 1252, about 1.4 miles south on Brooks Lane or County Road 3100, and 150 feet west, in a pasture:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; slightly hard, friable; common fine and medium roots; medium acid; clear wavy boundary.

A2—3 to 9 inches; dark brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; strongly acid; gradual wavy boundary.

E—9 to 19 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; slightly hard, friable; common fine and medium roots; strongly acid; clear wavy boundary.

Bt1—19 to 26 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium faint yellowish brown (10YR 5/8) and pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; thin patchy clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—26 to 39 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/8) and red (2.5YR 4/8) mottles; moderate medium and coarse subangular blocky structure; hard, firm; few fine roots; thin patchy clay films on faces of peds; about 2 percent light gray coatings on faces of some peds; about 2 or 3 percent plinthite; very strongly acid; clear wavy boundary.

Bt3—39 to 46 inches; yellowish brown (10YR 5/8) sandy clay loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish red (5YR 5/8) and red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; hard, firm; few fine roots; about 2 percent light gray (10YR 7/2) coatings 5 to 12 millimeters in width on faces of some peds; 2 or 3 percent plinthite; very strongly acid; clear wavy boundary.

Bt4—46 to 59 inches; mottled yellowish brown (10YR 5/8), grayish brown (10YR 5/2), and red (2.5YR 4/8) sandy clay loam; moderate coarse subangular blocky structure; very hard, very firm; few fine roots; about 3 percent light gray (10YR 7/2) coatings about 5 millimeters in width on faces of some peds; thin patchy clay films on faces of some peds; very strongly acid; clear wavy boundary.

Btg—59 to 70 inches; grayish brown (10YR 5/2) clay; common coarse prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; extremely hard, very firm; about 3 percent light gray (10YR 7/2) coatings on faces of peds; very strongly acid.

The solum is more than 60 inches thick.

The A or Ap horizon is dark grayish brown, dark brown, brown, or yellowish brown. The E horizon, if it occurs, is yellowish brown or light yellowish brown. The number of faint mottles in shades of yellow or brown ranges from none to common in the E horizon. Reaction is strongly acid or medium acid in the A and E horizons.

The Bt horizon is yellowish brown or brownish yellow. It has common mottles in shades of gray, brown, or red. It is sandy clay loam, loam, or clay loam. In some pedons the lower part of this horizon has 2 to 4 percent light gray coatings on some peds. In some pedons this horizon has 2 or 3 percent plinthite. Reaction is very strongly acid or strongly acid.

The Btg horizon is light gray, light brownish gray, or grayish brown. The number of mottles in shades of brown or red is common or many. This horizon is sandy clay or clay. In some pedons it has 2 to 4 percent light gray (10YR 7/2) coatings on faces of peds.

Leagueville Series

The Leagueville series consists of very deep, poorly drained, sandy soils on uplands. These soils formed in sandy and loamy sediments. Native vegetation consists of hardwoods, sedges, and mid and tall grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Leagueville loamy fine sand, 0 to 5 percent slopes; from the intersection of U.S. Highway 69 and Farm Road 16 in Lindale, 2.4 miles east on Farm Road 16, about 0.8 mile south on a county road, 0.8 mile east on a county road, and 1,300 feet south, at the head of a drainageway:

A1—0 to 8 inches; very dark gray (10YR 3/1) loamy fine sand; common fine and medium distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; soft, very friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.

A2—8 to 15 inches; dark gray (10YR 4/1) loamy fine sand; common fine and medium distinct brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; soft, very friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.

E—15 to 28 inches; grayish brown (10YR 5/2) loamy

fine sand; common fine and medium distinct brown (7.5YR 5/4) mottles; massive; soft, very friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Btg1—28 to 44 inches; gray (10YR 5/1) sandy clay loam; many medium distinct yellowish brown (10YR 5/4) and reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; very hard, friable; few fine roots; patchy clay films on faces of peds; very strongly acid; clear wavy boundary.

Btg2—44 to 63 inches; light gray (10YR 6/1) sandy clay loam; many medium and coarse distinct reddish brown (5YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very hard, friable; few fine roots; patchy clay films on faces of peds; few streaks of uncoated sand; very strongly acid.

The solum is more than 60 inches thick. Reaction ranges from very strongly acid to slightly acid in the A and E horizons and from extremely acid to strongly acid in the Btg horizon.

The A horizon is very dark gray, very dark grayish brown, dark gray, dark grayish brown, grayish brown, or brown. In pedons that have value of less than 3.5, the horizon is less than 10 inches thick. The E horizon is grayish brown, light brownish gray, or light gray. The combined thickness of the A and E horizons is 20 to 40 inches.

In most pedons the Btg horizon is gray, light brownish gray, or light gray and has common or many medium and coarse mottles in shades of brown, yellow, or red. In some pedons, however, it is mottled in shades of brown, yellow, or red. In some pedons it has streaks and pockets of grayish, clean sand. Texture ranges from sandy clay loam to fine sandy loam.

Some pedons have an E/B or B/E horizon below the Btg horizon. The E material makes up 40 to 80 percent of the horizon and is gray, light gray, or light brownish gray loamy fine sand. The B material is mottled yellowish brown, strong brown, and reddish brown sandy clay loam.

Lilbert Series

The Lilbert series consists of very deep, well drained, sandy soils on uplands. These soils formed in sandy and loamy coastal plain sediments under mixed pine and hardwood forest. Slope ranges from 1 to 6 percent.

Typical pedon of Lilbert loamy fine sand, 1 to 6 percent slopes; from the intersection of U.S. Highway 271 and Interstate Highway 20 about 12 miles northeast of Tyler, 0.75 mile east on Interstate 20, exit at Farm Road 757, about 1.4 miles east along service road on south side of Interstate 20 to Brooks Lane, 400 feet west on a service road, and 100 feet south, in a wooded area:

A—0 to 9 inches; brown (10YR 5/3) loamy fine sand; weak medium subangular blocky structure; loose, very friable; common medium roots; strongly acid; clear wavy boundary.

E—9 to 24 inches; pale brown (10YR 6/3) loamy fine sand; few medium faint brownish yellow (10YR 6/6) mottles; massive; loose, very friable; common medium roots; slightly acid; clear wavy boundary.

Bt—24 to 31 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine faint brown mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; thin patchy clay films on faces of peds; medium acid; clear wavy boundary.

Btv—31 to 47 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) and common fine and medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; very hard, friable; thin patchy clay films on faces of peds; about 8 percent plinthite; few medium soft nodules of iron and manganese; medium acid; gradual wavy boundary.

Btv/E—47 to 67 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium prominent red (2.5YR 5/8) and common medium faint brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; hard, firm; about 8 percent streaks and pockets of uncoated sand; approximately 5 percent plinthite; strongly acid; gradual wavy boundary.

B't—67 to 74 inches; mottled grayish brown (10YR 5/2), brownish yellow (10YR 6/6), and red (2.5YR 4/8) clay loam; weak coarse blocky structure; hard, friable; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is dark grayish brown, dark brown, dark yellowish brown, or brown. The E horizon is yellowish brown, light yellowish brown, or pale brown. The combined thickness of the A and E horizons ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is yellowish brown, brownish yellow, or strong brown. It has few to many red, yellowish red, or brown mottles, and in some pedons it has grayish brown mottles below a depth of 30 inches. Texture is clay loam or sandy clay loam. Reaction ranges from very strongly acid to medium acid.

The Btv horizon has colors in shades of brown, red, and gray. Gray mottles are below a depth of 30 inches. The content of plinthite ranges from 5 to 15 percent, by

volume. Reaction ranges from very strongly acid to medium acid.

The Btv/E horizon is in shades of gray, brown, and red. It is sandy clay loam, clay loam, or sandy clay. Streaks and pockets of uncoated sand make up as much as 15 percent of this horizon. The content of plinthite ranges from 5 to 8 percent, by volume. Reaction is very strongly acid or strongly acid.

The B't horizon has colors, textures, and reaction similar to those of the Btv/E horizon. Some pedons do not have a B't horizon.

Mantachie Series

The Mantachie series consists of very deep, somewhat poorly drained, loamy soils on flood plains (fig. 18). These soils formed in loamy alluvial sediments. Native vegetation consists mainly of hardwoods. Slope is 0 to 1 percent.

Typical pedon of Mantachie loam, frequently flooded; from the intersection of U.S. Highway 69 and Farm Road 346 south of Tyler, 550 feet west on Farm Road 346 and 300 feet north, in a creek bottom:

A1—0 to 2 inches; dark brown (10YR 3/3) loam; moderate medium subangular blocky structure; slightly hard, friable; many fine and medium roots; very strongly acid; clear wavy boundary.

A2—2 to 8 inches; dark grayish brown (10YR 4/2) loam; many fine distinct dark yellowish brown (10YR 3/4 and 3/6) mottles; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; few fine soft black masses 5 or 6 millimeters in diameter; very strongly acid; clear wavy boundary.

Bg1—8 to 13 inches; grayish brown (10YR 5/2) loam; many fine and medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; hard, friable; common fine and medium roots; few fine soft black masses; very strongly acid; clear wavy boundary.

Bg2—13 to 29 inches; mottled yellowish red (5YR 4/6), light brownish gray (10YR 6/2), and grayish brown (10YR 5/2) loam; weak medium subangular blocky structure; hard, friable; common fine roots; few fine soft black masses; common strata of loamy fine sand and fine sandy loam; very strongly acid; gradual wavy boundary.

Bg3—29 to 39 inches; dark gray (10YR 4/1) loam; many fine and medium distinct yellowish red (5YR 4/6) and strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; very strongly acid; gradual wavy boundary.

Bg4—39 to 50 inches; dark gray (10YR 4/1) clay loam; many fine and medium distinct yellowish brown (10YR 5/8) and strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; very hard, firm; about 10 percent black masses 2 to 10 millimeters in size; strongly acid; clear wavy boundary.

Bg5—50 to 60 inches; dark gray (10YR 4/1) clay loam; many fine and medium distinct yellowish brown (10YR 5/8) mottles; massive; very hard, firm; about 10 to 15 percent soft black masses 2 to 10 millimeters in size; strongly acid.

The A horizon is dark grayish brown, grayish brown, brown, dark yellowish brown, or dark brown. It has few or common mottles in shades of brown, gray, and red in most pedons. Reaction is very strongly acid or strongly acid.

The Bg horizon is dark gray, gray, light brownish gray, dark grayish brown, grayish brown, or light gray. It has mottles in shades of yellow, brown, and red in most pedons. This horizon is sandy clay loam, clay loam, or loam. It has strata of silty clay loam, loamy fine sand, or fine sandy loam in some pedons. It has few or common soft black masses in most pedons. Reaction is very strongly acid or strongly acid.

Oakwood Series

The Oakwood series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in loamy, unconsolidated sediments, mainly under hardwood forest and some pine. Slope ranges from 1 to 8 percent.

Typical pedon of Oakwood fine sandy loam, 1 to 5 percent slopes; from the intersection of Loop 323 West and Texas Highway 110 in Tyler, 7.9 miles northwest on Texas Highway 110 and 250 feet northeast, in a pasture:

A—0 to 7 inches; dark brown (10YR 4/3) fine sandy loam; common fine faint brownish mottles; weak fine and medium subangular blocky structure; hard, very friable; many fine and medium roots; slightly acid; clear wavy boundary.

E—7 to 15 inches; light yellowish brown (10YR 6/4) fine sandy loam; common fine faint brownish yellow mottles; massive; hard, very friable; common fine and medium roots; many very fine pores; common wormcasts; slightly acid; clear wavy boundary.

Bt1—15 to 34 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable; common fine roots; patchy clay films on faces of peds; few streaks of uncoated sand along faces of peds; few fine

pebbles; strongly acid; gradual wavy boundary.
Bt2—34 to 39 inches; brownish yellow (10YR 6/6) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; very hard, friable; few fine roots; about 3 percent streaks and pockets of light yellowish brown (10YR 6/4) uncoated sand; patchy clay films on faces of peds; few medium soft black masses; few fine pebbles; medium acid; gradual wavy boundary.
Btv—39 to 52 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium prominent red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; very hard, friable; about 4 percent streaks and pockets of very pale brown (10YR 7/3) uncoated sand; patchy clay films on faces of peds; common medium soft black masses; about 8 percent plinthite; few fine pebbles; medium acid; gradual wavy boundary.
Btv/E—52 to 72 inches; brownish yellow (10YR 6/8) sandy clay loam; many medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; very hard, friable; about 10 percent streaks and pockets of very pale brown (10YR 7/3) uncoated sand; about 5 percent plinthite; patchy clay films on faces of peds; few fine pebbles; medium acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is dark yellowish brown, yellowish brown, dark brown, or brown. The E horizon is pale brown, yellowish brown, or light yellowish brown. The combined thickness of the A and E horizons is 6 to 20 inches. Reaction ranges from medium acid to neutral.

The Bt horizon is yellowish brown, dark yellowish brown, brownish yellow, or strong brown. The number of mottles in shades of red ranges from none to many. Reaction ranges from very strongly acid to slightly acid.

The Btv and Btv/E horizons are yellowish brown, brownish yellow, or strong brown or are mottled in these colors and shades of gray and red. Streaks and pockets of light gray, light yellowish brown, very pale brown, pale brown, or light brownish gray, uncoated sand make up 5 to 12 percent of these horizons. The content of plinthite ranges from 5 to about 8 percent. Reaction ranges from very strongly acid to medium acid.

Owentown Series

The Owentown series consists of very deep, moderately well drained, loamy soils on flood plains. These soils formed in loamy alluvium under mixed pine and hardwood forest vegetation. Slope is 0 to 1 percent.

Typical pedon of Owentown loamy fine sand, occasionally flooded; from the intersection of Loop 323 and Old Longview Road in Tyler, 8.7 miles northeast on Old Longview Road and 450 feet southeast, on a flood plain along a small creek:

A—0 to 4 inches; dark yellowish brown (10YR 4/4) loamy fine sand; moderate fine and medium granular structure; soft, very friable; many fine and medium roots; strongly acid; clear smooth boundary.
Bw1—4 to 11 inches; yellowish brown (10YR 5/6) loamy fine sand; common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; soft, very friable; common fine and medium roots; strongly acid; clear smooth boundary.
Bw2—11 to 20 inches; brownish yellow (10YR 6/6) loamy fine sand; few fine faint yellowish brown mottles; weak coarse blocky structure parting to weak fine and medium subangular blocky; soft, very friable; common fine and few medium roots; less than 10 percent strata of yellowish brown (10YR 5/8) fine sandy loam 1.0 to 1.5 centimeters thick; strongly acid; clear smooth boundary.
Bw3—20 to 33 inches; yellowish brown (10YR 5/6) fine sandy loam; common fine distinct light yellowish brown (10YR 6/4) mottles; weak medium and coarse subangular blocky structure parting to moderate fine subangular blocky; soft, friable; common fine roots; about 10 percent pockets as much as 2.5 centimeters across of strong brown (7.5YR 5/6) fine sandy loam that is slightly more clayey than the matrix; strongly acid; gradual wavy boundary.
Bw4—33 to 53 inches; dark brown (10YR 4/3) fine sandy loam; common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable; common fine roots; many fine pores; about 2 percent soft black masses; medium acid; gradual wavy boundary.
BC—53 to 80 inches; mottled dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2) fine sandy loam; weak fine and medium subangular blocky structure; slightly hard, friable; common very fine and fine roots; about 10 percent, by volume, soft black masses; medium acid.

The solum ranges from 60 to more than 80 inches in thickness. The average content of clay in the control section ranges from 8 to 17 percent. Some pedons have buried horizons at a depth of 20 to 40 inches. In unlimed areas reaction is strongly acid or medium acid throughout.

The A or Ap horizon is dark brown, dark yellowish brown, yellowish brown, brown, dark grayish brown, or reddish brown. In pedons that have moist value of 3, the horizon is less than 7 inches thick.

The Bw horizon is dark yellowish brown, dark brown, brown, yellowish brown, brownish yellow, or strong brown. The number of mottles in shades of brown, yellow, red, or gray is few or common. Grayish mottles occur below a depth of 24 inches. Strata or pockets of fine sandy loam or sandy clay loam 1 to 3 centimeters thick make up less than 15 percent, by volume, of the horizon. By weighted average the texture is fine sandy loam or loam. Layers of loamy fine sand, however, are common in the upper part.

The BC horizon is mainly in shades of brown and gray. In some pedons it has few or common mottles in shades of yellow or red. This horizon is fine sandy loam or loam. In some pedons it has strata of loamy fine sand or sandy clay loam.

Pickton Series

The Pickton series consists of very deep, well drained, sandy soils on uplands. These soils formed in unconsolidated sandy and loamy sediments, mainly under hardwood forest and some pine. Slope ranges from 1 to 15 percent.

Typical pedon of Pickton loamy fine sand, 1 to 6 percent slopes; from the intersection of Interstate Highway 20 and U.S. Highway 69 about 10 miles northwest of Tyler, 1.0 mile east on Interstate Highway 20, about 2.4 miles north and northwest on Jim Hogg Road, 0.2 mile east on a county road, and 500 feet north, in a pasture:

A—0 to 11 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; medium acid; clear wavy boundary.

E—11 to 52 inches; pale brown (10YR 6/3) loamy fine sand; single grained; loose; very friable; common fine roots; slightly acid; clear wavy boundary.

Bt1—52 to 64 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; slightly hard, friable; few fine roots; patchy clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—64 to 72 inches; strong brown (7.5YR 5/8) sandy clay loam; many coarse distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; hard, friable; few fine roots; patchy clay films on faces of peds; medium acid.

The solum is more than 80 inches thick.

The A horizon is dark brown, brown, yellowish brown, dark yellowish brown, dark grayish brown, grayish brown, or pale brown. The E horizon is yellowish brown, light yellowish brown, brownish yellow, pale brown, or very pale brown. The combined thickness of the A and E horizons is 40 to 72 inches. Reaction ranges from medium acid to neutral.

The Bt horizon is yellowish brown, brownish yellow, strong brown, or reddish yellow or is mottled in these colors and red. In some pedons the lower part of this horizon has light gray and light brownish gray mottles and as much as 10 percent streaks and pockets of very pale brown, uncoated sand. Reaction ranges from very strongly acid to medium acid.

Raino Series

The Raino series consists of very deep, moderately well drained, loamy soils on old terraces. These soils formed in loamy and clayey sediments under mixed hardwood and pine forest. Slope ranges from 0 to 2 percent.

Typical pedon of Raino fine sandy loam, 0 to 2 percent slopes; from the intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, 1.6 miles east and southeast on Farm Road 346 and 150 feet east, in a pasture:

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam; weak fine and medium granular structure; slightly hard, very friable; common fine and medium roots; medium acid; clear wavy boundary.

E—4 to 12 inches; yellowish brown (10YR 5/4) fine sandy loam; common fine faint dark brown (7.5YR 4/4) mottles; massive; slightly hard, very friable; common fine and medium roots; medium acid; gradual wavy boundary.

EB—12 to 20 inches; yellowish brown (10YR 5/4) loam; many medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, very friable; few fine and medium roots; medium acid; clear wavy boundary.

Bt/E—20 to 34 inches; mottled yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), and red (2.5YR 4/6) sandy clay loam (Bt); weak medium subangular blocky structure; hard, friable; few fine roots; about 15 percent vertical streaks and pockets of light brownish gray (10YR 6/2) fine sandy loam (E); patchy clay films on faces of peds; very strongly acid; abrupt wavy boundary.

Btg—34 to 60 inches; mottled light gray (10YR 6/1), yellowish brown (10YR 5/6 and 5/8), and red (2.5YR 4/8) clay; weak coarse subangular blocky structure; extremely hard, extremely firm; few fine

roots; patchy clay films on faces of peds; very strongly acid.

The A horizon is brown, dark brown, or dark grayish brown. The E horizon is pale brown, brown, or yellowish brown. In some pedons the A and E horizons have faint mottles in shades of brown. Reaction is strongly acid or medium acid in these horizons.

The EB horizon is brown, yellowish brown, or light yellowish brown. In some pedons it has faint yellowish mottles. Reaction is strongly acid or medium acid.

The Bt part of the Bt/E horizon is yellowish brown, brownish yellow, light yellowish brown, or reddish yellow or is mottled in shades of red, yellow, gray, and brown. The Bt/E horizon is dominantly loam or sandy clay loam. The E part is vertical streaks and pockets of light yellowish brown, pale brown, or light gray loamy or sandy material. It makes up 15 to 20 percent of the horizon. Reaction is very strongly acid or strongly acid throughout the horizon.

The Btg horizon is mottled in shades of gray, red, brown, and yellow. Reaction ranges from very strongly acid to medium acid.

Redsprings Series

The Redsprings series consists of very deep, well drained, loamy soils on uplands (fig. 19). These soils formed in sediments consisting of glauconitic materials interbedded with shale and sandy materials, mainly under a mixed hardwood forest and some pine. Slope ranges from 2 to 25 percent.

Typical pedon of Redsprings very gravelly sandy loam, 8 to 25 percent slopes; from the intersection of Loop 323 North and Farm Road 14 in Tyler, 6.1 miles north on Farm Road 14, about 0.65 mile west and south on Park Road 16 to fork in road, 0.2 mile west on north fork, 0.05 mile north on Cedar Point campground road, and 150 feet west, in a wooded area:

A—0 to 5 inches; dark reddish brown (2.5YR 3/4) very gravelly sandy loam; weak fine and medium granular structure; hard, friable; many fine, medium, and coarse roots; about 45 percent ironstone pebbles; medium acid; clear wavy boundary.

Bt1—5 to 24 inches; red (2.5YR 4/6) clay; moderate fine and medium subangular blocky structure; very hard, firm; common fine, medium, and coarse roots; continuous clay films on faces of peds; few fine remnants of weathered glauconitic materials; few fragments of ironstone less than 6 inches across; very strongly acid; gradual wavy boundary.

Bt2—24 to 37 inches; red (2.5YR 4/6) clay; moderate medium subangular blocky structure; very hard, firm; few fine and medium roots; continuous clay films on faces of peds; few fine remnants of weathered glauconitic materials; about 3 percent fine light brownish gray fragments of shale; about 5 percent horizontally oriented fragments of glauconitic ironstone 1 to 3 inches thick and 10 to 15 inches across; very strongly acid; gradual wavy boundary.

B/C—37 to 49 inches; red (2.5YR 4/6) clay (B); weak coarse subangular blocky structure; very hard, firm; few fine roots; continuous clay films on faces of peds; about 35 percent weathered glauconitic materials (C); about 10 percent horizontally oriented glauconitic ironstone 0.5 inch to 2.0 inches thick and 1 to 10 inches across; about 5 percent discontinuous strata less than 1 inch thick of light brownish gray shale having a clayey texture; very strongly acid; gradual wavy boundary.

C—49 to 65 inches; strong brown (7.5YR 5/8), weathered glauconitic materials; massive; very hard, friable; about 10 percent fragments of glauconitic ironstone mainly less than 3 inches across; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. The content of fragments of glauconitic ironstone 0.5 inch to 3.0 inches thick and 3 to 10 inches across the long axis ranges from 0 to 10 percent, by volume, throughout. In some pedons these fragments also are on or embedded in the surface layer. They cover less than 1 percent of the surface area.

The A horizon is dark reddish brown, dark red, or reddish brown. This horizon contains 35 to 60 percent ironstone gravel. Reaction is medium acid to neutral.

The Bt horizon is red or dark red. It is clay or clay loam. The content of clay ranges from 35 to 60 percent. This horizon contains as much as 10 percent ironstone gravel and 1 to 10 percent glauconitic material. Reaction is very strongly acid to slightly acid.

The B/C horizon is sandy clay loam, clay loam, or clay. It contains as much as 35 percent glauconitic material and as much as 15 percent ironstone gravel. The number of grayish fragments of shale having a clayey texture ranges from none to common. Reaction is very strongly acid to medium acid.

The C horizon is strong brown glauconitic materials. In some pedons it has stratified layers of red sandy clay loam, grayish shale having a clayey texture, and fragments of glauconitic ironstone. The extent of these layers varies. Roots penetrate the materials. They are concentrated along fractures or cleavage planes. In most pedons the horizon has clay flows along some vertical fractures. Base saturation ranges from 35 to 60 percent at a depth of 50 inches below the top of the Bt horizon. Reaction is very strongly acid or strongly acid.

Sacul Series

The Sacul series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in interbedded clayey and loamy sediments under mixed pine and hardwood forests. Slope ranges from 1 to 15 percent.

Typical pedon of Sacul very fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 135 and Farm Road 15 in Troup, 1.6 miles north on Texas Highway 135, about 1.25 miles east on a county road, south and west on a private road to a house, and 300 feet west of the house, in a pasture:

Ap—0 to 3 inches; dark brown (10YR 4/3) very fine sandy loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; soft, very friable; many fine and few medium roots; strongly acid; abrupt smooth boundary.

E—3 to 9 inches; brown (7.5YR 5/4) very fine sandy loam; few fine faint strong brown mottles; weak medium subangular blocky structure; soft, very friable; common fine and few medium roots; less than 2 percent ironstone pebbles; strongly acid; abrupt smooth boundary.

BE—9 to 11 inches; strong brown (7.5YR 4/6) loam; common medium faint brown (7.5YR 5/4) E material; weak medium subangular blocky structure; hard, friable; common fine and medium roots; less than 2 percent ironstone pebbles; very strongly acid; clear wavy boundary.

Bt1—11 to 21 inches; dark red (2.5YR 3/6) clay; few fine faint red and few fine distinct brown (10YR 5/3) mottles; weak medium prismatic structure parting to moderate fine and medium angular blocky; very hard, firm; few fine and medium roots; less than 2 percent ironstone pebbles; continuous thin clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—21 to 30 inches; dark red (2.5YR 3/6) clay; common fine prominent grayish brown (10YR 5/2) and common fine faint red mottles; moderate medium prismatic structure parting to moderate fine and medium angular blocky; very hard, firm; few fine roots; common fine grayish brown (10YR 5/2) and brown (10YR 5/3) fragments of shale; less than 2 percent ironstone pebbles; continuous thin clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—30 to 35 inches; red (2.5YR 4/6) clay; many medium prominent grayish brown (10YR 5/2) and common medium distinct brown (7.5YR 5/4) mottles; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm; few fine roots; less than 2 percent ironstone pebbles; few very fine to medium angular vertical pressure faces about 1 centimeter in diameter; common thin clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt4—35 to 41 inches; grayish brown (10YR 5/2) clay; many medium prominent red (2.5YR 4/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm; few fine roots; few ironstone pebbles; few fragments of shale having a clayey texture; common medium pressure faces; common thin clay films on faces of peds; very few fine pores; very strongly acid; clear wavy boundary.

Bt5—41 to 51 inches; light brownish gray (10YR 6/2) clay; common medium prominent dark red (2.5YR 3/6 and 10R 3/6) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, firm; very few fine roots; few ironstone pebbles; few fragments of shale; few slickensides; common pressure faces; very strongly acid; clear wavy boundary.

BC—51 to 58 inches; light brownish gray (10YR 6/2) clay loam; common medium distinct strong brown (7.5YR 5/6), common medium prominent red (2.5YR 4/6), and common medium distinct brown (7.5YR 5/4) mottles; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm; thin patchy clay films on vertical and horizontal faces of peds; few fine pores; extremely acid; clear wavy boundary.

C1—58 to 75 inches; light brownish gray (10YR 6/2) clay loam; common fine distinct reddish yellow (7.5YR 6/8), common medium prominent red (2.5YR 4/8), and common medium distinct strong brown (7.5YR 4/8) mottles; moderate coarse prismatic structure; very hard, firm; common strata of ironstone; extremely acid; gradual wavy boundary.

C2—75 to 80 inches; light brownish gray (10YR 6/2) clay loam; common fine distinct reddish yellow (7.5YR 6/8), common medium prominent red (2.5YR 4/8), and common medium distinct strong brown (7.5YR 4/8) mottles; weak medium prismatic structure; very hard, firm; common strata of ironstone; extremely acid.

The solum ranges from 40 to 60 inches in thickness. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The A or Ap horizon is brown, dark brown, or dark grayish brown. The E horizon is brown or yellowish brown. The BE horizon, if it occurs, is strong brown.

The upper part of the Bt horizon is red or dark red and has few or common brownish mottles. The lower part is red and has grayish and brownish mottles. In some pedons, the horizon is mottled in these colors or the grayish colors are dominant.

The BC and C horizons are grayish and have reddish, brownish, or yellowish mottles. In some pedons these horizons are interbedded with layers of shale having a clayey texture. Texture is clay loam or sandy clay loam.

Tenaha Series

The Tenaha series consists of very deep, well drained, sandy soils on uplands. These soils formed in unconsolidated sandstone and shale under mixed pine and hardwood forest. Slope ranges from 8 to 20 percent.

Typical pedon of Tenaha loamy fine sand, 8 to 20 percent slopes; from the intersection of Interstate 20 and Farm Road 757 about 12 miles northeast of Tyler, 7.5 miles east on Interstate 20, about 0.7 mile north on County Road 3113 to intersection with Farm Road 1252, about 1.1 miles north on County Road 3111, and 1,100 feet east, in a stand of native pine:

A—0 to 6 inches; dark brown (10YR 4/3) loamy fine sand; weak medium subangular blocky structure; soft, very friable; common fine and medium roots; slightly acid; clear wavy boundary.

E—6 to 28 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose, very friable; few fine roots; slightly acid; clear wavy boundary.

Bt1—28 to 36 inches; yellowish red (5YR 5/6) sandy clay loam; few medium distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; thin discontinuous clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—36 to 56 inches; yellowish red (5YR 5/6) sandy clay loam; common medium distinct brownish yellow (10YR 6/8) and few fine distinct red (2.5YR 4/8) mottles; weak medium subangular blocky structure; hard, friable; few fine pores and root channels; thin patchy clay films on faces of peds; very strongly acid; clear wavy boundary.

C—56 to 70 inches; stratified red (2.5YR 5/6 and 10R 4/8) and brownish yellow (10YR 6/8) sandy clay loam and fine sandy loam interbedded with light gray (10YR 7/2) shaly material; very hard, firm; few fine roots; few flakes of mica; very strongly acid.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is dark grayish brown, dark brown, or brown. The E horizon is yellowish brown or pale brown. The combined thickness of the A and E horizons ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is strong brown, yellowish brown, or yellowish red or is mottled in shades of these colors and red. It is clay loam or sandy clay loam. Reaction is very strongly acid or strongly acid. Some pedons contain a B/C horizon that has as much as 15 percent unconsolidated fragments of shale.

The C horizon is loamy materials in shades of red, yellow, or brown. In many pedons it is interbedded with gray shale having a clayey texture. Reaction is very strongly acid or strongly acid.

Tonkawa Series

The Tonkawa series consists of very deep, excessively drained, sandy soils on uplands (fig. 20). These soils formed in thick sandy deposits. Native vegetation consists mainly of short grasses, sparse hardwoods, and some pines. Slope ranges from 1 to 15 percent.

Typical pedon of Tonkawa fine sand, 1 to 6 percent slopes; from the intersection of Interstate Highway 20 and Farm Road 14, about 0.25 mile south on Farm Road 14, about 0.2 mile northeast on an oil road, 0.6 mile east to an oil well, and 165 feet southwest:

A—0 to 10 inches; dark brown (10YR 4/3) fine sand; weak fine and medium subangular blocky structure parting to weak fine granular; loose, very friable; common fine and medium roots; medium acid; clear wavy boundary.

C1—10 to 56 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose, very friable; common fine, medium, and coarse roots; medium acid; gradual wavy boundary.

C2—56 to 76 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose, very friable; slightly acid; gradual wavy boundary.

C3—76 to 80 inches; very pale brown (10YR 7/4) fine sand; single grained; loose, very friable; slightly acid.

Reaction ranges from strongly acid to slightly acid. Lamellae are in the lower part of some pedons; however, they are thinner than is definitive for an argillic horizon.

The A horizon is brown, dark brown, dark yellowish brown, or very dark gray. The C horizon is brown, strong brown, yellowish brown, light yellowish brown, reddish yellow, very pale brown, light gray, or white.

Wolfpen Series

The Wolfpen series consists of very deep, well drained, sandy soils on uplands (fig. 21). These soils formed in sandy and loamy sediments, mainly under hardwood forest and some pine. Slope ranges from 1 to 15 percent.

Typical pedon of Wolfpen loamy fine sand, 1 to 6 percent slopes; from the intersection of Loop 323 North and U.S. Highway 271 in Tyler, 1.6 miles north on U.S. Highway 271, about 6.2 miles north on Farm Road 2015, about 0.45 mile west on a county road, and 75 feet south, in a pasture:

Ap—0 to 7 inches; dark brown (10YR 4/3) loamy fine sand; weak fine subangular blocky structure; soft, very friable; common fine and medium roots; slightly acid; clear wavy boundary.

E—7 to 27 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; soft, very friable; common fine and medium roots; slightly acid; clear wavy boundary.

Bt1—27 to 38 inches; yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; hard, friable; common fine roots; patchy clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—38 to 61 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; about 3 percent streaks and pockets of pale brown (10YR 6/3) uncoated sand; patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt/E—61 to 75 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium prominent red (2.5YR 4/8) and common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; hard, friable; about 10 percent streaks and pockets of pale brown (10YR 6/3) uncoated sand; patchy clay films on faces of peds; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is dark brown, brown, or yellowish brown. The E horizon is pale brown, very pale brown, light yellowish brown, yellowish brown, or brown. The combined thickness of the A and E horizons is 20 to 40 inches. In unlimed areas reaction ranges from very strongly acid to slightly acid.

The Bt horizon is yellowish brown, brownish yellow, or strong brown. The number of red and yellowish red mottles ranges from none to common. In some pedons, below a depth of 37 inches, this horizon also has light brownish gray and light gray mottles. It is mainly sandy clay loam. In some pedons, however, the upper part of the horizon is sandy loam. The content of clay ranges from 20 to 30 percent in the upper 20 inches of this horizon. Reaction ranges from very strongly acid to medium acid.

The Bt/E horizon, if it occurs, is yellowish brown or strong brown. It has common or many red, light brownish gray, light gray, and yellowish red mottles. Streaks and pockets of light gray, light brownish gray, or pale brown, uncoated sand make up 5 to 15 percent of this horizon. Reaction is very strongly acid or strongly acid.

Formation of the Soils

In this section the factors of soil formation are described as they relate to the soils in Smith County.

Factors of Soil Formation

Soil is the product of soil-forming processes acting on geologic materials. 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 of the factors are important in the formation of any soil, but the influence of each varies from place to place.

Geology and Parent Material

Sean Duffey and Tom Liefer, geologists, Soil Conservation Service, helped prepare this section.

Smith County is in the West Gulf Coastal Plain physiographic province. The topography generally is gently rolling, although some areas are marked by rough terrain. Elevation ranges from about 270 feet above sea level in the northeast corner of the county along the Sabine River to about 670 feet above sea level in the northwestern part of the county near Garden Valley.

The major geologic feature is the Tyler Basin, which is a troughlike depression trending north-northeast and centered near Tyler. This synclinal structure, which opens to the south, is bounded by the Mount Enterprise Fault Zone, which extends from Shelby County to about 30 miles south of Tyler in Anderson County. It is characterized by piercement salt domes throughout the central part of the basin. In the vicinity of Lindale, two northeast trending, parallel faults form a graben, or downfaulted trough feature. About 8 miles north of Tyler, a third fault trends north-northeast into Wood County. Other minor faults occur throughout Smith County, particularly in association with the salt domes. Because of the faults, sites that are selected for engineering work should be individually evaluated.

The entire county is underlain by formations of Eocene age *(11)*. In ascending order the formations that outcrop in the county include Carrizo Sand, Reklaw, Queen City Sand, Weches, and Sparta Sand. Underlying the Carrizo Sand Formation, but not outcropping in the county, is the Wilcox Group. The Wilcox Group and the Carrizo Sand Formation together make up one of the three principal ground-water aquifers in the county. The two other important aquifers are the Queen City Sand Formation and the Sparta Sand Formation.

The Carrizo Sand Formation ranges from 40 to 225 feet in thickness. It underlies most of the county but outcrops only in small areas in the northwest and southeast corners. The Carrizo Sand is a uniform, white to gray, fine- to medium-grained, clean, very porous, loose, quartz sandstone that grades upward into a silty sandstone. The main soils in areas of the Carrizo Sand Formation are Oakwood, Pickton, and Wolfpen soils in the northwestern part of the county and Bowie, Darco, and Lilbert soils in the southeastern part.

The Reklaw Formation overlies the Carrizo Sand and outcrops in adjoining areas in the northwest and southeast corners of the county. It underlies almost all of the county, except for the areas where the Carrizo Sand outcrops. It ranges from 5 to 40 feet in thickness. It consists of two distinct members. The lower member is Newby Sand, and the upper is Marquez Shale. The Newby Sand is a gray to green, poorly bedded, fine- to very fine-grained, glauconitic sandstone. Where exposed, this member is hardened by weathering, resulting in the formation of small, prominent bluffs. The Marquez Shale is a soft, black to dark brown, silty, carbonaceous shale. The main soils in areas of the Reklaw Formation are Bowie, Cuthbert, and Kirvin soils.

The Queen City Sand Formation ranges from 0 to 700 feet in thickness. It outcrops in more than two-thirds of the county. It has three members. The basal Arp member is a loose, gray to brown, porous, medium- to fine-grained, silty to shaly, quartz sandstone. The middle Owen member is a soft, dark olive green, glauconitic sandstone. The upper unnamed member is a soft, massive, cross-bedded, fine-grained, muscovite,

quartz sand that has interfingering beds of soft shale and hard, ferruginous sandstone and lignite stringers. The main soils in areas of the Queen City Sand are Cuthbert, Oakwood, Pickton, and Wolfpen soils in the western part of the county and Bowie, Cuthbert, Darco, and Lilbert soils in the eastern part.

The Weches Formation, which averages 70 feet in thickness, underlies the central part of the county. It outcrops as a thin, circular belt around the overlying Sparta Sand Formation. It varies from a black to brown, massive shale near the base to a green-brown, hard, glauconitic sandstone at the top. It is resistant to erosion and forms small cuestas or escarpments. The main soils in areas of the Weches Formation are Elrose and Redsprings soils.

The Sparta Sand Formation ranges from 0 to 280 feet in thickness. It covers approximately 20 percent of the county. It outcrops throughout the central part. It is characterized by a mottled, reddish gray to white, loose, coarse- to fine-grained, quartz sandstone that has interfingering layers of blue and gray shale. The main soils in areas of the Sparta Sand Formation are Pickton, Tonkawa, and Wolfpen soils.

Quaternary sediments occur on flood plains along the principal streams and in nearby areas. They generally consist of clay, silt, sand, and minor amounts of gravel. They include Pleistocene age fluviatile terrace deposits, which are remnants of old stream flood plains that are higher on the landscape than the present-day flood plains. Recent alluvial sediments deposited along the Sabine River are from west of the county. The main soils on the terraces are Derly and Raino soils. The main soils along the Sabine River are Estes and Gladewater soils. The main soils along the other streams are Mantachie soils.

The three principal ground-water aquifers are the Carrizo-Wilcox aquifer, the Queen City Sand aquifer, and the Sparta Sand aquifer *(3)*. They receive the vast majority of their ground-water recharge from rainwater infiltrating down into the formations in their respective outcrop areas. The lower aquifers receive some recharge from the overlying formations and from streams crossing the outcroppings.

The Carrizo-Wilcox aquifer is stratigraphically the lowest of the three aquifers and is the largest, most productive, and the least sensitive to land management practices. The water quality is generally very good; however, iron is present in moderate amounts and the content of dissolved solids increases with depth. Also, water quality in the aquifer may be adversely affected by the placement of wells near any of the salt domes. Excessive pumping can cause poorer quality water that is lower in the aquifer to move upward into the zone of higher quality water. The principal flow of ground water is to the east and southeast from the western recharge area. Deviation from the principal direction of flow occurs near the recharge area in the southeast corner of the county where ground water moves to the northwest because of the synclinal structure of the bedrock.

In the Queen City Sand aquifer, the supply of suitable water is limited because the water is acidic, has a high content of iron, and is generally of an inferior quality compared to that of the other two principal aquifers. The aquifer is recharged from its extensive outcrop area throughout the county. Ground water primarily moves north to the Sabine River in the northern half of the county or south to the Neches River in the southern half. The aquifer feeds numerous springs and creeks throughout the county. In areas where the aquifer lies on or near the surface, landfills, sewage disposal, applications of pesticide and fertilizer, and inappropriate cropping methods could have a major impact on the continued suitability and availability of ground water from this aquifer. Oil well maintenance, oil spillage, brine disposal, improper well casings, and inadequate well integrity can also affect the quality of ground water.

The Sparta Sand aquifer is stratigraphically the uppermost of the three principal aquifers. It is the least extensive, occurring mostly in the central part of the county. The ground water from this aquifer is of good quality. The movement of ground water is generally southeast toward the city of Tyler or to local springs and streams. Because the aquifer is close to Tyler and is near the surface, the quality and quantity of water are greatly affected by land use and land management practices. In addition to the potential sources of contamination listed for the Queen City Sand aquifer, the quality of ground water in the Sparta Sand aquifer could be adversely affected by contaminated runoff from urban streets and lawns and by seepage from sanitary sewers and underground fuel storage tanks.

Climate

Smith County has a warm, humid, subtropical climate that is characterized by heavy rains. Summers are hot and humid. Winters are usually mild. Seasonal changes are gradual.

The climate greatly influenced the development of the soils in the county. The high humidity and rainfall caused most of the loamy soils on uplands to be strongly weathered, leached, and acidic. As a result, most of the soils in the county are very deep. Most differences between the soils, however, cannot be attributed to the climate because the climate is relatively uniform throughout the county.

Plant and Animal Life

Plants, burrowing animals, earthworms, micro-organisms, and humans have directly influenced the formation of soils.

Soils that form under trees accumulate organic matter in the upper few inches. Cultivation, however, quickly destroys the organic matter in soils, such as in most cultivated areas of Bowie fine sandy loam, 1 to 5 percent slopes.

Earthworms, crawfish, and burrowing rodents help mix the material within the soil. Earthworms enhance the movement of air, water, and plant nutrients in the soil. Crawfish are most numerous in soils that have clayey layers and a slow runoff rate. They bring soil material from the lower layers to the surface. Gophers and other burrowing animals help mix and aerate loamy soils, such as Oakwood soils, and sandy soils, such as Wolfpen soils.

Relief

Relief affects the formation of soils by influencing drainage, infiltration, and plant cover. It also strongly influences how much water percolates through the soil. Soils on nearly level terraces, such as Derly soils, have poor drainage. Cuthbert soils, which are strongly sloping to steep, have a thinner solum than the nearby Oakwood soils, which are gently sloping. On the steeper slopes water runs off faster, less moisture infiltrates into the soils, and the plant cover is thinner.

Although most of the soils in the county are gently sloping to steep, the development of shallow soils as a result of relief is not common. The abundant rainfall and long warm periods have overcome most of the effects of relief. Nearly all of the soils in the county are deeply developed.

Time

The length of time that climate, living organisms, and relief act upon the parent material affects the kind of soil that forms. The effects of time are modified by the other four factors of soil formation. In general, however, soils that do not have definite horizons are young, or immature. Soils that have well defined horizons are old, or mature.

The soils in the county range from young to old. Mantachie, Owentown, and Gladewater soils are on flood plains and have faint horizons. Bowie, Cuthbert, and Kirvin soils in the uplands are mature soils that have distinct horizons having little resemblance to the original parent material.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1988. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Dillard, J.W. 1963. Availability and quality of ground water in Smith County, Texas. Tex. Water Comm. Bull. 6302, 60 pp., illus.

(4) Schoenmann, L.R., and others. 1917. Soil survey of Smith County, Texas. U.S. Dep. Agric., Bur. of Soils, 51 pp., illus.

(5) United States Department of Agriculture. 1935. Growth and yield of second-growth red gum in fully stocked stands on alluvial lands in the South. Forest Serv. Occas. Pap. 54, 34 pp., illus.

(6) United States Department of Agriculture. 1951 (being revised). Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(7) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(8) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(9) United States Department of Agriculture. 1976. Volume, yield, and stand tables for second growth southern pines. Forest Serv. Misc. Publ. 50, 302 pp., illus.

(10) United States Department of Agriculture. 1984 (rev.). Procedures for collecting soil samples and methods of analysis for soil survey. Soil Surv. Invest. Rep. 1, 68 pp., illus.

(11) University of Texas, Bureau of Economic Geology. 1964. Geologic atlas of Texas, Tyler sheet.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

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.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

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. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

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 establishing terraces, diversions, and other water-control structures 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.

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.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly

continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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 human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not 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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

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.

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 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. 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.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of

clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or 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 Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

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 three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, 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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed 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 also is exposed to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Reaction, soil. A measure of the 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 degrees of acidity or alkalinity, expressed as pH values, are:

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

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

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C

horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. Technically, the A horizon in mineral soils. Generally refers to the uppermost mineral layer of soil. Includes the Ap horizon or "plow layer."

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is 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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1954-81 at Tyler)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	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	53.8	31.5	42.7	79	9	47	3.02	1.28	4.48	5	1.0
February	59.1	35.5	47.3	81	15	84	3.35	1.89	4.64	6	.7
March	67.2	43.0	55.1	86	21	215	3.54	1.95	4.93	6	.1
April	76.5	52.9	64.7	90	31	441	4.93	1.98	7.40	6	.0
May	82.8	60.2	71.5	93	42	667	4.95	2.11	7.36	6	.0
June	89.4	67.0	78.2	98	51	846	3.63	1.17	5.65	5	.0
July	93.8	70.4	82.1	104	59	995	2.88	.92	4.47	4	.0
August	93.1	68.7	80.9	102	55	958	2.66	1.11	3.97	4	.0
September	86.6	63.4	75.0	98	44	750	4.29	1.70	6.46	5	.0
October	78.3	51.5	64.9	94	31	462	3.28	1.05	5.10	4	.0
November	66.8	42.1	54.5	85	20	183	3.81	1.65	5.64	5	.1
December	58.4	34.7	46.6	80	13	60	3.38	1.29	5.13	5	.2
Yearly:											
Average	75.5	51.7	63.6	---	---	---	---	---	---	---	---
Extreme	---	---	---	104	8	---	---	---	---	---	---
Total	---	---	---	---	---	5,708	43.72	34.12	52.76	61	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 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1954-81 at Tyler)

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--	Mar. 18	Apr. 4	Apr. 16
2 years in 10 later than--	Mar. 11	Mar. 28	Apr. 10
5 years in 10 later than--	Feb. 25	Mar. 15	Mar. 31
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 9	Oct. 25	Oct. 23
2 years in 10 earlier than--	Nov. 18	Nov. 3	Oct. 28
5 years in 10 earlier than--	Dec. 5	Nov. 18	Nov. 7

TABLE 3.--GROWING SEASON

(Recorded in the period 1954-81 at Tyler)

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	253	223	198
8 years in 10	262	231	206
5 years in 10	280	248	221
2 years in 10	298	264	236
1 year in 10	309	273	244

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AoB	Alto loam, 1 to 3 percent slopes	2,320	0.4
AtB	Attoyac fine sandy loam, 1 to 3 percent slopes	2,520	0.4
BeB	Bernaldo fine sandy loam, 1 to 3 percent slopes	3,240	0.5
BoB	Bowie fine sandy loam, 1 to 5 percent slopes	32,870	5.4
BoD	Bowie fine sandy loam, 5 to 8 percent slopes	6,000	1.0
ByC	Briley loamy fine sand, 1 to 5 percent slopes	2,940	0.5
CfE	Cuthbert fine sandy loam, 5 to 20 percent slopes	84,340	13.9
CgE	Cuthbert gravelly fine sandy loam, 12 to 30 percent slopes	16,160	2.7
CrE	Cuthbert-Urban land complex, 5 to 20 percent slopes	2,660	0.4
CuC	Cuthbert and Redsprings soils, graded, 3 to 8 percent slopes	3,810	0.6
DaC	Darco loamy fine sand, 1 to 6 percent slopes	8,110	1.3
DaE	Darco loamy fine sand, 8 to 15 percent slopes	5,830	1.0
Db	Derly-Besner complex, 0 to 1 percent slopes	3,020	0.5
Dr	Derly-Raino complex, 0 to 1 percent slopes	900	0.1
ErB	Elrose fine sandy loam, 1 to 3 percent slopes	6,490	1.1
ErD	Elrose fine sandy loam, 3 to 8 percent slopes	12,060	2.0
Es	Estes silty clay loam, frequently flooded	3,670	0.6
FrB	Freestone fine sandy loam, 1 to 3 percent slopes	3,540	0.6
GaB	Gallime fine sandy loam, 1 to 5 percent slopes	10,830	1.8
Gw	Gladewater clay, frequently flooded	11,850	1.9
Ke	Keechi loam, frequently flooded	6,010	1.0
KfC	Kirvin very fine sandy loam, 1 to 5 percent slopes	25,050	4.1
KgC	Kirvin gravelly fine sandy loam, 2 to 8 percent slopes	7,800	1.3
KuB	Kullit fine sandy loam, 1 to 3 percent slopes	2,050	0.3
KvC	Kirvin-Urban land complex, 1 to 5 percent slopes	2,270	0.4
LgB	Leagueville loamy fine sand, 0 to 5 percent slopes	2,330	0.4
LtC	Lilbert loamy fine sand, 1 to 6 percent slopes	34,510	5.7
Ma	Mantachie loam, frequently flooded	42,670	7.0
OkB	Oakwood fine sandy loam, 1 to 5 percent slopes	35,780	5.9
OkD	Oakwood fine sandy loam, 5 to 8 percent slopes	4,600	0.8
OuC	Oakwood-Urban land complex, 2 to 6 percent slopes	2,250	0.4
Ow	Owentown loamy fine sand, occasionally flooded	8,260	1.4
PkC	Pickton loamy fine sand, 1 to 6 percent slopes	48,730	8.0
PkE	Pickton loamy fine sand, 8 to 15 percent slopes	12,200	2.0
PuC	Pickton-Urban land complex, 1 to 6 percent slopes	560	0.1
PuE	Pickton-Urban land complex, 8 to 15 percent slopes	223	*
Px	Pits	530	0.1
Ra	Raino fine sandy loam, 0 to 2 percent slopes	3,060	0.5
RdC	Redsprings very gravelly sandy loam, 2 to 5 percent slopes	12,650	2.1
RdE	Redsprings very gravelly sandy loam, 8 to 25 percent slopes	27,470	4.5
RuD	Redsprings-Urban land complex, 4 to 12 percent slopes	530	0.1
SaC	Sacul very fine sandy loam, 1 to 5 percent slopes	1,330	0.2
SaD	Sacul very fine sandy loam, 5 to 15 percent slopes	720	0.1
TeE	Tenaha loamy fine sand, 8 to 20 percent slopes	14,890	2.4
ToC	Tonkawa fine sand, 1 to 6 percent slopes	4,360	0.7
ToE	Tonkawa fine sand, 8 to 15 percent slopes	610	0.1
TuC	Tonkawa-Urban land complex, 1 to 6 percent slopes	430	0.1
Ur	Urban land	2,950	0.5
WoC	Wolfpen loamy fine sand, 1 to 6 percent slopes	48,740	8.0
WoE	Wolfpen loamy fine sand, 8 to 15 percent slopes	16,310	2.7
WuC	Wolfpen-Urban land complex, 1 to 6 percent slopes	2,230	0.4
WuE	Wolfpen-Urban land complex, 8 to 15 percent slopes	910	0.1
	Water areas greater than 40 acres in size	11,680	1.9
	Total	607,853	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
AoB	Alto loam, 1 to 3 percent slopes
AtB	Attoyac fine sandy loam, 1 to 3 percent slopes
BeB	Bernaldo fine sandy loam, 1 to 3 percent slopes
BoB	Bowie fine sandy loam, 1 to 5 percent slopes
ErB	Elrose fine sandy loam, 1 to 3 percent slopes
FrB	Freestone fine sandy loam, 1 to 3 percent slopes
GaB	Gallime fine sandy loam, 1 to 5 percent slopes
KuB	Kullit fine sandy loam, 1 to 3 percent slopes
OkB	Oakwood fine sandy loam, 1 to 5 percent slopes
Ra	Raino fine sandy loam, 0 to 2 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Watermelons	Improved bermuda-grass	Common bermuda-grass	Bahiagrass	Tall fescue	Weeping lovegrass
		Bu	Tons	AUM*	AUM*	AUM*	AUM*	AUM*
AoB---------- Alto	IIe	80	---	8.0	7.5	8.5	---	---
AtB---------- Attoyac	IIe	90	---	10.0	8.0	9.0	---	---
BeB---------- Bernaldo	IIe	90	---	12.0	8.0	9.0	---	---
BoB---------- Bowie	IIIe	85	10	12.0	7.5	8.0	---	---
BoD---------- Bowie	IVe	80	8	10.5	7.0	7.5	---	---
ByC---------- Briley	IIIe	60	12	9.5	5.5	5.0	---	5.5
CfE---------- Cuthbert	VIe	---	---	7.0	6.0	6.0	---	5.0
CgE---------- Cuthbert	VIIe	---	---	---	---	5.0	---	5.0
CrE**. Cuthbert-Urban land								
CuC---------- Cuthbert and Redsprings	VIe	---	---	5.0	2.5	2.5	---	4.0
DaC---------- Darco	IIIs	55	12	6.5	---	---	---	6.0
DaE---------- Darco	VIe	---	---	5.5	---	---	---	5.0
Db---------- Derly-Besner	IIIw	---	---	7.0	---	5.0	---	---
Dr---------- Derly-Raino	IIIw	---	---	8.0	---	6.6	---	---
ErB---------- Elrose	IIe	85	10	11.0	7.5	8.0	---	---
ErD---------- Elrose	IIIe	80	8	10.5	7.0	7.5	---	---
Es---------- Estes	Vw	---	---	---	5.0	6.0	4.5	---
FrB---------- Freestone	IIe	80	---	9.0	6.0	7.0	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Watermelons	Improved bermuda-grass	Common bermuda-grass	Bahiagrass	Tall fescue	Weeping lovegrass
		Bu	Tons	AUM*	AUM*	AUM*	AUM*	AUM*
GaB--Gallime	IIIe	85	12	11.0	7.5	8.0	---	---
Gw--Gladewater	Vw	---	---	7.0	5.0	6.0	4.5	---
Ke--Keechi	Vw	---	---	---	---	---	---	---
KfC--Kirvin	IIIe	75	---	9.0	8.0	8.0	---	---
KgC--Kirvin	IVe	40	---	8.0	7.0	7.0	---	---
KuB--Kullit	IIe	75	---	10.0	6.0	9.0	6.0	---
KvC**. Kirvin-Urban land								
LgB--Leagueville	IVw	---	---	---	4.0	5.0	4.5	---
LtC--Lilbert	IVe	75	13	10.0	6.0	6.0	---	6.0
Ma--Mantachie	Vw	---	---	---	5.0	6.0	4.5	---
OkB--Oakwood	IIIe	85	---	11.0	7.5	8.0	---	---
OkD--Oakwood	IVe	75	---	10.5	7.0	7.5	---	---
OuC**. Oakwood-Urban land								
Ow--Owentown	IIw	90	---	10.0	8.0	9.0	6.0	---
PkC--Pickton	IIIs	65	10	6.5	---	---	---	5.0
PkE--Pickton	IVe	---	---	6.5	---	---	---	4.5
PuC**. Pickton-Urban land								
PuE**. Pickton-Urban land								
Px**. Pits								

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Watermelons	Improved bermuda-grass	Common bermuda-grass	Bahiagrass	Tall fescue	Weeping lovegrass
		Bu	Tons	AUM*	AUM*	AUM*	AUM*	AUM*
Ra Raino	IIIs	75	---	10.0	6.0	9.0	6.0	---
RdC Redsprings	IVe	45	---	6.0	4.5	4.5	---	5.0
RdE Redsprings	VIe	---	---	5.0	4.0	4.0	---	4.5
RuD**. Redsprings-Urban land								
SaC Sacul	IVe	50	---	7.0	6.0	6.0	---	5.5
SaD Sacul	VIe	---	---	6.5	5.0	5.0	---	5.0
TeE Tenaha	VIe	---	---	7.0	5.5	5.0	---	5.5
ToC Tonkawa	IVs	---	9	5.0	---	---	---	4.0
ToE Tonkawa	IVe	---	---	---	---	---	---	---
TuC**. Tonkawa-Urban land								
Ur**. Urban land								
WoC Wolfpen	IIIs	75	12	8.0	6.0	6.0	---	6.0
WoE Wolfpen	VIe	---	---	7.0	5.5	5.5	---	6.0
WuC**. Wolfpen-Urban land								
WuE**. Wolfpen-Urban land								

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
AoB---------- Alto	8A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Southern red oak----	80 70 70	230 170 ---	Loblolly pine.
AtB---------- Attoyac	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	91 84 90 80	330 270 210 110	Loblolly pine, sweetgum, American sycamore, southern red oak, black walnut.
BeB---------- Bernaldo	10A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	91 82 90 80	330 270 210 110	Loblolly pine, sweetgum, southern red oak.
BoB, BoD-------- Bowie	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	89 82 90 80	330 270 210 110	Loblolly pine, shortleaf pine, sweetgum, southern red oak.
ByC---------- Briley	8S	Slight	Slight	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	85 75	280 220	Loblolly pine.
CfE---------- Cuthbert	8C	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------	84 70	230 170	Loblolly pine.
CgE---------- Cuthbert	8R	Severe	Severe	Moderate	Slight	Loblolly pine------- Shortleaf pine------	75 65	180 130	Loblolly pine.
CuC**: Cuthbert-------	5C	Severe	Moderate	Severe	Slight	Loblolly pine------- Shortleaf pine------	60 ---	60 ---	Loblolly pine.
Redsprings-----	6C	Moderate	Moderate	Severe	Slight	Loblolly pine------- Shortleaf pine------	65 60	100 90	Loblolly pine.
DaC, DaE-------- Darco	8S	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	83 74	230 170	Loblolly pine, shortleaf pine.
Db**: Derly----------	4W	Slight	Severe	Moderate	Severe	Sweetgum---------- Water oak---------- Willow oak----------	70 --- ---	50 --- ---	Sweetgum, water oak, willow oak.
Besner---------	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum----------	90 81 90	330 270 210	Loblolly pine, southern red oak, sweetgum.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Dr**:									
Derly	4W	Slight	Severe	Moderate	Severe	Sweetgum	70	50	Sweetgum, water oak, willow oak.
						Water oak	70	---	
						Willow oak	72	---	
Raino	9W	Slight	Moderate	Slight	Moderate	Loblolly pine	88	330	Loblolly pine, shortleaf pine, water oak, cherrybark oak, sweetgum.
						Shortleaf pine	80	270	
						Water oak	90	---	
ErB, ErD Elrose	10A	Slight	Slight	Slight	Slight	Loblolly pine	92	330	Loblolly pine, southern red oak, sweetgum.
						Shortleaf pine	80	270	
						Sweetgum	90	210	
Es Estes	8W	Slight	Severe	Moderate	Moderate	Sweetgum	93	210	Sweetgum, green ash, willow oak, water oak.
						Willow oak	86	---	
						Water oak	93	---	
FrB Freestone	8W	Slight	Moderate	Slight	Moderate	Loblolly pine	80	230	Loblolly pine, sweetgum, shortleaf pine, southern red oak.
						Shortleaf pine	70	---	
						Sweetgum	---	---	
GaB Gallime	9A	Slight	Slight	Slight	Slight	Loblolly pine	91	330	Loblolly pine, sweetgum, southern red oak.
						Shortleaf pine	82	270	
						Sweetgum	---	---	
						Southern red oak	---	---	
Gw Gladewater	6W	Slight	Severe	Moderate	Severe	Sweetgum	80	120	Sweetgum, water oak, willow oak, green ash.
						Water oak	85	---	
						Willow oak	85	---	
						Green ash	70	---	
Ke Keechi	9W	Slight	Severe	Severe	Severe	Sweetgum	70	50	Sweetgum, water oak.
						Water oak	96	---	
KfC Kirvin	8A	Slight	Slight	Slight	Slight	Loblolly pine	84	230	Loblolly pine.
						Shortleaf pine	75	170	
KgC Kirvin	8F	Moderate	Moderate	Moderate	Slight	Loblolly pine	72	130	Loblolly pine.
						Shortleaf pine	63	90	
KuB Kullit	9W	Slight	Moderate	Slight	Moderate	Loblolly pine	88	330	Loblolly pine, sweetgum, cherrybark oak.
						Shortleaf pine	80	270	
						Southern red oak	---	---	
						White oak	---	---	
						Sweetgum	90	210	
LgB Leagueville	8W	Slight	Severe	Severe	Severe	Loblolly pine	90	330	Loblolly pine, sweetgum, cherrybark oak, southern red oak, water oak.
						Sweetgum	90	210	
						Water oak	90	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
LtC---------- Lilbert	8S	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	91 82 --- ---	330 270 --- ---	Loblolly pine.
Ma---------- Mantachie	8W	Slight	Severe	Severe	Severe	Sweetgum---------- Water oak---------- Willow oak----------	95 --- ---	260 --- ---	Sweetgum, water oak, willow oak.
OkB, OkD-------- Oakwood	9A	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum---------- Southern red oak----	91 80 --- ---	330 270 --- ---	Loblolly pine, southern red oak.
Ow---------- Owentown	11A	Slight	Slight	Slight	Slight	Loblolly pine------- Sweetgum---------- Black-gum---------- Southern red oak---- White oak----------	100 100 --- --- ---	460 310 --- --- ---	Loblolly pine, southern red oak, pecan, black walnut, sweetgum.
PkC, PkE-------- Pickton	8S	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Southern red oak----	80 72 70	230 170 ---	Loblolly pine.
Ra---------- Raino	9W	Slight	Moderate	Slight	Moderate	Loblolly pine------- Shortleaf pine------ Water oak----------	88 80 90	330 270 ---	Loblolly pine, shortleaf pine, water oak, cherrybark oak, sweetgum.
RdC, RdE-------- Redsprings	8F	Moderate	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------	82 70	230 170	Loblolly pine.
SaC, SaD-------- Sacul	8C	Moderate	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------	84 75	280 220	Loblolly pine, shortleaf pine.
TeE---------- Tenaha	8S	Slight	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------	85 75	280 220	Loblolly pine.
ToC, ToE-------- Tonkawa	5S	Slight	Severe	Severe	Severe	Loblolly pine------- Shortleaf pine------	60 55	60 40	Loblolly pine.
WoC, WoE-------- Wolfpen	9S	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	90 82	330 270	Loblolly pine, shortleaf pine.

* Volume is the yield in board feet (Doyle rule) per acre per year calculated over a 50-year period for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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
AoB---------- Alto	Favorable	3,500	Longleaf uniola	15
	Normal	2,000	Indiangrass	15
	Unfavorable	1,500	Sedge	15
			Pinehill bluestem	10
			Beaked panicum	10
			Panicum	10
			Brownseed paspalum	5
AtB---------- Attoyac	Favorable	1,300	Pinehill bluestem	55
	Normal	1,050	Slender bluestem	5
	Unfavorable	800	Longleaf uniola	5
			Splitbeard bluestem	5
			Southern bayberry	5
			Carolina jessamine	5
			Greenbrier	5
			Yaupon	5
			American beautyberry	5
BeB---------- Bernaldo	Favorable	1,300	Pinehill bluestem	55
	Normal	1,050	Slender bluestem	5
	Unfavorable	800	Longleaf uniola	5
			Splitbeard bluestem	5
			Southern bayberry	5
			Carolina jessamine	5
			Yaupon	5
			American beautyberry	5
BoB, BoD---------- Bowie	Favorable	3,500	Pinehill bluestem	50
	Normal	3,000	Pineywoods dropseed	10
	Unfavorable	2,000	Longleaf uniola	10
			Big bluestem	10
			Indiangrass	5
ByC---------- Briley	Favorable	1,500	Pinehill bluestem	50
	Normal	1,200	Longleaf uniola	10
	Unfavorable	900	Fineleaf bluestem	10
			Pineywoods dropseed	10
CfE---------- Cuthbert	Favorable	2,300	Pinehill bluestem	50
	Normal	1,800	Big bluestem	10
	Unfavorable	1,300	Longleaf uniola	10
			Fineleaf bluestem	5
			Pineywoods dropseed	5
			Cutover muhly	5
CgE---------- Cuthbert	Favorable	2,200	Pinehill bluestem	50
	Normal	1,700	Longleaf uniola	10
	Unfavorable	1,200	Fineleaf bluestem	10
			Big bluestem	5
			Pineywoods dropseed	5
CrE*: Cuthbert----------	Favorable	2,300	Pinehill bluestem	50
	Normal	1,800	Big bluestem	10
	Unfavorable	1,300	Longleaf uniola	10
			Fineleaf bluestem	5
			Pineywoods dropseed	5
			Cutover muhly	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
CrE*:				
Urban land.				
CuC*:				
Cuthbert	Favorable	1,500	Pinehill bluestem	50
	Normal	1,000	Big bluestem	10
	Unfavorable	400	Fineleaf bluestem	10
			Longleaf uniola	10
			Splitbeard bluestem	5
Redsprings	Favorable	1,500	Pinehill bluestem	50
	Normal	1,000	Longleaf uniola	10
	Unfavorable	400	Big bluestem	10
			Fineleaf bluestem	10
			Splitbeard bluestem	5
			Purpletop	5
DaC, DaE	Favorable	1,650	Pinehill bluestem	50
Darco	Normal	1,350	Longleaf uniola	10
	Unfavorable	1,000	Indiangrass	5
			Fineleaf bluestem	5
			Splitbeard bluestem	5
			Pineywoods dropseed	5
			Purple lovegrass	5
			Fringeleaf paspalum	5
Db*:				
Derly	Favorable	4,500	Florida paspalum	15
	Normal	3,500	Virginia wildrye	15
	Unfavorable	2,000	Little bluestem	10
			Beaked panicum	10
			Giant cane	10
			Panicum	10
			Redtop panicum	10
			Carolina joint-tail	5
Besner	Favorable	1,300	Pinehill bluestem	55
	Normal	1,050	Slender bluestem	5
	Unfavorable	800	Longleaf uniola	5
			Splitbeard bluestem	5
			Southern bayberry	5
			Carolina jessamine	5
			Greenbrier	5
			Yaupon	5
			American beautyberry	5
Dr*:				
Derly	Favorable	4,500	Florida paspalum	15
	Normal	3,500	Virginia wildrye	15
	Unfavorable	2,000	Little bluestem	10
			Beaked panicum	10
			Giant cane	10
			Panicum	10
			Redtop panicum	10
			Carolina joint-tail	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
Dr*:				
Raino	Favorable	2,000	Little bluestem	25
	Normal	1,600	Pinehill bluestem	25
	Unfavorable	1,250	Beaked panicum	10
			Longleaf uniola	10
			Spreading panicum	5
			Brownseed paspalum	5
			Cutover muhly	5
ErB, ErD	Favorable	1,500	Longleaf uniola	10
Elrose	Normal	1,200	Pineywoods dropseed	10
	Unfavorable	900	Big bluestem	10
			Pinehill bluestem	10
Es	Favorable	1,900	Longleaf uniola	15
Estes	Normal	1,700	Pinehill bluestem	15
	Unfavorable	1,500	Sedge	10
			Beaked panicum	10
			Panicum	5
			Greenbrier	5
			Alabama supplejack	5
FrB	Favorable	2,500	Little bluestem	15
Freestone	Normal	1,750	Beaked panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			Panicum	10
GaB	Favorable	3,000	Pinehill bluestem	20
Gallime	Normal	2,500	Beaked panicum	20
	Unfavorable	2,000	Longleaf uniola	20
			Purpletop	5
			Panicum	5
			American beautyberry	5
			Greenbrier	5
Gw	Favorable	3,500	Sedge	20
Gladewater	Normal	2,000	Paspalum	15
	Unfavorable	1,500	Virginia wildrye	10
			Panicum	10
			Beaked panicum	5
			Purpletop	5
			Pinehill bluestem	5
Ke	Favorable	1,300	Sedge	20
Keechi	Normal	1,200	Greenbrier	15
	Unfavorable	1,100	Longleaf uniola	10
			Virginia wildrye	10
			Panicum	5
			Paspalum	5
			Blackberry	5
			Poison-ivy	5
			Yaupon	5
			Southern bayberry	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
KfC---------- Kirvin	Favorable	2,000	Pinehill bluestem----------	50
	Normal	1,300	Longleaf uniola----------	10
	Unfavorable	1,000	Pineywoods dropseed----------	5
			American beautyberry----------	5
			Purpletop----------	5
			Indiangrass----------	5
			Brownseed paspalum----------	5
KgC---------- Kirvin	Favorable	2,400	Pinehill bluestem----------	50
	Normal	1,900	Longleaf uniola----------	10
	Unfavorable	1,500	American beautyberry----------	5
			Indiangrass----------	5
			Brownseed paspalum----------	5
			Fineleaf bluestem----------	5
KuB---------- 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
KvC*:				
Kirvin----------	Favorable	2,000	Pinehill bluestem----------	50
	Normal	1,300	Longleaf uniola----------	10
	Unfavorable	1,000	Pineywoods dropseed----------	5
			American beautyberry----------	5
			Purpletop----------	5
			Indiangrass----------	5
			Brownseed paspalum----------	5
Urban land.				
LgB---------- Leagueville	Favorable	2,000	Longleaf uniola----------	15
	Normal	1,500	Pinehill bluestem----------	10
	Unfavorable	1,000	Panicum----------	10
			Southern bayberry----------	10
			Broomsedge bluestem----------	5
			Sedge----------	5
			Common buttonbush----------	5
			Greenbrier----------	5
LtC---------- Lilbert	Favorable	1,500	Pinehill bluestem----------	50
	Normal	1,200	Fineleaf bluestem----------	10
	Unfavorable	900	Longleaf uniola----------	10
			Pineywoods dropseed----------	10
			Indiangrass----------	5
Ma---------- Mantachie	Favorable	1,600	Longleaf uniola----------	35
	Normal	1,200	Pinehill bluestem----------	20
	Unfavorable	1,000		

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
OkB, OkD----------	Favorable	1,200	Pinehill bluestem----------	40
Oakwood	Normal	800	Longleaf uniola----------	10
	Unfavorable	500	Beaked panicum----------	5
			Purpletop----------	5
			Indiangrass----------	5
			Panicum----------	5
			Paspalum----------	5
			Sedge----------	5
			Yaupon----------	5
OuC*:				
Oakwood----------	Favorable	1,200	Pinehill bluestem----------	40
	Normal	800	Longleaf uniola----------	10
	Unfavorable	500	Beaked panicum----------	5
			Purpletop----------	5
			Indiangrass----------	5
			Panicum----------	5
			Paspalum----------	5
			Sedge----------	5
			Yaupon----------	5
Urban land.				
Ow----------	Favorable	2,000	Beaked panicum----------	15
Owentown	Normal	1,500	Virginia wildrye----------	15
	Unfavorable	1,000	Longleaf uniola----------	15
			Panicum----------	15
PkC, PkE----------	Favorable	3,000	Little bluestem----------	20
Pickton	Normal	2,500	Panicum----------	15
	Unfavorable	2,000	Purpletop----------	10
			Big bluestem----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Beaked panicum----------	5
PuC*, PuE*:				
Pickton----------	Favorable	3,000	Little bluestem----------	20
	Normal	2,500	Panicum----------	15
	Unfavorable	2,000	Purpletop----------	10
			Big bluestem----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Beaked panicum----------	5
Urban land.				
Ra----------	Favorable	2,000	Little bluestem----------	25
Raino	Normal	1,600	Pinehill bluestem----------	25
	Unfavorable	1,250	Beaked panicum----------	10
			Longleaf uniola----------	10
			Spreading panicum----------	5
			Brownseed paspalum----------	5
			Cutover muhly----------	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
RdC, RdE----------	Favorable	2,300	Pinehill bluestem----------	50
Redsprings	Normal	1,800	Fineleaf bluestem----------	10
	Unfavorable	1,200	Longleaf uniola----------	10
			Big bluestem----------	10
			Pineywoods dropseed----------	5
			Indiangrass----------	5
			Cutover muhly----------	5
RuD*:				
Redsprings--------	Favorable	2,300	Pinehill bluestem----------	50
	Normal	1,800	Fineleaf bluestem----------	10
	Unfavorable	1,200	Longleaf uniola----------	10
			Big bluestem----------	10
			Pineywoods dropseed----------	5
			Indiangrass----------	5
			Cutover muhly----------	5
Urban land.				
SaC, SaD----------	Favorable	3,000	Bluestem----------	25
Sacul	Normal	2,200	Beaked panicum----------	15
	Unfavorable	1,500	Uniola----------	10
			Plumegrass----------	8
			Panicum----------	7
			Sedge----------	5
TeE----------	Favorable	2,500	Pinehill bluestem----------	50
Tenaha	Normal	2,000	Fineleaf bluestem----------	10
	Unfavorable	1,250	Longleaf uniola----------	10
			Indiangrass----------	5
			Slender bluestem----------	5
			Pineywoods dropseed----------	5
			Dogwood----------	5
			Yaupon----------	5
ToC, ToE----------	Favorable	3,000	Broomsedge bluestem----------	20
Tonkawa	Normal	2,000	Pinehill bluestem----------	20
	Unfavorable	1,200	Arrowfeather threeawn----------	15
			Panicum----------	10
			Indiangrass----------	10
TuC*:				
Tonkawa----------	Favorable	3,000	Broomsedge bluestem----------	20
	Normal	2,000	Pinehill bluestem----------	20
	Unfavorable	1,200	Arrowfeather threeawn----------	15
			Panicum----------	10
			Indiangrass----------	10
Urban land.				
WoC, WoE----------	Favorable	3,500	Little bluestem----------	20
Wolfpen	Normal	2,500	Purpletop----------	15
	Unfavorable	2,000	Panicum----------	15
			Longleaf uniola----------	10
			Beaked panicum----------	10
			Indiangrass----------	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
WuC*, WuE*:				
Wolfpen	Favorable	3,500	Little bluestem	20
	Normal	2,500	Purpletop	15
	Unfavorable	2,000	Panicum	15
			Longleaf uniola	10
			Beaked panicum	10
			Indiangrass	5
Urban land.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AoB Alto	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
AtB Attoyac	Slight	Slight	Moderate: slope.	Slight	Slight.
BeB Bernaldo	Slight	Slight	Moderate: slope.	Slight	Slight.
BoB Bowie	Slight	Slight	Moderate: slope.	Slight	Slight.
BoD Bowie	Slight	Slight	Severe: slope.	Slight	Slight.
ByC Briley	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
CfE Cuthbert	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty.
CgE Cuthbert	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Moderate: small stones, droughty.
CrE*: Cuthbert	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty.
Urban land.					
CuC*: Cuthbert	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: too clayey.
Redsprings	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Moderate: too clayey, small stones.
DaC Darco	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: droughty.
DaE Darco	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: slope, droughty.
Db*: Derly	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Db*:					
Besner	Slight	Slight	Slight	Slight	Slight.
Dr*:					
Derly	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Raino	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
ErB, ErD	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Elrose					
Es	Severe:	Severe:	Severe:	Severe:	Severe:
Estes	flooding, ponding, percs slowly.	ponding, percs slowly.	ponding, flooding.	ponding.	ponding, flooding.
FrB	Moderate:	Moderate:	Moderate:	Moderate:	Moderate:
Freestone	wetness, percs slowly.	wetness, percs slowly.	wetness, percs slowly, slope.	wetness.	wetness.
GaB	Slight	Slight	Moderate:	Slight	Slight.
Gallime			slope.		
Gw	Severe:	Severe:	Severe:	Severe:	Severe:
Gladewater	flooding, wetness, percs slowly.	wetness, too clayey, percs slowly.	too clayey, wetness, flooding.	wetness, too clayey.	wetness, flooding, too clayey.
Ke	Severe:	Severe:	Severe:	Severe:	Severe:
Keechi	flooding, wetness.	wetness.	wetness, flooding.	wetness.	wetness, flooding.
KfC	Moderate:	Moderate:	Moderate:	Slight	Slight.
Kirvin	percs slowly.	percs slowly.	slope.		
KgC	Severe:	Severe:	Severe:	Slight	Severe:
Kirvin	small stones.	small stones.	small stones.		small stones.
KuB	Moderate:	Moderate:	Moderate:	Slight	Slight.
Kullit	wetness.	wetness.	slope, wetness.		
KvC*:					
Kirvin	Moderate:	Moderate:	Moderate:	Slight	Slight.
	percs slowly.	percs slowly.	slope.		
Urban land.					
LgB	Severe:	Severe:	Severe:	Severe:	Severe:
Leagueville	flooding, wetness.	wetness.	wetness.	wetness.	wetness.
LtC	Moderate:	Moderate:	Moderate:	Moderate:	Moderate:
Lilbert	too sandy.	too sandy.	too sandy, slope.	too sandy.	droughty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ma Mantachie	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
OkB Oakwood	Slight	Slight	Moderate: slope.	Slight	Slight.
OkD Oakwood	Slight	Slight	Severe: slope.	Slight	Slight.
OuC*: Oakwood	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
Ow Owentown	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.
PkC Pickton	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
PkE Pickton	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
PuC*: Pickton	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Urban land.					
PuE*: Pickton	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Urban land.					
Px*. Pits					
Ra Raino	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
RdC Redsprings	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
RdE Redsprings	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
RuD*: Redsprings	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight	Severe: small stones.
Urban land.					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SaC Sacul	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
SaD Sacul	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
TeE Tenaha	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
ToC Tonkawa	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
ToE Tonkawa	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
TuC*: Tonkawa Urban land.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Ur*. Urban land					
WoC Wolfpen	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
WoE Wolfpen	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope, too sandy.
WuC*: Wolfpen Urban land.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
WuE*: Wolfpen Urban land.	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AoB---- Alto	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
AtB---- Attoyac	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeB---- Bernaldo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BoB---- Bowie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BoD---- Bowie	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ByC---- Briley	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
CfE---- Cuthbert	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CgE---- Cuthbert	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CrE*: Cuthbert----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
CuC*: Cuthbert----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Redsprings----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
DaC---- Darco	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
DaE---- Darco	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Db*: Derly----	Fair	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
Besner----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Dr*: Derly----	Fair	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
Raino----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ErB---- Elrose	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
ErD---- Elrose	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Es---- Estes	Very poor.	Poor	Fair	Good	Poor	Fair	Fair	Poor	Fair	Fair.
FrB---- Freestone	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
GaB---- Gallime	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Gw---- Gladewater	Poor	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Fair.
Ke---- Keechi	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
KfC---- Kirvin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KgC---- Kirvin	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KvC*:										
Kirvin----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
KuB---- Kullit	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
LgB---- Leagueville	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
LtC---- Lilbert	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Ma---- Mantachie	Poor	Fair	Fair	Good	Poor	Fair	Fair	Fair	Good	Fair.
OkB, OkD---- Oakwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OuC*:										
Oakwood----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
Ow---- Owentown	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
PkC, PkE---- Pickton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
PuC*, PuE*:										
Pickton----	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PuC*, PuE*: Urban land.										
Px*. Pits										
Ra---------- Raino	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RdC---------- Redsprings	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RdE---------- Redsprings	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RuD*: Redsprings--------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Urban land.										
SaC---------- Sacul	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SaD---------- Sacul	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TeE---------- Tenaha	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ToC, ToE---------- Tonkawa	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
TuC*: Tonkawa----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Urban land.										
Ur*. Urban land										
WoC, WoE---------- Wolfpen	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
WuC*, WuE*: Wolfpen----------	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Urban land.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AoB Alto	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
AtB Attoyac	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
BeB Bernaldo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BoB Bowie	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.	Slight.
BoD Bowie	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: low strength.	Slight.
ByC Briley	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
CfE Cuthbert	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: droughty.
CgE Cuthbert	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Moderate: small stones, droughty.
CrE*: Cuthbert	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: droughty.
Urban land.						
CuC*: Cuthbert	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: too clayey.
Redsprings	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: too clayey, small stones.
DaC Darco	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
DaE Darco	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Db*:						
Derly	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Besner	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Slight	Slight.
Dr*:						
Derly	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Raino	Severe: wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Slight.
ErB Elrose	Moderate: too clayey.	Slight	Slight	Slight	Severe: low strength.	Slight.
ErD Elrose	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Es Estes	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
FrB Freestone	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
GaB Gallime	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Slight	Slight	Slight.
Gw Gladewater	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding, too clayey.
Ke Keechi	Severe: wetness, cutbanks cave.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
KfC Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
KgC Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: small stones.
KuB Kullit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
KvC*:						
Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KvC*: Urban land.						
LgB---- Leagueville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
LtC---- Lilbert	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight----	Moderate: droughty.
Ma---- Mantachie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
OkB---- Oakwood	Moderate: wetness.	Slight----	Moderate: wetness.	Slight----	Moderate: low strength.	Slight.
OkD---- Oakwood	Moderate: wetness.	Slight----	Moderate: wetness.	Moderate: slope.	Moderate: low strength.	Slight.
OuC*: Oakwood----	Moderate: wetness.	Slight----	Moderate: wetness.	Moderate: slope.	Moderate: low strength.	Slight.
Urban land.						
Ow---- Owentown	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
PkC---- Pickton	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Slight----	Moderate: droughty.
PkE---- Pickton	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
PuC*: Pickton----	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Slight----	Moderate: droughty.
Urban land.						
PuE*: Pickton----	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Urban land.						
Px*. Pits						
Ra---- Raino	Severe: wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Slight.
RdC---- Redsprings	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Severe: small stones.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RdE---------- Redsprings	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
RuD*: Redsprings-------	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Severe: small stones.
Urban land.						
SaC---------- Sacul	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
SaD---------- Sacul	Moderate: too clayey, slope, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
TeE---------- Tenaha	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
ToC---------- Tonkawa	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
ToE---------- Tonkawa	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
TuC*: Tonkawa----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
Urban land.						
WoC---------- Wolfpen	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty, too sandy.
WoE---------- Wolfpen	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
WuC*: Wolfpen----------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty, too sandy.
Urban land.						
WuE*: Wolfpen----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Urban land.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AoB Alto	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
AtB Attoyac	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
BeB Bernaldo	Moderate: wetness.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
BoB, BoD Bowie	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
ByC Briley	Slight	Moderate: seepage, slope.	Slight	Severe: seepage.	Good.
CfE Cuthbert	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
CgE Cuthbert	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
CrE*: Cuthbert	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Urban land.					
CuC*: Cuthbert	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Redsprings	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
DaC Darco	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
DaE Darco	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
Db*: Derly	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

See footnote at end of table.

TABLE 12.--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
Db*:					
Besner	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Good.
Dr*:					
Derly	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Raino	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
ErB, ErD Elrose	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
Es Estes	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
FrB Freestone	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
GaB Gallime	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Good.
Gw Gladewater	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Ke Keechi	Severe: flooding, wetness, percs slowly.	Severe: seepage, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
KfC, KgC Kirvin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KuB Kullit	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
KvC*:					
Kirvin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
LgB Leagueville	Severe: wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--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
LtC---------- Lilbert	Moderate: percs slowly.	Severe: seepage.	Slight----------	Severe: seepage.	Good.
Ma---------- Mantachie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
OkB, OkD---------- Oakwood	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
OuC*: Oakwood---------- Urban land.	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Ow---------- Owentown	Severe: flooding, wetness.	Severe: seepage, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Fair: wetness.
PkC---------- Pickton	Severe: poor filter.	Severe: seepage.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
PkE---------- Pickton	Severe: poor filter.	Severe: seepage, slope.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
PuC*: Pickton---------- Urban land.	Severe: poor filter.	Severe: seepage.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
PuE*: Pickton---------- Urban land.	Severe: poor filter.	Severe: seepage, slope.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
Px*: Pits					
Ra---------- Raino	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
RdC---------- Redsprings	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey, hard to pack.
RdE---------- Redsprings	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 12.--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
RuD*:					
Redsprings	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, hard to pack, slope.
Urban land.					
SaC	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Sacul					
SaD	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: too clayey.	Moderate: slope, wetness.	Poor: too clayey, hard to pack.
Sacul					
TeE	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Fair: too sandy, slope.
Tenaha					
ToC	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Tonkawa					
ToE	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Tonkawa					
TuC*:					
Tonkawa	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Urban land.					
Ur*.					
Urban land					
WoC	Severe: poor filter.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
Wolfpen					
WoE	Severe: poor filter.	Severe: seepage, slope.	Severe: wetness.	Severe: seepage.	Fair: too clayey, slope.
Wolfpen					
WuC*:					
Wolfpen	Severe: poor filter.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
Urban land.					
WuE*:					
Wolfpen	Severe: poor filter.	Severe: seepage, slope.	Severe: wetness.	Severe: seepage.	Fair: too clayey, slope.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AoB Alto	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AtB Attoyac	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BeB Bernaldo	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
BoB, BoD Bowie	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
ByC Briley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
CfE Cuthbert	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CgE Cuthbert	Fair: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
CrE*: Cuthbert	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
CuC*: Cuthbert	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Redsprings	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DaC Darco	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
DaE Darco	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
Db*: Derly	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Db*:				
Besner	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Dr*:				
Derly	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Raino	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
ErB, ErD	Poor:	Improbable:	Improbable:	Poor:
Elrose	low strength.	excess fines.	excess fines.	too clayey.
Es	Poor:	Improbable:	Improbable:	Poor:
Estes	low strength, wetness.	excess fines.	excess fines.	too clayey, wetness.
FrB	Poor:	Improbable:	Improbable:	Fair:
Freestone	low strength, shrink-swell.	excess fines.	excess fines.	too clayey.
GaB	Fair:	Improbable:	Improbable:	Good.
Gallime	low strength, shrink-swell.	excess fines.	excess fines.	
Gw	Poor:	Improbable:	Improbable:	Poor:
Gladewater	low strength, wetness, shrink-swell.	excess fines.	excess fines.	too clayey, wetness.
Ke	Poor:	Improbable:	Improbable:	Poor:
Keechi	wetness.	excess fines.	excess fines.	wetness.
KfC, KgC	Poor:	Improbable:	Improbable:	Poor:
Kirvin	low strength.	excess fines.	excess fines.	too clayey.
KuB	Poor:	Improbable:	Improbable:	Fair:
Kullit	low strength.	excess fines.	excess fines.	too clayey.
KvC*:				
Kirvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
LgB	Poor:	Improbable:	Improbable:	Poor:
Leagueville	wetness.	excess fines.	excess fines.	wetness.
LtC	Good	Improbable:	Improbable:	Fair:
Lilbert		excess fines.	excess fines.	too sandy.
Ma	Fair:	Improbable:	Improbable:	Fair:
Mantachie	wetness.	excess fines.	excess fines.	too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OkB, OkD---------- Oakwood	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
OuC*: Oakwood----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
Ow---------- Owentown	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
PkC, PkE---------- Pickton	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
PuC*, PuE*: Pickton----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Urban land.				
Px*. Pits				
Ra---------- Raino	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
RdC---------- Redsprings	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
RdE---------- Redsprings	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
RuD*: Redsprings----------	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Urban land.				
SaC, SaD---------- Sacul	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
TeE---------- Tenaha	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
ToC, ToE---------- Tonkawa	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
TuC*: Tonkawa----------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Urban land.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ur*. Urban land				
WoC Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
WoE Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
WuC*: Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Urban land.				
WuE*: Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
Urban land.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AoB---------- Alto	Moderate: seepage.	Moderate: wetness.	Favorable--------	Wetness----------	Favorable.
AtB---------- Attoyac	Moderate: seepage.	Moderate: piping.	Deep to water----	Favorable--------	Favorable.
BeB---------- Bernaldo	Moderate: seepage.	Moderate: piping.	Deep to water----	Favorable--------	Favorable.
BoB, BoD---------- Bowie	Moderate: seepage.	Moderate: piping, wetness.	Deep to water----	Favorable--------	Rooting depth.
ByC---------- Briley	Moderate: seepage.	Moderate: piping.	Deep to water----	Soil blowing-----	Droughty.
CfE---------- Cuthbert	Slight----------	Moderate: piping.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
CgE---------- Cuthbert	Slight----------	Moderate: piping.	Deep to water----	Slope----------	Slope, droughty.
CrE*: Cuthbert---------	Slight----------	Moderate: piping.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
Urban land.					
CuC*: Cuthbert---------	Slight----------	Moderate: piping.	Deep to water----	Percs slowly-----	Droughty, percs slowly.
Redsprings-------	Slight----------	Moderate: hard to pack.	Deep to water----	Favorable--------	Favorable.
DaC---------- Darco	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Too sandy, soil blowing.	Droughty.
DaE---------- Darco	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Too sandy, slope, soil blowing.	Droughty, slope.
Db*: Derly----------	Slight----------	Severe: hard to pack, wetness.	Percs slowly-----	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Besner----------	Severe: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Dr*:					
Derly	Slight	Severe: hard to pack, wetness.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Raino	Slight	Severe: hard to pack.	Percs slowly	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
ErB, ErD	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Soil blowing	Favorable.
Elrose					
Es	Slight	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
Estes					
FrB	Slight	Severe: hard to pack.	Percs slowly	Wetness, percs slowly.	Percs slowly.
Freestone					
GaB	Severe: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable.
Gallime					
Gw	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Gladewater					
Ke	Moderate: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, too sandy, percs slowly.	Wetness, percs slowly.
Keechi					
KfC	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily.
Kirvin					
KgC	Slight	Severe: hard to pack.	Deep to water	Favorable	Favorable.
Kirvin					
KuB	Moderate: seepage.	Moderate: piping, wetness, thin layer.	Favorable	Wetness	Favorable.
Kullit					
KvC*:					
Kirvin	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily.
Urban land.					
LgB	Severe: seepage.	Severe: piping, wetness.	Slope	Wetness	Wetness.
Leagueville					
LtC	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing	Droughty.
Lilbert					
Ma	Moderate: seepage.	Severe: piping, wetness.	Flooding	Wetness	Wetness.
Mantachie					

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
OkB, OkD---------- Oakwood	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water----	Soil blowing-----	Favorable.
OuC*: Oakwood----------	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water----	Soil blowing-----	Favorable.
Urban land.					
Ow---------- Owentown	Severe: seepage.	Severe: piping.	Flooding---------	Wetness----------	Droughty.
PkC---------- Pickton	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Too sandy, soil blowing.	Droughty.
PkE---------- Pickton	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Slope, too sandy, soil blowing.	Slope, droughty.
PuC*: Pickton----------	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Too sandy, soil blowing.	Droughty.
Urban land.					
PuE*: Pickton----------	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Slope, too sandy, soil blowing.	Slope, droughty.
Urban land.					
Px*. Pits					
Ra---------- Raino	Slight----------	Severe: hard to pack.	Percs slowly-----	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
RdC---------- Redsprings	Slight----------	Moderate: hard to pack.	Deep to water----	Favorable--------	Favorable.
RdE---------- Redsprings	Slight----------	Moderate: hard to pack.	Deep to water----	Slope----------	Slope.
RuD*: Redsprings-------	Slight----------	Moderate: hard to pack.	Deep to water----	Slope----------	Slope.
Urban land.					
SaC---------- Sacul	Slight----------	Severe: hard to pack.	Deep to water----	Percs slowly, wetness.	Percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
SaD---------- Sacul	Slight----------	Severe: hard to pack.	Deep to water----	Slope, percs slowly, wetness.	Slope, percs slowly.
TeE---------- Tenaha	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Slope, soil blowing.	Droughty, slope.
ToC---------- Tonkawa	Severe: seepage.	Severe: seepage.	Deep to water----	Too sandy, soil blowing.	Droughty.
ToE---------- Tonkawa	Severe: seepage.	Severe: seepage.	Deep to water----	Slope, too sandy, soil blowing.	Slope, droughty.
TuC*: Tonkawa----------	Severe: seepage.	Severe: seepage.	Deep to water----	Too sandy, soil blowing.	Droughty.
Urban land.					
Ur*. Urban land					
WoC---------- Wolfpen	Severe: seepage.	Severe: thin layer.	Deep to water----	Favorable--------	Droughty.
WoE---------- Wolfpen	Severe: seepage.	Severe: thin layer.	Deep to water----	Slope----------	Slope, droughty.
WuC*: Wolfpen----------	Severe: seepage.	Severe: thin layer.	Deep to water----	Favorable--------	Droughty.
Urban land.					
WuE*: Wolfpen----------	Severe: seepage.	Severe: thin layer.	Deep to water----	Slope----------	Slope, droughty.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
AoB--- Alto	0-6	Loam---	SM-SC, SC	A-2-4, A-4	0	95-100	90-95	80-90	30-50	15-26	4-10
	6-35	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	95-100	85-95	75-95	42-65	30-45	15-30
	35-41	Clay loam, sandy clay, clay.	CL, SC	A-6, A-7	0	95-100	85-95	80-95	42-70	30-45	15-30
	41-50	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0-4	95-100	75-95	60-85	42-65	32-45	15-25
	50-70	Stratified sandy clay loam and shale.	CL, SC, CH	A-6, A-7, A-2-6, A-2-7	0-4	90-100	65-90	60-90	30-60	30-51	15-30
AtB--- Attoyac	0-12	Fine sandy loam	SM-SC, CL-ML, ML, SM	A-4	0	98-100	95-100	70-100	40-65	<23	NP-7
	12-60	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	95-100	80-100	45-75	23-40	7-24
BeB--- Bernaldo	0-12	Fine sandy loam	SM, ML	A-4	0	100	95-100	90-100	40-60	<25	NP-4
	12-47	Loam, sandy clay loam.	CL	A-6	0	99-100	98-100	90-100	51-75	26-40	12-24
	47-63	Loam, sandy clay loam.	CL, SC, ML, SM	A-4, A-6, A-2-4, A-2-6	0	100	95-100	90-100	28-65	20-40	3-22
BoB--- Bowie	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	97-100	94-100	90-100	30-55	<25	NP-6
	11-49	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	87-100	80-100	40-72	20-40	8-25
	49-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2	0	80-100	70-100	65-100	35-77	20-40	8-25
BoD--- Bowie	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	97-100	94-100	90-100	30-55	<25	NP-6
	11-34	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	87-100	80-100	40-72	20-40	8-25
	34-63	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2	0	80-100	70-100	65-100	35-77	20-40	8-25
ByC--- Briley	0-12	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-45	<25	NP-4
	12-27	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-100	17-45	<25	NP-4
	27-60	Sandy clay loam	SC, CL	A-4, A-6	0	95-100	95-100	85-100	36-65	22-39	8-22
CfE--- Cuthbert	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-1	85-100	78-100	75-98	20-55	<32	NP-7
	9-26	Sandy clay loam, clay loam, clay.	SC, CL, CH	A-6, A-7-6	0-1	95-100	88-100	80-100	45-98	37-64	19-40
	26-34	Sandy clay loam, clay loam, clay, shale.	SC, CL	A-6, A-7, A-2-6,	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	34-60	Stratified fine sandy loam to clay and shale.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	21-45	7-26

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CgE---------- Cuthbert	0-7	Gravelly fine sandy loam.	SM, GM, GM-GC, SM-SC	A-1-b, A-2-4, A-4	0-5	60-88	50-80	35-75	20-49	<32	NP-7
	7-20	Sandy clay loam, clay loam, clay.	SC, CL, CH	A-6, A-7-6	0-1	95-100	88-100	80-100	45-98	37-64	19-40
	20-28	Sandy clay loam, clay, clay loam, shaly clay.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	28-60	Stratified fine sandy loam to clay and shale.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	21-45	7-26
CrE*:											
Cuthbert--------	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-1	85-100	78-100	75-98	20-55	<32	NP-7
	9-26	Sandy clay loam, clay loam, clay.	SC, CL, CH	A-6, A-7-6	0-1	95-100	88-100	80-100	45-98	37-64	19-40
	26-34	Sandy clay loam, clay, clay loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	34-60	Stratified fine sandy loam to clay and shale.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	21-45	7-26
Urban land.											
CuC*:											
Cuthbert--------	0-1	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-1	85-100	78-100	75-98	20-55	<32	NP-7
	1-8	Clay----------	SC, CL, CH	A-6, A-7-6	0-1	85-100	75-100	65-100	45-98	37-64	20-40
	8-22	Clay, sandy clay loam, shaly clay.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	22-60	Stratified fine sandy loam to clay and shale.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	21-45	7-26
Redsprings------	0-1	Very gravelly sandy loam.	SC, SM-SC, GM, GM-GC	A-2-4, A-4, A-2-7, A-2-6	0-7	49-80	40-65	30-65	18-45	20-42	4-20
	1-40	Clay----------	CL, CH	A-7-6	0-7	70-100	70-98	65-85	51-75	41-60	18-30
	40-48	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-7	95-100	90-100	75-100	51-90	32-52	16-30
	48-60	Stratified sandy clay loam and shale.	SC, CL, CH	A-4, A-6, A-7-6	0-7	90-100	75-100	50-90	36-80	25-57	9-31
DaC, DaE---------	0-53	Loamy fine sand	SM	A-2-4	0-2	95-100	95-100	75-100	15-30	<27	NP-3
Darco	53-80	Sandy clay loam, fine sandy loam.	SC, CL	A-6, A-7-6, A-2-4	0	95-100	95-100	80-100	23-55	25-45	9-28

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Db*:											
Derly	0-14	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<30	NP-10
	14-17	Clay loam, clay	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-60	20-36
	17-45	Clay, silty clay	CH, CL	A-7, A-6	0	100	100	90-100	75-95	39-60	26-36
	45-70	Clay, silty clay, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	56-95	34-60	20-36
Besner	0-37	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-70	<25	NP-7
	37-63	Loam, fine sandy loam.	CL-ML, ML, SM-SC, SM	A-4	0	100	95-100	80-100	40-75	<25	NP-7
	63-72	Loam, sandy clay loam.	SC, CL	A-6, A-4	0	100	95-100	80-100	36-75	18-35	8-20
Dr*:											
Derly	0-14	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<30	NP-10
	14-17	Clay loam, clay	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-60	20-36
	17-45	Clay, silty clay	CH, CL	A-7, A-6	0	100	100	90-100	75-95	39-60	26-36
	45-70	Clay, silty clay, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	56-95	34-60	20-36
Raino	0-12	Fine sandy loam	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	12-34	Loam, sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-72	20-40	5-20
	34-60	Clay, sandy clay, clay loam.	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
ErB Elrose	0-7	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	85-100	78-100	70-99	30-47	<25	NP-7
	7-28	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	90-100	85-100	80-99	36-65	20-39	8-23
	28-60	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0	90-100	80-100	80-100	50-97	32-65	16-37
ErD Elrose	0-13	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	85-100	78-100	70-99	30-47	<25	NP-7
	13-19	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	90-100	85-100	80-99	36-65	20-39	8-23
	19-80	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0	90-100	80-100	80-100	50-97	32-65	16-37
Es Estes	0-3	Silty clay loam	CL	A-7-6, A-6	0	100	100	95-100	65-96	30-49	15-30
	3-48	Clay loam, silty clay loam, silty clay.	CL, CH	A-7-6, A-6	0	100	100	95-100	65-95	30-55	14-32
	48-60	Silty clay, clay	CL, CH	A-7-6	0	100	100	95-100	75-100	41-60	25-40
FrB Freestone	0-17	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-4	0	95-100	95-100	90-100	36-62	<26	NP-7
	17-50	Sandy clay loam	CL, CL-ML	A-6, A-7, A-4	0	95-100	95-100	90-100	55-85	24-46	7-23
	50-67	Clay	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GaB--Gallime	0-10	Fine sandy loam	SM, SC, CL, ML	A-4	0	95-100	95-100	90-100	45-65	15-28	3-10
	10-22	Fine sandy loam	SM, SC, CL-ML	A-4	0	95-100	95-100	90-100	45-65	15-28	3-10
	22-63	Sandy clay loam, loam.	CL, SC	A-6, A-4	0	95-100	95-100	90-100	45-80	25-40	8-20
Gw--Gladewater	0-6	Clay	CH, CL	A-7	0	100	100	90-100	80-95	48-75	25-50
	6-69	Clay	CH	A-7	0	100	100	95-100	90-100	51-75	30-50
Ke--Keechi	0-7	Loam	ML, CL, CL-ML	A-4	0	95-100	95-100	85-95	60-75	23-31	3-10
	7-60	Stratified loamy sand to loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	95-100	95-100	50-95	15-75	<30	NP-10
KfC--Kirvin	0-11	Very fine sandy loam.	SM, ML, CL, SC	A-4	0-2	85-100	78-98	70-95	36-70	<30	NP-8
	11-41	Clay loam, clay	CL, CH	A-7	0-1	95-100	90-100	85-100	53-95	42-67	24-43
	41-47	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7	0-1	95-100	90-100	75-100	51-90	32-59	16-32
	47-64	Stratified sandy clay loam to clay loam and shale.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
KgC--Kirvin	0-14	Gravelly fine sandy loam.	SM, GM, SC, GM-GC	A-2-4, A-4	0-5	55-92	47-80	40-75	25-49	<30	NP-8
	14-45	Clay loam, clay	CL, CH	A-7	0-1	95-100	90-100	85-100	53-95	42-67	24-43
	45-50	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7	0-1	95-100	90-100	75-100	51-90	32-59	16-32
	50-64	Stratified sandy clay loam to shale.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
KuB--Kullit	0-19	Fine sandy loam	SM, CL-ML, ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	19-59	Loam, sandy clay loam, clay loam.	CL	A-4, A-6	0	100	98-100	90-100	55-85	25-40	8-21
	59-70	Sandy clay, clay	CL, CH	A-7-6	0	100	98-100	85-100	55-95	44-71	20-42
KvC*:											
Kirvin	0-11	Very fine sandy loam.	SM, ML, CL, SC	A-4	0-2	85-100	78-98	70-95	36-70	<30	NP-8
	11-41	Clay loam, clay	CL, CH	A-7	0-1	95-100	90-100	85-100	53-95	42-67	24-43
	41-47	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7	0-1	95-100	90-100	75-100	51-90	32-59	16-32
	47-64	Stratified sandy clay loam, clay loam, and shale.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
Urban land.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LgB	0-28	Loamy fine sand	SM	A-2	0	100	100	85-100	15-30	<20	NP-4
Leagueville	28-63	Sandy clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	100	95-100	85-100	36-60	20-35	5-15
LtC	0-9	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-40	<20	NP-3
Lilbert	9-24	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-40	<20	NP-3
	24-67	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	85-100	36-55	23-39	8-22
	67-74	Sandy clay loam, clay loam.	SC, CL	A-6, A-4, A-2-4, A-2-6	0	90-100	90-100	85-100	30-55	22-39	8-20
Ma	0-8	Loam	CL-ML, SM-SC, SM, ML	A-4	0	95-100	90-100	60-85	40-60	<20	NP-5
Mantachie	8-60	Loam, clay loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6, A-7-6	0	95-100	90-100	80-95	45-80	20-45	5-27
OkB	0-15	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	90-100	90-100	70-90	36-55	<25	NP-7
Oakwood	15-39	Sandy clay loam	SC, CL	A-4, A-6	0	90-100	90-100	80-95	40-75	20-40	8-22
	39-72	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	85-100	85-100	80-95	40-75	20-40	8-22
OkD	0-18	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	90-100	90-100	70-90	36-55	<25	NP-7
Oakwood	18-26	Sandy clay loam	SC, CL	A-4, A-6	0	90-100	90-100	80-95	40-75	20-40	8-22
	26-70	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	85-100	85-100	80-95	40-75	20-40	8-22
OuC*:											
Oakwood	0-15	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	90-100	90-100	70-90	36-55	<25	NP-7
	15-39	Sandy clay loam	SC, CL	A-4, A-6	0	90-100	90-100	80-95	40-75	20-40	8-22
	39-72	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	85-100	85-100	80-95	40-75	20-40	8-22
Urban land.											
Ow	0-4	Loamy fine sand	SM	A-2-4	0	100	95-100	80-100	15-30	<25	NP-3
Owentown	4-20	Loamy fine sand	SM, SM-SC, SC	A-4, A-2-4	0	100	95-100	80-100	20-49	<25	NP-10
	20-53	Fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	80-100	36-66	<28	NP-10
	53-80	Loamy fine sand, fine sandy loam.	SM, SM-SC, SC	A-4, A-2-4	0	100	95-100	80-100	20-49	<25	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
PkC, PkE--------- Pickton	0-11	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	11-52	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	52-72	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-6, A-2-4	0	100	95-100	85-100	25-75	23-35	5-14
PuC*, PuE*: Pickton---------	0-11	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	11-52	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	52-72	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-6, A-2-4	0	100	95-100	85-100	25-75	23-35	5-14
Urban land.											
Px*. Pits											
Ra---------- Raino	0-12	Fine sandy loam	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	12-34	Loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-72	20-40	5-20
	34-60	Clay----------	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
RdC---------- Redsprings	0-5	Very gravelly sandy loam.	SC, SM-SC, GM, GM-GC	A-2-4, A-4, A-2-7	0-7	49-80	40-65	30-65	18-45	20-42	3-20
	5-38	Clay loam, clay	CL, CH	A-7-6	0-2	70-100	70-98	65-90	51-75	41-60	18-35
	38-56	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-7	95-100	90-100	75-100	51-90	32-56	16-30
	56-63	Stratified sandy clay loam and shale.	SC, CL, CH	A-4, A-6, A-7-6	0-7	90-100	75-100	50-90	36-80	25-57	9-31
RdE---------- Redsprings	0-5	Very gravelly sandy loam.	SC, SM-SC, GM, GM-GC	A-2-4, A-4, A-2-7	0-7	49-80	40-65	30-65	18-45	20-42	3-20
	5-24	Clay loam, clay	CL, CH	A-7-6	0-2	70-100	70-98	65-90	51-75	41-60	18-35
	24-49	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-7	95-100	90-100	75-100	51-90	32-56	16-30
	49-65	Stratified sandy clay loam and shale.	SC, CL, CH	A-4, A-6, A-7-6	0-7	90-100	75-100	50-90	36-80	25-57	9-31
RuD*: Redsprings------	0-5	Very gravelly sandy loam.	SC, SM-SC, GM, GM-GC	A-2-4, A-4, A-2-7	0-7	49-80	40-65	30-65	18-45	20-42	3-20
	5-38	Clay loam, clay	CL, CH	A-7-6	0-2	70-100	70-98	65-90	51-75	41-60	18-35
	38-56	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-7	95-100	90-100	75-100	51-90	32-56	16-30
	56-63	Stratified sandy clay loam and shale.	SC, CL, CH	A-4, A-6, A-7-6	0-7	90-100	75-100	50-90	36-80	25-57	9-31
Urban land.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
SaC--- Sacul	0-11	Very fine sandy loam, loam.	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	11-51	Clay---	CH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	51-63	Sandy clay loam, clay loam.	CL, CH, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
SaD--- Sacul	0-7	Very fine sandy loam.	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	7-38	Clay---	CH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	38-60	Sandy clay loam, clay loam.	CL, CH, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
TeE--- Tenaha	0-6	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	70-95	15-40	<20	NP-3
	6-28	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	70-95	15-40	<20	NP-3
	28-56	Sandy clay loam, clay loam.	SC, CL	A-6, A-4, A-7-6	0	95-100	95-100	80-100	36-66	25-46	8-26
	56-70	Stratified fine sandy loam to sandy clay loam and shale.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-60	25-45	11-26
ToC--- Tonkawa	0-10	Fine sand---	SP-SM	A-3, A-2	0	100	97-100	90-100	6-12	<25	NP-3
	10-80	Fine sand, sand	SP-SM	A-3, A-2	0	100	95-100	90-100	6-12	<25	NP-3
ToE--- Tonkawa	0-6	Fine sand---	SP-SM	A-3, A-2	0	100	97-100	90-100	6-12	<25	NP-3
	6-80	Fine sand, sand	SP-SM	A-3, A-2	0	100	95-100	90-100	6-12	<25	NP-3
TuC*:											
Tonkawa---	0-11	Fine sand---	SP-SM	A-3, A-2	0	100	97-100	90-100	6-12	<25	NP-3
	11-80	Fine sand, sand	SP-SM	A-3, A-2	0	100	95-100	90-100	6-12	<25	NP-3
Urban land.											
Ur*. Urban land											
WoC--- Wolfpen	0-7	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	7-27	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	27-61	Sandy clay loam	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	61-75	Sandy clay loam, loam, fine sandy loam.	SC, SM, CL, ML	A-4, A-6, A-2, A-7	0	95-100	95-100	85-100	25-55	15-45	2-27
WoE--- Wolfpen	0-11	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	11-31	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	31-41	Sandy clay loam	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	41-67	Sandy clay loam, loam.	SC, SM, CL, ML	A-4, A-6, A-2, A-7	0	95-100	95-100	85-100	25-55	15-45	2-27

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WuC*:											
Wolfpen	0-7	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	7-27	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	27-61	Sandy clay loam	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	61-75	Sandy clay loam, loam, fine sandy loam.	SC, SM, CL, ML	A-4, A-6, A-2, A-7	0	95-100	95-100	85-100	25-55	15-45	2-27
Urban land.											
WuE*:											
Wolfpen	0-10	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	10-31	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	31-41	Sandy clay loam	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	41-67	Sandy clay loam, loam.	SC, SM, CL, ML	A-4, A-6, A-2, A-7	0	95-100	95-100	85-100	25-55	15-45	2-27
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm				Pct
AoB	0-6	15-25	1.30-1.40	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.32	5	<1
Alto	6-35	20-30	1.35-1.45	0.6-2.0	0.13-0.17	5.1-6.5	<2	Moderate	0.32		
	35-41	27-45	1.40-1.60	0.2-0.6	0.14-0.18	5.1-7.3	<2	Moderate	0.32		
	41-50	25-35	1.45-1.65	0.6-2.0	0.12-0.16	5.1-7.3	<2	Moderate	0.32		
	50-70	20-40	1.50-1.70	0.2-0.6	0.10-0.14	5.6-7.3	<2	Moderate	0.32		
AtB	0-12	8-20	1.30-1.50	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.32	5	<1
Attoyac	12-60	18-32	1.40-1.65	0.6-2.0	0.12-0.17	5.1-6.5	<2	Low	0.32		
BeB	0-12	3-15	1.30-1.50	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.28	5	<2
Bernaldo	12-47	15-30	1.40-1.65	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate	0.32		
	47-63	10-30	1.45-1.70	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low	0.32		
BoB	0-11	3-15	1.40-1.69	2.0-6.0	0.10-0.15	4.5-6.5	<2	Low	0.32	5	<1
Bowie	11-49	20-35	1.60-1.69	0.6-2.0	0.11-0.18	4.5-5.5	<2	Low	0.32		
	49-80	20-35	1.60-1.80	0.2-0.6	0.11-0.18	4.5-5.5	<2	Low	0.32		
BoD	0-11	3-15	1.40-1.69	2.0-6.0	0.10-0.15	4.5-6.5	<2	Low	0.32	5	<1
Bowie	11-34	20-35	1.60-1.69	0.6-2.0	0.11-0.18	4.5-5.5	<2	Low	0.32		
	34-63	20-35	1.60-1.80	0.2-0.6	0.11-0.18	4.5-5.5	<2	Low	0.32		
ByC	0-12	5-18	1.50-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.20	5	<2
Briley	12-27	5-18	1.50-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.20		
	27-60	20-35	1.55-1.69	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low	0.24		
CfE	0-9	2-15	1.20-1.40	2.0-6.0	0.11-0.15	4.5-6.5	<2	Low	0.37	3	<2
Cuthbert	9-26	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	26-34	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	<2	Moderate	0.32		
	34-60	20-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.0	<2	Moderate	0.32		
CgE	0-7	2-15	1.20-1.40	2.0-6.0	0.10-0.14	4.5-6.5	<2	Low	0.20	3	<2
Cuthbert	7-20	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	20-28	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	<2	Moderate	0.32		
	28-60	20-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.0	<2	Moderate	0.32		
CrE*:											
Cuthbert	0-9	2-15	1.20-1.40	2.0-6.0	0.11-0.15	4.5-6.5	<2	Low	0.37	3	<2
	9-26	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	26-34	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	<2	Moderate	0.32		
	34-60	20-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.0	<2	Moderate	0.32		
Urban land.											
CuC*:											
Cuthbert	0-1	2-15	1.20-1.40	2.0-6.0	0.10-0.14	4.5-6.5	<2	Low	0.20	3	<.5
	1-8	35-60	1.20-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	8-22	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	<2	Moderate	0.32		
	22-60	20-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.0	<2	Moderate	0.32		
Redsprings	0-1	2-15	1.35-1.55	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low	0.20	4	<.5
	1-40	35-60	1.30-1.45	0.2-0.6	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
	40-48	25-50	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.0	<2	Moderate	0.32		
	48-60	20-45	1.40-1.60	0.06-0.2	0.10-0.17	4.5-5.5	<2	Moderate	0.32		
DaC, DaE	0-53	3-15	1.50-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.17	5	<1
Darco	53-80	20-35	1.55-1.75	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	0.24		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm				Pct
Db*:											
Derly	0-14	8-20	1.40-1.60	0.6-2.0	0.13-0.24	4.5-5.5	<2	Low	0.37	5	<2
	14-17	30-45	1.40-1.55	0.06-0.2	0.15-0.22	4.5-5.5	<2	Moderate	0.37		
	17-45	40-60	1.45-1.60	<0.06	0.12-0.18	4.5-6.0	<2	High	0.32		
	45-70	30-60	1.44-1.65	<0.06	0.12-0.18	5.6-7.3	<2	High	0.32		
Besner	0-37	5-15	1.20-1.40	2.0-6.0	0.11-0.15	4.5-6.5	<2	Low	0.24	5	<1
	37-63	14-18	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low	0.32		
	63-72	15-30	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low	0.32		
Dr*:											
Derly	0-14	8-20	1.40-1.60	0.6-2.0	0.13-0.24	4.5-5.5	<2	Low	0.37	5	<2
	14-17	30-45	1.40-1.55	0.06-0.2	0.15-0.22	4.5-5.5	<2	Moderate	0.37		
	17-45	40-60	1.45-1.60	<0.06	0.12-0.18	4.5-6.0	<2	High	0.32		
	45-70	30-60	1.44-1.65	<0.06	0.12-0.18	5.6-7.3	<2	High	0.32		
Raino	0-12	5-18	1.30-1.40	0.6-2.0	0.11-0.20	4.5-6.5	<2	Low	0.43	5	<2
	12-34	18-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	<2	Moderate	0.43		
	34-60	40-60	1.45-1.65	<0.06	0.12-0.18	4.5-6.5	<2	High	0.32		
ErB	0-7	2-15	1.25-1.40	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	0.28	5	<2
Elrose	7-28	15-31	1.30-1.55	0.6-2.0	0.13-0.16	4.5-7.3	<2	Low	0.32		
	28-60	27-55	1.35-1.65	0.6-2.0	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
ErD	0-13	2-15	1.25-1.40	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	0.28	5	<2
Elrose	13-19	15-31	1.30-1.55	0.6-2.0	0.13-0.16	4.5-7.3	<2	Low	0.32		
	19-80	27-55	1.35-1.65	0.6-2.0	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
Es	0-3	28-40	1.30-1.50	0.06-0.2	0.17-0.21	5.1-6.0	<2	Moderate	0.32	5	<5
Estes	3-48	35-50	1.45-1.65	<0.06	0.15-0.21	3.6-5.5	<4	Moderate	0.32		
	48-60	40-60	1.50-1.65	<0.06	0.13-0.17	3.6-5.5	<4	High	0.32		
FrB	0-17	5-15	1.35-1.56	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low	0.32	5	<2
Freestone	17-50	20-35	1.35-1.55	0.2-0.6	0.12-0.17	4.5-5.5	<2	Moderate	0.32		
	50-67	40-50	1.29-1.60	0.06-0.2	0.12-0.18	4.5-6.5	<2	High	0.32		
GaB	0-10	10-20	1.30-1.40	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.32	5	<2
Gallime	10-22	10-20	1.35-1.50	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.32		
	22-63	18-35	1.40-1.65	0.6-2.0	0.12-0.17	4.5-6.0	<2	Moderate	0.32		
Gw	0-6	40-60	1.35-1.55	0.06-0.2	0.15-0.20	5.6-7.3	<2	High	0.32	5	1-3
Gladewater	6-69	40-60	1.40-1.60	<0.06	0.15-0.18	4.5-8.4	<2	High	0.32		
Ke	0-7	8-28	1.40-1.55	2.0-6.0	0.13-0.20	5.1-7.3	<2	Low	0.28	5	<1
Keechi	7-60	5-18	1.40-1.55	0.6-2.0	0.06-0.20	5.1-7.3	<2	Low	0.28		
KfC	0-11	2-15	1.20-1.40	2.0-6.0	0.11-0.16	5.1-7.3	<2	Low	0.37	4	<2
Kirvin	11-41	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	41-47	25-50	1.35-1.60	0.2-0.6	0.10-0.16	3.6-5.0	<2	Moderate	0.32		
	47-64	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	<2	Moderate	0.32		
KgC	0-14	2-15	1.20-1.40	2.0-6.0	0.08-0.12	5.1-7.3	<2	Low	0.20	4	<2
Kirvin	14-45	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	45-50	25-50	1.35-1.60	0.2-0.6	0.10-0.16	3.6-5.0	<2	Moderate	0.32		
	50-64	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	<2	Moderate	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm				Pct
KuB	0-19	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.24	5	<1
Kullit	19-59	18-35	1.35-1.60	0.6-2.0	0.11-0.15	4.5-5.5	<2	Low	0.32		
	59-70	35-50	1.35-1.65	0.2-0.6	0.11-0.15	4.5-5.0	<2	Moderate	0.28		
KvC*:											
Kirvin	0-11	2-15	1.20-1.40	2.0-6.0	0.11-0.16	5.1-7.3	<2	Low	0.37	4	<2
	11-41	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	<2	Moderate	0.32		
	41-47	25-50	1.35-1.60	0.2-0.6	0.10-0.16	3.6-5.0	<2	Moderate	0.32		
	47-64	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	<2	Moderate	0.32		
Urban land.											
LgB	0-28	2-10	1.20-1.50	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.17	5	<2
Leagueville	28-63	10-25	1.30-1.60	0.6-2.0	0.12-0.17	3.6-5.5	<2	Low	0.20		
LtC	0-9	3-15	1.50-1.60	6.0-20	0.07-0.12	4.5-6.5	<2	Low	0.20	5	<2
Lilbert	9-24	3-15	1.50-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.20		
	24-67	20-35	1.55-1.69	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low	0.24		
	67-74	20-35	1.60-1.75	0.2-0.6	0.10-0.15	4.5-6.0	<2	Low	0.24		
Ma	0-8	8-20	1.50-1.60	0.6-2.0	0.16-0.20	4.5-5.5	<2	Low	0.28	5	1-3
Mantachie	8-60	18-34	1.50-1.60	0.6-2.0	0.14-0.20	4.5-5.5	<2	Low	0.28		
OkB	0-15	5-15	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low	0.32	5	<1
Oakwood	15-39	20-35	1.50-1.70	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low	0.32		
	39-72	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-6.5	<2	Low	0.28		
OkD	0-18	5-15	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low	0.32	5	<1
Oakwood	18-26	20-35	1.50-1.70	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low	0.32		
	26-70	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-6.5	<2	Low	0.28		
OuC*:											
Oakwood	0-15	5-15	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low	0.32	5	<1
	15-39	20-35	1.50-1.70	0.6-2.0	0.15-0.20	5.1-6.5	<2	Low	0.32		
	39-72	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-6.5	<2	Low	0.28		
Urban land.											
Ow	0-4	5-12	1.25-1.40	2.0-6.0	0.07-0.11	5.1-6.0	<2	Low	0.28	5	<1
Owentown	4-20	5-15	1.30-1.40	2.0-6.0	0.07-0.11	5.1-6.0	<2	Low	0.28		
	20-53	6-18	1.30-1.55	0.6-2.0	0.11-0.16	5.1-6.0	<2	Low	0.32		
	53-80	5-12	1.30-1.40	2.0-6.0	0.07-0.11	5.1-6.0	<2	Low	0.28		
PkC, PkE	0-11	4-12	1.30-1.60	6.0-20	0.07-0.11	5.6-7.3	<2	Low	0.17	5	<2
Pickton	11-52	3-12	1.30-1.60	6.0-20	0.07-0.11	5.1-7.3	<2	Low	0.17		
	52-72	20-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	0.24		
PuC*, PuE*:											
Pickton	0-11	4-12	1.30-1.60	6.0-20	0.07-0.11	5.6-7.3	<2	Low	0.17	5	<2
	11-52	3-12	1.30-1.60	6.0-20	0.07-0.11	5.1-7.3	<2	Low	0.17		
	52-72	20-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	0.24		
Urban land.											
Px*.											
Pits											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm				Pct
Ra	0-12	5-18	1.30-1.40	0.6-2.0	0.11-0.20	4.5-6.5	<2	Low	0.43	5	<2
Raino	12-34	18-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	<2	Moderate	0.43		
	34-60	40-60	1.45-1.65	<0.06	0.12-0.18	4.5-6.5	<2	High	0.32		
RdC	0-5	2-15	1.35-1.55	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low	0.20	4	<2
Redsprings	5-38	35-60	1.30-1.45	0.2-0.6	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
	38-56	25-55	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.0	<2	Moderate	0.32		
	56-63	20-45	1.40-1.60	0.06-0.2	0.10-0.17	4.5-5.5	<2	Moderate	0.32		
RdE	0-5	2-15	1.35-1.55	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low	0.20	4	<2
Redsprings	5-37	35-60	1.30-1.45	0.2-0.6	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
	37-49	25-55	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.0	<2	Moderate	0.32		
	49-65	20-45	1.40-1.60	0.06-0.2	0.10-0.17	4.5-5.5	<2	Moderate	0.32		
RuD*:											
Redsprings	0-5	2-15	1.35-1.55	0.6-2.0	0.08-0.12	5.6-7.3	<2	Low	0.20	4	<2
	5-24	35-60	1.30-1.45	0.2-0.6	0.12-0.18	4.5-6.5	<2	Moderate	0.32		
	24-56	25-55	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.0	<2	Moderate	0.32		
	56-63	20-45	1.40-1.60	0.06-0.2	0.10-0.17	4.5-5.5	<2	Moderate	0.32		
Urban land.											
SaC	0-11	5-25	1.30-1.50	0.6-2.0	0.10-0.20	4.5-5.5	<2	Low	0.32	5	1-3
Sacul	11-51	40-60	1.20-1.35	0.06-0.2	0.12-0.18	4.5-5.5	<2	High	0.32		
	51-63	20-40	1.25-1.45	0.2-0.6	0.16-0.24	4.5-5.5	<2	Moderate	0.37		
SaD	0-7	5-25	1.30-1.50	0.6-2.0	0.10-0.20	4.5-5.5	<2	Low	0.32	5	1-3
Sacul	7-38	40-60	1.20-1.35	0.06-0.2	0.12-0.18	4.5-5.5	<2	High	0.32		
	38-60	20-40	1.25-1.45	0.2-0.6	0.16-0.24	4.5-5.5	<2	Moderate	0.37		
TeE	0-6	3-15	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	<2	Low	0.17	3	<1
Tenaha	6-28	3-15	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	<2	Low	0.24		
	28-56	20-35	1.50-1.65	0.6-2.0	0.12-0.17	4.5-5.5	<2	Low	0.24		
	56-70	10-30	1.60-1.75	0.2-0.6	0.08-0.14	4.5-5.5	<2	Low	0.24		
ToC	0-10	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15	5	<1
Tonkawa	10-80	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15		
ToE	0-6	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15	5	<1
Tonkawa	6-80	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15		
TuC*:											
Tonkawa	0-11	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15	5	<1
	11-80	2-8	1.30-1.55	6.0-20	0.04-0.08	4.5-6.5	<2	Low	0.15		
Urban land.											
Ur*.											
Urban land											
WoC	0-7	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	<2	Low	0.17	5	.5-2
Wolfpen	7-27	3-12	1.30-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low	0.17		
	27-61	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	0.24		
	61-75	15-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low	0.24		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm				Pct
WoE----------	0-11	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	<2	Low----------	0.17	5	.5-2
Wolfpen	11-31	3-12	1.30-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low----------	0.17		
	31-41	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
	41-67	15-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
WuC*:											
Wolfpen----------	0-7	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	<2	Low----------	0.17	5	.5-2
	7-27	3-12	1.30-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low----------	0.17		
	27-61	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
	61-75	15-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
Urban land.											
WuE*:											
Wolfpen----------	0-10	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	<2	Low----------	0.17	5	.5-2
	10-31	3-12	1.30-1.65	6.0-20	0.07-0.11	4.5-6.5	<2	Low----------	0.17		
	31-41	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
	41-67	15-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low----------	0.24		
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
AoB---------- Alto	C	None--------	---	---	2.5-4.0	Apparent	Jan-Mar	High-----	Moderate.
AtB---------- Attoyac	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
BeB---------- Bernaldo	B	None--------	---	---	4.0-6.0	Apparent	Nov-Feb	Moderate	Moderate.
BoB, BoD---------- Bowie	B	None--------	---	---	3.5-5.0	Apparent	Jan-Apr	Moderate	High.
ByC---------- Briley	B	None--------	---	---	>6.0	---	---	Moderate	High.
CfE, CgE---------- Cuthbert	C	None--------	---	---	>6.0	---	---	High-----	High.
CrE*: Cuthbert---------	C	None--------	---	---	>6.0	---	---	High-----	High.
Urban land.									
CuC*: Cuthbert---------	D	None--------	---	---	>6.0	---	---	High-----	High.
Redsprings-------	D	None--------	---	---	>6.0	---	---	High-----	High.
DaC, DaE---------- Darco	A	None--------	---	---	>6.0	---	---	Low------	Moderate.
Db*: Derly----------	D	None--------	---	---	0-1.5	Perched	Oct-May	High-----	High.
Besner----------	B	None--------	---	---	4.0-6.0	Apparent	Jan-Feb	Low------	Moderate.
Dr*: Derly----------	D	None--------	---	---	0-1.5	Perched	Oct-May	High-----	High.
Raino----------	D	None--------	---	---	2.0-3.5	Perched	Dec-May	High-----	Moderate.
ErB, ErD---------- Elrose	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
Es---------- Estes	D	Frequent----	Brief to long.	Nov-May	+.5-2.0	Perched	Nov-May	High-----	High.
FrB---------- Freestone	C	None--------	---	---	1.5-3.0	Perched	Dec-May	High-----	Moderate.
GaB---------- Gallime	B	None--------	---	---	4.0-6.0	Apparent	Dec-Mar	Moderate	Moderate.
Gw---------- Gladewater	D	Frequent----	Brief to long.	Nov-May	0-3.5	Apparent	Nov-May	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
Ke Keechi	C	Frequent	Long	Dec-May	0-1.5	Apparent	Dec-Apr	High	Moderate.
KfC, KgC Kirvin	C	None	---	---	>6.0	---	---	High	High.
KuB Kullit	B	None	---	---	2.0-3.0	Apparent	Dec-May	High	High.
KvC*: Kirvin	C	None	---	---	>6.0	---	---	High	High.
Urban land.									
LgB Leagueville	B/D	Rare	---	---	0.5-1.5	Apparent	Nov-May	High	High.
LtC Lilbert	B	None	---	---	>6.0	---	---	Moderate	High.
Ma Mantachie	C	Frequent	Brief	Nov-May	1.0-1.5	Apparent	Dec-Mar	High	High.
OkB, OkD Oakwood	B	None	---	---	3.5-5.0	Apparent	Jan-Apr	High	Moderate.
OuC*: Oakwood	B	None	---	---	3.5-5.0	Apparent	Jan-Apr	High	Moderate.
Urban land.									
Ow Owentown	B	Occasional	Brief	Nov-May	2.5-4.0	Apparent	Dec-Mar	Moderate	Moderate.
PkC, PkE Pickton	A	None	---	---	4.0-6.0	Apparent	Jan-Mar	Moderate	High.
PuC*, PuE*: Pickton	A	None	---	---	4.0-6.0	Apparent	Jan-Mar	Moderate	High.
Urban land.									
Px*. Pits									
Ra Raino	D	None	---	---	2.0-3.5	Perched	Dec-May	High	Moderate.
RdC, RdE Redsprings	B	None	---	---	>6.0	---	---	High	High.
RuD*: Redsprings	B	None	---	---	>6.0	---	---	High	High.
Urban land.									
SaC, SaD Sacul	C	None	---	---	2.0-4.0	Apparent	Dec-Apr	High	Moderate.
TeE Tenaha	B	None	---	---	>6.0	---	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
ToC, ToE---------- Tonkawa	A	None---------	---	---	>6.0	---	---	Low------	Moderate.
TuC*: Tonkawa---------- Urban land.	A	None---------	---	---	>6.0	---	---	Low------	Moderate.
Ur*. Urban land									
WoC, WoE---------- Wolfpen	A	None---------	---	---	4.0-6.0	Apparent	Dec-May	Moderate	High.
WuC*, WuE*: Wolfpen---------- Urban land.	A	None---------	---	---	4.0-6.0	Apparent	Dec-May	Moderate	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL ANALYSIS OF SELECTED SOILS

(Data determined by the Soil Survey Laboratory Staff, Lincoln, Nebraska. Dashes indicate material was not detected or data were not determined)

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	COLE	Bulk density (field moist)	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/cm	g/cm^3	--Pct (wt)--	
Attoyac fine sandy loam[1]:														
(S82TX-423-005)[2]	0-9	A	0.6	1.6	10.4	36.2	24.9	73.7	21.4	4.9	---	1.68	7.5	2.2
	9-15	BA	---	0.9	8.4	33.5	24.3	67.1	24.3	8.6	0.006	1.69	7.7	3.2
	15-30	Bt1	0.3	0.7	6.2	23.3	18.1	48.6	23.3	28.1	0.016	1.69	15.7	10.0
	30-45	Bt1	0.7	0.9	6.3	22.9	18.3	49.1	23.3	27.6	---	1.70	---	10.0
	45-55	Bt2	3.7	2.2	6.6	21.8	16.2	50.5	21.5	28.0	0.011	1.64	17.2	10.4
	55-66	Bt2	2.3	1.9	6.9	23.3	16.5	50.9	24.1	25.0	0.009	1.72	15.0	9.7
	66-80	Bt3	0.7	0.8	7.4	25.3	18.5	52.7	24.0	23.3	0.011	1.71	14.5	8.8
Cuthbert very fine sandy loam[3]:														
(S82TX-423-003)	0-3	A	2.3	2.3	8.3	16.3	40.0	69.2	27.8	3.0	---	1.40	---	5.5
	3-9	E	1.6	1.1	6.3	13.5	43.9	66.4	28.7	4.9	---	1.48	9.9	2.3
	9-20	Bt	---	0.1	0.3	2.2	30.6	33.2	29.3	37.5	0.026	1.50	21.1	14.2
	20-27	B/C	---	0.1	0.1	2.9	39.1	42.2	30.7	27.1	0.015	1.55	16.6	10.8
	27-39	C/B	---	---	---	2.8	51.8	54.6	32.8	12.6	0.012	1.61	14.8	5.5
	39-55	C1	---	---	0.1	17.0	66.9	84.0	8.7	7.3	0.004	1.62	7.1	2.8
	55-68	C2	---	---	---	17.2	73.4	90.6	4.9	4.5	0.002	1.59	5.9	2.1
	68-80	C3	---	---	---	8.9	77.2	86.1	10.2	3.7	0.002	1.52	6.1	3.0
Kirvin very fine sandy loam[4]:														
(S72TX-423-001)	0-3	A	1.1	1.4	2.6	13.5	53.6	72.2	26.4	1.4	---	---	---	4.6
	3-7	E1	2.4	0.8	2.3	11.7	53.6	70.8	26.8	2.4	---	---	---	1.7
	7-12	E2	1.6	0.8	1.6	9.0	48.3	61.3	33.9	4.8	---	---	---	2.2
	12-28	Bt1	0.3	0.2	0.3	1.3	10.4	12.5	23.7	63.8	---	---	---	24.4
	28-40	Bt2	0.4	0.5	0.3	1.0	11.5	13.7	35.9	50.4	---	---	---	20.0
	40-48	B/C	0.8	0.7	0.4	4.1	21.7	27.7	30.2	42.1	---	---	---	16.7
	48-65	C	0.7	1.2	0.6	2.6	24.7	29.8	28.9	41.3	---	---	---	17.6
Mantachie clay loam[5]:														
(S82TX-423-001)	0-3	A1	0.4	0.8	2.3	14.9	9.1	27.5	41.4	31.1	---	1.30	---	15.3
	3-7	A2	0.1	0.4	1.9	15.9	9.7	28.0	42.2	29.8	---	1.40	---	12.5
	7-14	Bg1	0.1	0.3	3.7	34.5	20.3	58.9	31.7	9.4	0.002	1.71	11.9	3.2
	14-23	Bg2	0.6	0.5	3.7	29.4	15.2	49.4	28.7	21.9	---	1.70	---	9.8
	23-35	Bg3	1.0	1.4	4.7	32.5	14.9	54.5	24.4	21.1	0.023	1.68	17.1	9.8
	35-43	Bg4	0.8	0.8	3.3	30.3	15.2	50.4	19.3	30.3	0.094	1.44	24.8	14.2
	43-66	2Cg	---	0.3	3.0	33.9	15.0	52.2	14.2	33.6	0.034	1.51	22.1	15.3
	66-79	3Cg	0.2	1.3	7.0	53.8	15.6	77.9	9.4	12.7	---	1.60	---	7.5

See footnotes at end of table.

TABLE 18.--PHYSICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	COLE	Bulk density (field moist)	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/cm	g/cm^3	--Pct (wt)--	
Redsprings very gravelly sandy loam[6]:														
(S82TX-423-002)	0-7	A	22.8	15.7	7.7	16.2	8.7	71.1	18.6	10.3	---	1.30	---	10.0
	7-13	Bt1	7.3	8.2	6.3	24.1	11.5	57.4	19.3	23.3	---	1.40	---	9.8
	13-22	Bt2	3.9	2.5	2.0	17.9	6.8	33.1	10.8	56.1	0.036	1.45	25.5	18.7
	22-31	Bt3	2.7	1.2	0.9	19.0	8.8	32.6	13.4	54.0	0.021	1.52	25.0	20.9
	31-41	Bt4	1.8	1.2	0.8	18.2	12.9	34.9	17.6	47.5	0.028	1.52	22.7	18.9
	41-51	B/C	1.0	0.9	1.0	19.8	9.7	32.4	18.4	49.2	0.028	1.49	26.4	18.7
	51-65	C	3.5	2.7	2.0	10.2	8.1	26.5	26.7	46.8	---	1.50	---	21.1
	65-79	2C	0.8	0.5	0.5	25.6	10.9	38.3	19.8	41.9	0.026	1.50	24.6	16.6
Wolfpen loamy fine sand[7]:														
(S82TX-423-004)	0-4	A1	---	0.2	8.1	63.5	13.0	84.8	14.1	1.1	---	1.57	4.0	1.1
	4-9	A2	---	0.1	7.2	62.3	12.9	82.5	15.4	2.1	0.002	1.70	5.6	1.0
	9-21	E	---	0.1	7.2	58.6	10.9	76.8	19.5	3.7	---	1.60	5.6	1.3
	21-25	E/B	---	0.1	7.1	56.8	10.5	74.5	19.7	5.8	0.002	1.65	5.8	2.3
	25-39	Bt	---	0.1	5.6	45.6	9.5	60.8	19.8	19.4	0.018	1.66	15.6	9.3
	39-60	Btv1	---	---	8.3	55.0	9.4	72.7	16.2	11.1	0.008	1.72	12.1	5.8
	60-73	Btv2	---	0.1	11.1	59.3	7.4	77.9	13.5	8.6	0.004	1.79	9.2	4.4
	73-85	Btv/E	---	0.2	11.8	60.6	6.3	78.9	12.9	8.2	0.004	1.85	9.8	4.8

[1] Pedon location: from intersection of Texas Highway 64 and Farm Road 724, northwest 2.4 miles on Farm Road 724, south 300 feet, in a pasture.

[2] The Bt1 and Bt2 horizons were subdivided for sampling purposes.

[3] Pedon location: from intersection of U.S. Highway 69 and Farm Road 16 in Lindale, north 3.3 miles on U.S. Highway 69, north 0.7 mile on County Road 4118, east 0.3 mile on County Road 452, north 0.2 mile on a farm lane, east 300 feet, in a wooded area. The pedon is a taxadjunct to the Cuthbert series because mineralogy is kaolinitic rather than mixed.

[4] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, southeast 6.8 miles on Farm Road 346, south 100 feet, in a wooded area.

[5] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, south 3.6 miles on Texas Highway 110, west 2.6 miles on Farm Road 344, south 1.45 miles on Yarborough Lane, west 0.8 mile on a road in a pasture, on a flood plain along West Mud Creek.

[6] Pedon location: from intersection of Farm Road 16 and Farm Road 1253 in Garden Valley, east 0.2 mile on Farm Road 16, north 2.5 miles on County Road 443, northwest 0.25 mile on County Road 443, east 35 feet, in a wooded area. The pedon is a taxadjunct to the Redsprings series because mineralogy is mixed rather than kaolinitic.

[7] Pedon location: from intersection of Loop 323 and Texas Highway 14 in Tyler, north 1.8 miles on Texas Highway 14, west 0.2 mile on County Road 37, south 150, feet in an old field. The pedon is outside the range of the Wolfpen series because it has more than 5 percent plinthite below a depth of 60 inches.

TABLE 19.--CHEMICAL ANALYSIS OF SELECTED SOILS

(Determined by the Soil Survey Laboratory Staff, Lincoln, Nebraska. TR indicates trace. Dashes indicate that data were not available)

Soil name and sample number	Depth	Horizon	Extractable bases				Cation-exchange capacity	Base saturation	Reaction 1:1 soil:water	Organic matter
			Ca	Mg	K	Na				
	In		Meq/100g					Pct	pH	Pct
Attoyac fine sandy loam[1]:										
(S82TX-423-005)[2]	0-9	A	1.0	0.3	0.1	TR	5.2	27	4.6	0.99
	9-15	BA	1.4	0.4	0.1	---	4.4	43	5.4	0.44
	15-30	Bt1	3.5	1.5	0.4	TR	10.3	52	5.7	0.32
	30-45	Bt1	2.8	1.7	0.3	TR	10.0	48	5.6	0.29
	45-55	Bt2	2.3	1.5	0.1	TR	8.2	48	5.3	0.24
	55-66	Bt2	2.0	1.5	0.1	0.1	8.9	42	5.3	0.24
	66-80	Bt3	1.5	1.5	0.1	0.1	7.7	42	5.2	0.20
Cuthbert very fine sandy loam[3]:										
(S82TX-423-003)	0-3	A	1.9	0.8	0.3	---	8.6	35	5.1	4.40
	3-9	E	0.1	0.2	0.1	---	3.1	13	4.6	0.88
	9-20	Bt	0.2	1.3	0.4	---	11.3	17	4.7	0.90
	20-27	B/C	0.1	0.7	0.2	---	8.4	12	4.5	0.88
	27-39	C/B	---	0.3	0.1	---	4.0	10	4.4	0.26
	39-55	C1	TR	0.2	TR	---	2.2	9	4.4	0.20
	55-68	C2	---	0.1	---	---	1.2	8	4.5	0.17
	68-80	C3	0.1	0.2	TR	---	2.0	15	4.5	0.17
Kirvin very fine sandy loam[4]:										
(S72TX-423-001)	0-3	A	---	---	---	---	---	---	5.1	2.94
	3-7	E1	---	---	---	---	---	---	5.5	0.36
	7-12	E2	---	---	---	---	---	---	5.5	0.34
	12-28	Bt1	---	---	---	---	---	---	4.7	0.77
	28-40	Bt2	---	---	---	---	---	---	4.5	---
	40-48	B/C	0.3	4.0	0.4	0.1	25.0	19	4.2	---
	48-65	C	0.2	3.0	0.4	0.1	25.9	14	3.8	---
Mantachie clay loam[5]:										
(S82TX-423-001)	0-3	A1	8.0	2.5	0.4	0.3	27.0	41	4.5	4.73
	3-7	A2	3.9	1.7	0.3	0.2	17.9	34	4.4	3.04
	7-14	Bg1	0.4	0.7	0.1	---	4.5	27	4.5	0.88
	14-23	Bg2	0.4	3.2	0.2	TR	13.7	28	4.3	0.90
	23-35	Bg3	0.5	3.8	0.2	---	12.7	35	4.6	0.43
	35-43	Bg4	2.1	5.9	0.5	---	17.7	48	4.8	0.51
	43-66	2Cg	1.6	3.2	0.5	---	20.6	26	4.4	0.46
	66-79	3Cg	0.9	1.1	0.1	---	6.4	33	4.8	0.20
Redsprings very gravelly sandy loam[6]:										
(S82TX-423-002)	0-7	A	9.7	1.9	0.4	---	19.5	62	6.0	4.20
	7-13	Bt1	3.7	1.3	0.2	---	10.6	49	6.1	1.00
	13-22	Bt2	5.6	4.0	0.4	---	16.7	60	6.3	0.85
	22-31	Bt3	3.5	4.1	0.3	---	17.0	46	5.4	0.56
	31-41	Bt4	2.8	4.0	0.2	---	16.1	43	5.3	0.41
	41-51	B/C	3.5	5.5	0.2	---	18.3	50	5.1	0.32
	51-65	C	2.8	5.1	0.2	---	19.1	42	5.2	0.34
	65-79	2C	1.3	4.8	0.3	---	18.6	34	4.7	0.24

See footnotes at end of table.

TABLE 19.--CHEMICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases				Cation-exchange capacity	Base saturation	Reaction 1:1 soil:water	Organic matter
			Ca	Mg	K	Na				
	In		Meq/100g					Pct	pH	Pct
Wolfpen loamy fine sand:[7]										
(S82TX-423-004)	0-4	A1	0.4	0.1	0.1	TR	2.6	23	4.6	0.51
	4-9	A2	0.2	0.1	0.1	TR	2.1	19	4.6	0.39
	9-21	E	0.3	0.1	0.1	TR	2.8	18	4.8	0.27
	21-25	E/B	0.9	0.2	0.1	TR	3.5	34	5.1	0.26
	25-39	Bt	4.5	1.7	0.3	TR	11.5	57	5.5	0.37
	39-60	Btv1	2.3	1.1	0.1	0.1	7.4	49	5.2	0.24
	60-73	Btv2	1.8	0.9	0.1	TR	5.7	49	5.5	0.20
	73-85	Btv/E	1.7	0.9	0.1	TR	5.6	48	5.5	0.17

[1] Pedon location: from intersection of Texas Highway 64 and Farm Road 724, northwest 2.4 miles on Farm Road 724, south 300 feet, in a pasture.

[2] The Bt1 and Bt2 horizons were subdivided for sampling purposes.

[3] Pedon location: from intersection of U.S. Highway 69 and Farm Road 16 in Lindale, north 3.3 miles on U.S. Highway 69, north 0.7 mile on County Road 4118, east 0.3 mile on County Road 452, north 0.2 mile on a farm lane, east 300 feet, in a wooded area. The pedon is a taxadjunct to the Cuthbert series because mineralogy is kaolinitic rather than mixed.

[4] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, southeast 6.8 miles on Farm Road 346, south 100 feet, in a wooded area.

[5] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, south 3.6 miles on Texas Highway 110, west 2.6 miles on Farm Road 344, south 1.45 miles on Yarborough Lane, west 0.8 mile on a road in a pasture, on a flood plain along West Mud Creek.

[6] Pedon location: from intersection of Farm Road 16 and Farm Road 1253 in Garden Valley, east 0.2 mile on Farm Road 16, north 2.5 miles on County Road 442, northwest 0.25 mile on County Road 443, east 35 feet, in a wooded area. The pedon is a taxadjunct to the Redsprings series because mineralogy is mixed rather than kaolinitic.

[7] Pedon location: from intersection of Loop 323 and Texas Highway 14 in Tyler, north 1.8 miles on Texas Highway 14, west 0.2 mile on County Road 37, south 150 feet, in an old field. The pedon is outside the range of the Wolfpen series because it has more than 5 percent plinthite below a depth of 60 inches.

TABLE 20.--CLAY MINERALOGY OF SELECTED SOILS

(Data determined by the Soil Survey Laboratory Staff, Lincoln, Nebraska. Dashes indicate that material was not detected)

Soil name and sample number	Depth	Horizon	Clay mineralogy and relative amounts[1] (x-ray <.002mm)					
			Kaolinite	Montmorillonite	Mica	Vermiculite	Goethite	Quartz
	In							
Attoyac fine sandy loam[2]: (S82TX-423-005)	15-30	Bt1	4	1	2	---	1	---
Cuthbert very fine sandy loam[3]: (S82TX-423-003)	9-20	Bt	5	1	2	---	1	---
	55-68	C2	5	2	2	---	2	---
Mantachie clay loam[4]: (S82TX-423-001)	14-23	Bg2	3	4	2	---	---	1
	43-66	2Cg	3	2	1	---	2	---
Redsprings very gravelly sandy loam[5]: (S82TX-423-002)	13-22	Bt2	4	1	1	---	2	---
	31-41	Bt4	4	1	1	---	2	---
	51-65	C	4	2	1	---	2	---
	65-79	2C	5	3	2	---	1	---
Wolfpen loamy fine sand[6]: (S82TX-423-004)	25-39	Bt	4	2	2	3	---	---
	60-73	Btv2	3	2	2	3	---	---

[1] Relative amounts: 5, dominant; 4, abundant; 3, moderate; 2, small; and 1, trace.

[2] Pedon location: from intersection of Texas Highway 64 and Farm Road 724, northwest 2.4 miles on Farm Road 724, south 300 feet, in a pasture.

[3] Pedon location: from intersection of U.S. Highway 69 and Farm Road 16 in Lindale, north 3.3 miles on U.S. Highway 69, north 0.7 mile on County Road 4118, east 0.3 mile on County Road 452, north 0.2 mile in an area of farmland, east 300 feet, in a wooded area. The pedon is a taxadjunct to the Cuthbert series because mineralogy is kaolinitic rather than mixed.

[4] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, south 3.6 miles on Texas Highway 110, west 2.6 miles on Farm Road 344, south 1.45 miles on Yarborough Lane, west 0.8 mile on a road in a pasture, on a flood plain along West Mud Creek.

[5] Pedon location: from intersection of Farm Road 16 and Farm Road 1253 in Garden Valley, east 0.2 mile on Farm Road 16, north 2.5 miles on County Road 443, northwest 0.25 mile on County Road 443, east 35 feet, in a wooded area. The pedon is a taxadjunct to the Redsprings series because mineralogy is mixed rather than kaolinitic.

[6] Pedon location: from intersection of Loop 323 and Texas Highway 14 in Tyler, north 1.8 miles on Texas Highway 14, west 0.2 mile on County Road 37, south 150 feet, in an old field. The pedon is outside the range of the Wolfpen series because it has more than 5 percent plinthite below a depth of 60 inches.

TABLE 21.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. LL means liquid limit, and PI means plasticity index)

Soil name, report number, horizon, and depth in inches	Classification		Percentage passing sieve--						LL	PI	Particle density	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		g/cc	Pct	Pct	
Attoyac fine sandy loam[1]: (S82TX-423-5)														
A------- 0 to 9	A-4(0)	SM-SC	---	---	100	99	96	40	21	4	2.66	19.0	1.3	1.76
Bt2----- 45 to 66	A-6(12)	CL	---	---	100	99	97	61	40	24	2.60	15.0	11.8	1.91
Bowie fine sandy loam[2]: (S83TX-423-1)														
A------- 0 to 5	A-4(0)	SM	---	---	---	100	99	38	21	3	2.61	17.0	1.7	1.69
E------- 5 to 11	A-4(0)	SM	---	---	---	100	99	38	21	3	2.61	17.0	1.7	1.69
Bt------ 11 to 35	A-6(7)	CL	---	---	100	99	99	57	32	18	2.64	22.0	5.6	1.86
Btv2---- 49 to 64	A-2-6(1)	SC	97	96	93	90	89	35	33	14	2.65	19.0	7.0	1.76
Cuthbert very fine sandy loam[3]: (S82TX-423-3)														
E------- 3 to 9	A-4(0)	ML	---	100	93	85	81	53	24	3	2.69	21.0	2.1	1.68
Bt------ 9 to 20	A-7-6(26)	CL	---	---	---	---	100	94	49	28	2.69	21.0	12.3	1.73
C2------ 55 to 68	A-4(2)	ML	---	---	---	---	100	53	32	7	2.65	29.0	1.6	1.52
Darco loamy fine sand[2]: (S84TX-423-3)														
E------- 4 to 53	A-2-4(0)	SM	---	---	---	---	100	17	19	3	2.67	14.0	2.8	1.86
Bt1----- 53 to 68	A-2-4(0)	SC	---	---	---	---	100	27	26	9	2.66	18.0	4.2	1.77
Freestone fine sandy loam[4]: (S84TX-423-1)														
BA------ 4 to 20	A-4(0)	ML	---	---	100	99	99	56	17	2	2.65	16.0	2.6	1.82
B/E1---- 20 to 30	A-4(3)	CL	---	---	100	99	99	61	23	9	2.67	17.0	3.2	1.84
Btg2---- 53 to 60	A-7-6(16)	CL	---	---	100	99	99	71	43	25	2.67	14.0	13.3	1.90
Lilbert loamy fine sand[2]: (S84TX-423-2)														
E------- 9 to 24	A-2-4(0)	SM	---	---	---	100	99	34	16	1	2.64	17.0	0	1.74
Bt------ 24 to 31	A-6(2)	SC	---	100	98	97	97	45	25	11	2.68	17.0	4.5	1.85
Btv/E--- 47 to 67	A-4(0)	SC	---	100	99	99	99	40	23	9	2.69	16.0	3.9	1.86

See footnotes at end of table.

TABLE 21.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Percentage passing sieve--						LL	PI	Particle density	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		g/cc	Pct	Pct	
Mantachie clay loam[5]: (S82TX-423-1)														
Bg3----- 23 to 35	A-6(4)	CL	---	---	100	98	95	54	29	14	2.60	17.0	6.7	1.80
Bg4----- 35 to 43	A-7-6(11)	CL	---	---	---	100	99	55	44	27	2.70	19.0	11.8	1.76
Redsprings very gravelly sandy loam[6]: (S82TX-423-2)														
A------- 0 to 7	A-2-7(0)	SC	91	85	68	45	30	18	42	13	2.62	28.0	6.3	1.56
Bt2----- 13 to 22	A-7-6(13)	CL	---	100	98	90	82	60	50	26	2.82	18.0	14.3	1.84
C------- 51 to 65	A-7-6(14)	CH	---	100	93	78	68	55	57	31	2.82	22.0	14.8	1.75
Wolfpen loamy fine sand[7]: (S82TX-423-4)														
A1------ 0 to 4	A-2-4(0)	SM	---	---	---	100	99	29	18	3	2.63	17.0	1.0	1.81
Bt------ 25 to 40	A-6(2)	SC	---	---	---	100	99	41	32	14	2.64	19.0	7.0	1.80

[1] Pedon location: from intersection of Texas Highway 64 and Farm Road 724, northwest 2.4 miles on Farm Road 724, south 300 feet, in a pasture.

[2] This is the typical pedon for the series in this survey area. It is described in the section "Soil Series and Their Morphology."

[3] Pedon location: from intersection of U.S. Highway 69 and Farm Road 16 in Lindale, north 3.3 miles on U.S. Highway 69, north 0.7 mile on County Road 4118, east 0.3 mile east on County Road 452, north 0.2 mile on a farm lane, east 300 feet, in a wooded area. The pedon is a taxadjunct to the Cuthbert series because the mineralogy is kaolinitic rather than mixed.

[4] Pedon location: from intersection of Interstate 20 and Texas Highway 110 in Carroll, west 5.8 miles on Interstate 20, south 1.1 miles south on Willow Branch Road, west 200 feet, in a pasture.

[5] Pedon location: from intersection of Texas Highway 110 and Farm Road 346 in Whitehouse, south 3.6 miles on Texas Highway 110, west 2.6 miles on Farm Road 344, south 1.45 miles on Yarborough Lane, west 0.8 mile on a road in a pasture, on a flood plain along West Mud Creek.

[6] Pedon location: from intersection of Farm Road 16 and Farm Road 1253 in Garden Valley, east 0.2 mile on Farm Road 16, north 2.5 miles on County Road 443, northwest 0.25 mile on County Road 443, east 35 feet, in a wooded area. The pedon is a taxadjunct to the Redsprings series because the mineralogy is mixed rather than kaolinitic.

[7] Pedon location: from intersection of Loop 323 and Texas Highway 14 in Tyler, north 1.8 miles on Texas Highway 14, west 0.2 mile on County Road 37, south 150 feet, in an old field. The pedon is outside the range of the Wolfpen series because it has more than 5 percent plinthite below a depth of 60 inches.

TABLE 22.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alto	Fine-loamy, siliceous, thermic Typic Hapludalfs
Attoyac	Fine-loamy, siliceous, thermic Typic Paleudalfs
Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Besner	Coarse-loamy, siliceous, thermic Glossic Paleudalfs
Bowie	Fine-loamy, siliceous, thermic Plinthic Paleudults
Briley	Loamy, siliceous, thermic Arenic Paleudults
Cuthbert	Clayey, mixed, thermic Typic Hapludults
Darco	Loamy, siliceous, thermic Grossarenic Paleudults
Derly	Fine, montmorillonitic, thermic Typic Glossaqualfs
Elrose	Fine-loamy, siliceous, thermic Typic Paleudalfs
Estes	Fine, montmorillonitic, acid, thermic Aeric Fluvaquents
Freestone	Fine-loamy, siliceous, thermic Glossaquic Paleudalfs
Gallime	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Gladewater	Fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Keechi	Coarse-loamy, siliceous, nonacid, thermic Typic Fluvaquents
Kirvin	Clayey, mixed, thermic Typic Hapludults
Kullit	Fine-loamy, siliceous, thermic Aquic Paleudults
Leagueville	Loamy, siliceous, thermic Arenic Paleaquults
Lilbert	Loamy, siliceous, thermic Arenic Plinthic Paleudults
Mantachie	Fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
Oakwood	Fine-loamy, siliceous, thermic Plinthic Paleudalfs
Owentown	Coarse-loamy, siliceous, thermic Fluventic Dystrochrepts
Pickton	Loamy, siliceous, thermic Grossarenic Paleudalfs
Raino	Fine-loamy over clayey, siliceous, thermic Aquic Glossudalfs
Redsprings	Fine, kaolinitic, thermic Ultic Hapludalfs
Sacul	Clayey, mixed, thermic Aquic Hapludults
Tenaha	Loamy, siliceous, thermic Arenic Hapludults
Tonkawa	Thermic, coated Typic Quartzipsamments
Wolfpen	Loamy, siliceous, thermic Arenic Paleudalfs

*U.S. G.P.O.:1994-300-438:80511/SCS

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