SOIL SURVEY OF

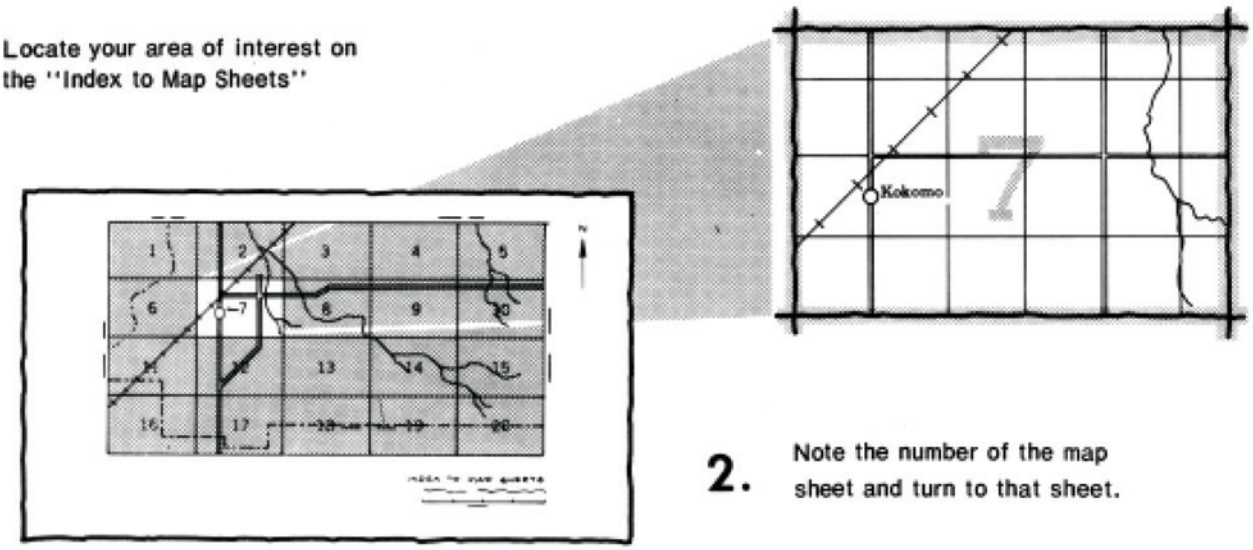
Henderson County, Texas

United States Department of Agriculture
Soil Conservation Service

in cooperation with
Texas Agricultural Experiment Station

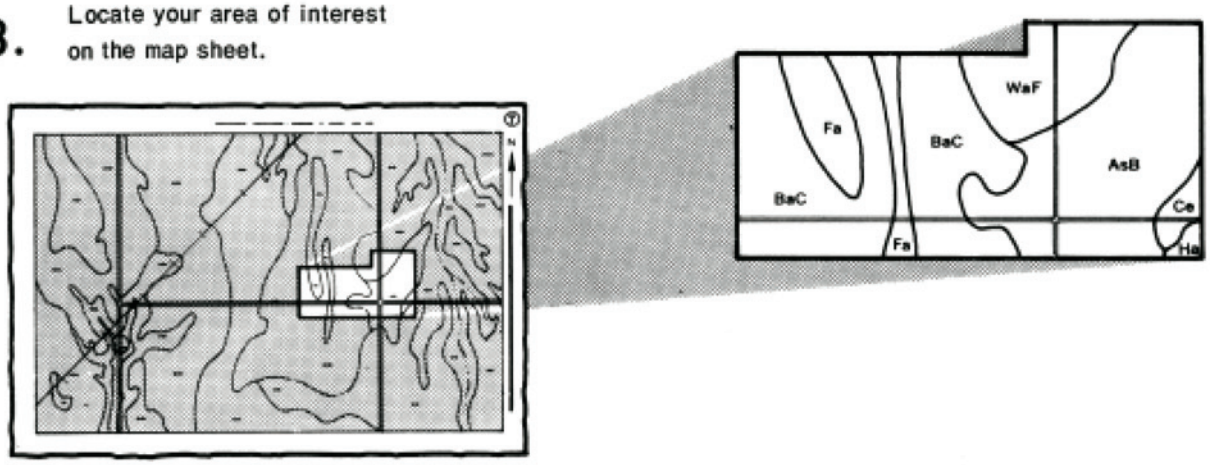
HOW TO USE

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

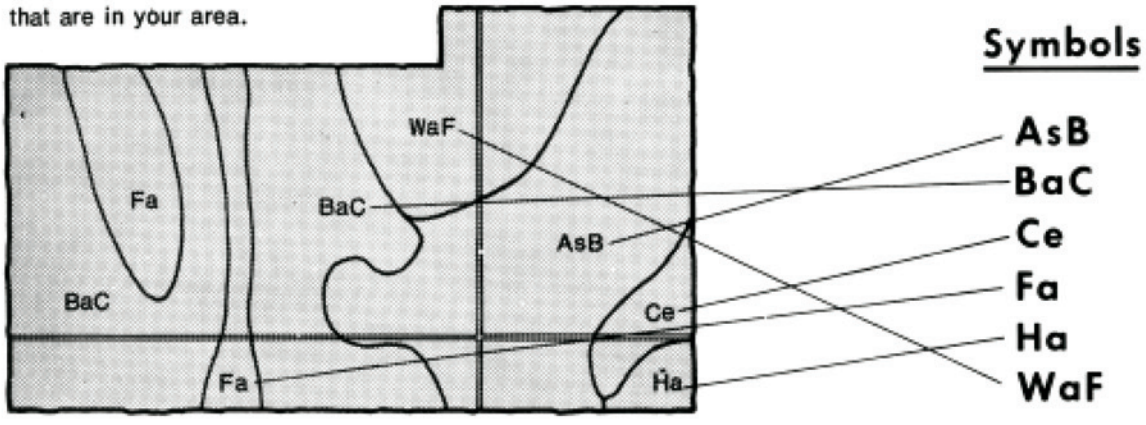


2. Note the number of the map sheet and turn to that sheet.

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

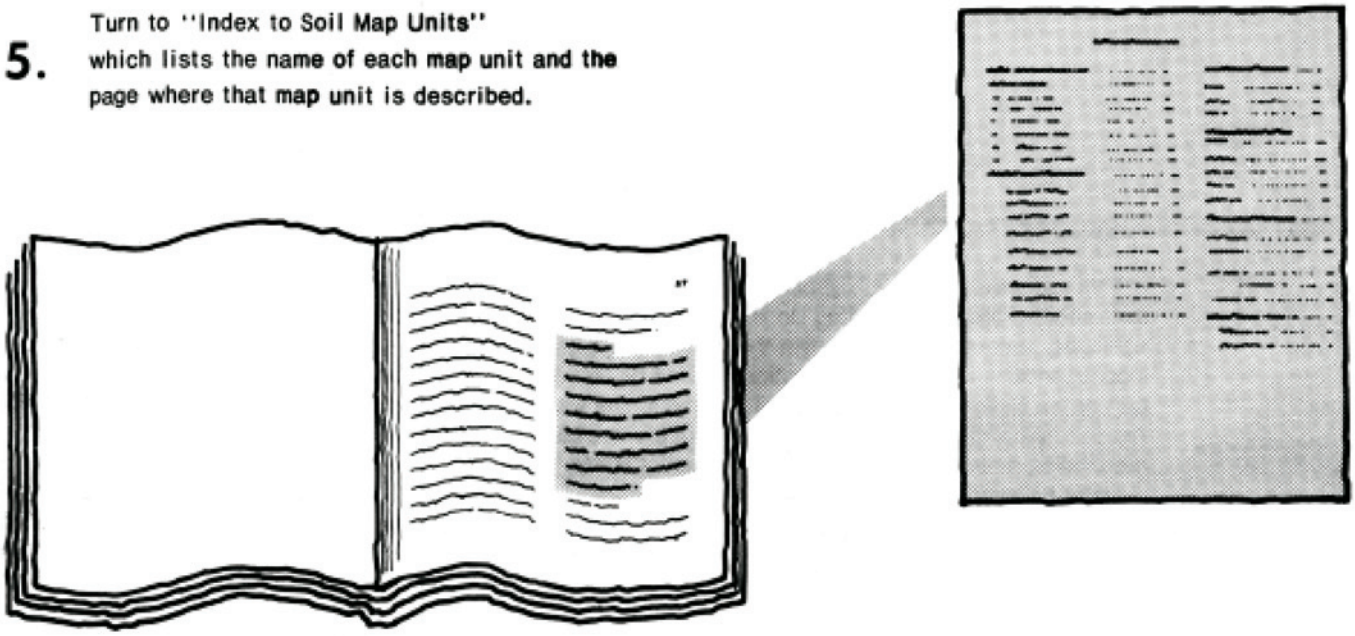


4. List the map unit symbols that are in your area.

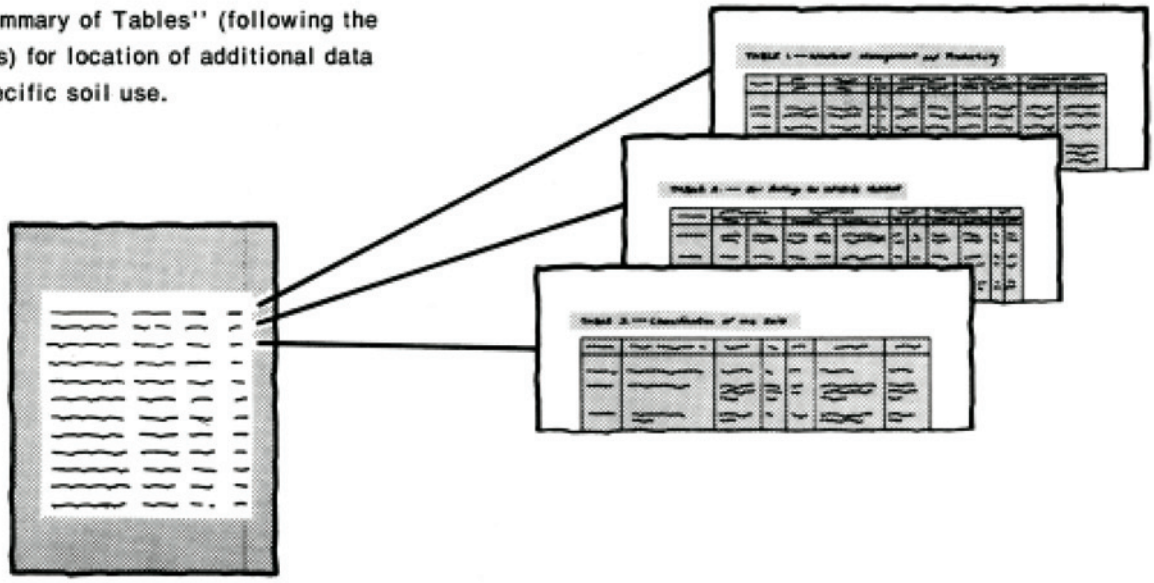


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1973-1977. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Trinity-Neches Soil and Water Conservation District.

Cover: An improved pasture of coastal bermudagrass. The soil is Wolfpen loamy fine sand.

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Issued November 1979

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Foreword

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

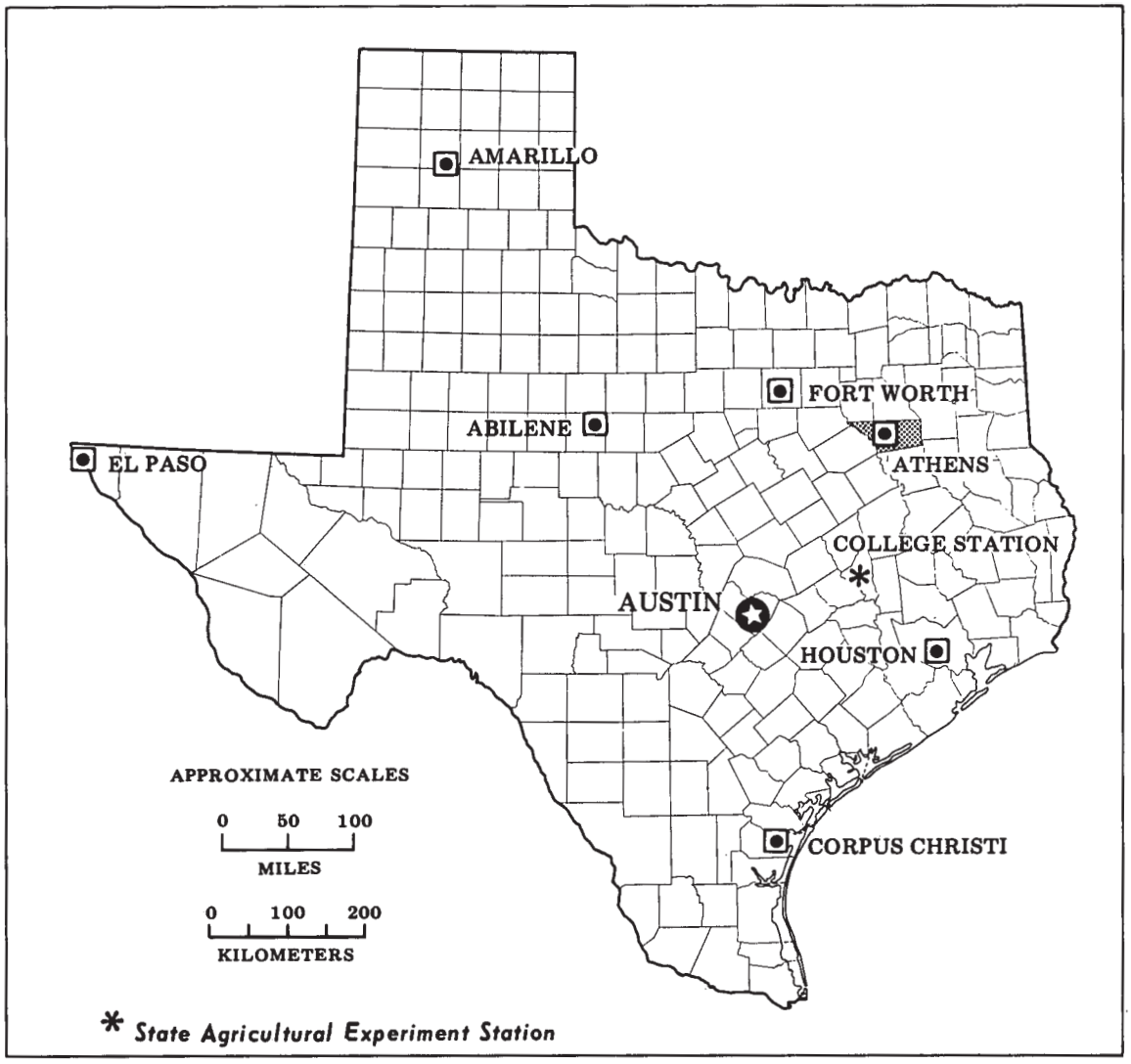
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers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

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Henderson County in Texas.

SOIL SURVEY OF HENDERSON COUNTY, TEXAS

**By Don T. Hatherly and Major D. Mays, Soil Conservation Service,
Thomas H. Holt, soil scientist, Soil Conservation Service,
assisted in field mapping**

**United States Department of Agriculture, Soil Conservation Service,
in cooperation with Texas Agricultural Experiment Station**

HENDERSON COUNTY is in the eastern part of Texas. Athens, the county seat, is located near the center of the county. In 1973 the estimated population of the county was 29,600.

The county is irregular in shape, measuring about 22 miles from north to south and about 41 miles from east to west. It covers 945 square miles, or 604,800 acres. The land surface is nearly level to undulating and steep. The elevation ranges from about 270 to 700 feet above sea level. The county is dissected by many streams. Drainage in the western half of the county flows westward towards the Trinity River, and drainage in the eastern half flows eastward to the Neches River. About 55 percent of the county is pastureland, 34 percent woodland, 7 percent water area, and 4 percent urban land and cropland.

The eastern half of Henderson County is on the western edge of the East Texas Timberlands Resource Area. The west-central part is in the Texas Claypan Land Resource Area, and the extreme western part is in the Blackland Prairies Land Resource Area. The soils in East Texas Timberlands Area formed under forest vegetation and are dominantly light colored and sandy and loamy. The soils in the Texas Claypan Area formed under grass and hardwood tree vegetation and are dominantly light colored and loamy. The soils in the Blackland Prairies Areas formed under grasses and are dominantly dark colored, loamy and clayey. Slope is the main management concern on the soils of this survey area. The soils are susceptible to sheet and gully erosion.

General nature of the county

The history, agriculture, natural resources, and climate of the county are briefly described in this section.

History

Henderson County was created and organized in 1846 from parts of Houston and Nacogdoches Counties. It was named for Governor J. Pinckney Henderson who served as Governor of Texas from February 19, 1846 to December 21, 1847.

Buffalo is said to have been one of the first settlements in the county and served as its first county seat. Only the old site of this settlement remains today. Athens was designated the county seat in 1854.

The westward expansion of the railroad reached Athens in 1880 and gave the county its first railroad shipping point. Prior to construction of the railroads, the Trinity River was very important in the transportation of products exported from the county. Oil was discovered in Henderson County in 1934.

Agriculture

Agriculture in Henderson County has changed drastically over the years. During the early development of the county, farming was the main agricultural enterprise and cotton was the main crop. Cattle, hogs, and sheep were raised mainly for subsistence. Farming has declined, however, and many old cropland fields plus many areas cleared of timber have been established as pasture for beef cattle. For example, in 1919 there was about 88,000 acres of cotton in the county. In 1975 there was about 200 acres.

The main agricultural enterprise in Henderson County is beef cattle. Livestock operations are primarily cow-calf. As of 1975 there was about 200,000 acres of Coastal bermudagrass pastures with another 50,000 acres of pasture in such grasses as lovegrass and bahiagrass. Supplemental feeding is generally heavy. A large amount of Coastal bermudagrass hay is produced each year, and much of it is used as supplemental feed during

the winter months. The raising of hogs and horses is also important to the economy of the county.

Corn, peas, peanuts, and some grain sorghum are the main crops. Farming operations are dryland and are small to medium sized.

Natural resources

Soil is one of the most important natural resources in the county. The production of livestock forage is a major source of livelihood for many of the people.

Oil and gas are obtained from numerous wells in the county. These wells are a source of income for some landowners. The drilling and servicing of oil and gas wells provides employment to many people.

Sand, gravel, and clay are mined commercially. The sand and gravel are used mainly in construction, and the clay is used in the manufacturing of brick and pottery products.

Large amounts of easily mined lignite are in the western part of Henderson County.

Climate

Henderson County is hot in summer but cool in winter when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfalls are infrequent. Annual total precipitation is normally adequate for corn, grain sorghum, and peas.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Athens, Texas, for the period 1954 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 50 degrees F, and the average daily minimum temperature is 39 degrees. The lowest temperature on record, which occurred at Athens on January 24, 1963, is 9 degrees. In summer the average temperature is 82 degrees, and the average daily maximum temperature is 94 degrees. The highest recorded temperature, which occurred on August 14, 1969, is 110 degrees.

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

Of the total annual precipitation, 22 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 6.90 inches at Athens on May 10, 1968. Thunderstorms occur on about 50 days each year, and most occur in spring.

Snowfall is rare; in 60 percent of the winters there is no measurable snowfall. In 20 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 2 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 50 in winter. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

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

How this survey was made

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

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

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

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

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

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

General soil map for broad land use planning

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

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. General ratings of the potential of each, in relation to the other map units, for major land uses, are given in the map unit description. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated farm crops, pasture, woodland, urban uses,* and *recreation areas*. Cultivated farm crops are those grown extensively by farmers in the survey area. Pasture refers to land in improved grasses. Woodland refers to land that is producing either trees native to the area or introduced species. Urban uses include residential, commercial, and industrial developments. Recreation areas include campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

Forested soils on uplands

This group of soils makes up about 63 percent of the county. The major soils are in the Pickton, Wolfpen, Woodtell, Freestone, Bernaldo, Cuthbert, and Trawick series. These are gently sloping to steep soils on uplands. They have a sandy or loamy surface layer and loamy or clayey underlying layers. They are well drained or moderately well drained and are moderately permeable to very slowly permeable.

Most areas of the soils are in pasture or woodland, a much smaller acreage is in crops. Improved pastures consist mainly of Coastal bermudagrass, common bermudagrass, and lovegrass. Wooded areas are in hardwood trees or a mixture of hardwood and pine trees. Crops are mainly peas, peanuts, or corn.

1. Pickton-Wolfpen

Sandy, moderately permeable, well drained, gently sloping to moderately steep soils

This map unit is made up of soils that have slopes of 1 to 15 percent. It covers about 45 percent of the county. Pickton soils make up about 41 percent of the unit; Wolfpen soils, about 22 percent; and other soils, such as Cuthbert, Tonkawa, Larue, Nahatche, and Bernaldo soils, the remaining 37 percent (fig. 1).

The gently sloping to moderately steep Pickton soils are on high broad ridgetops and side slopes on uplands. These soils typically are very friable, slightly acid, loamy fine sand in the upper 50 inches. This layer is brown in the upper part and light yellowish brown in the lower part. Below this, to a depth of 80 inches, is firm, medium acid, strong brown sandy clay loam with reddish mottles.

The gently sloping to strongly sloping Wolfpen soils are on slightly lower broad ridgetops and side slopes on uplands. These soils typically have a surface layer of very friable, neutral, loamy fine sand about 28 inches thick. It is brown in the upper part and pale brown in the lower part. Below this, to a depth of 80 inches, is firm sandy clay loam. It is yellowish brown and medium acid in the upper part and is gray and very strongly acid in the lower part.

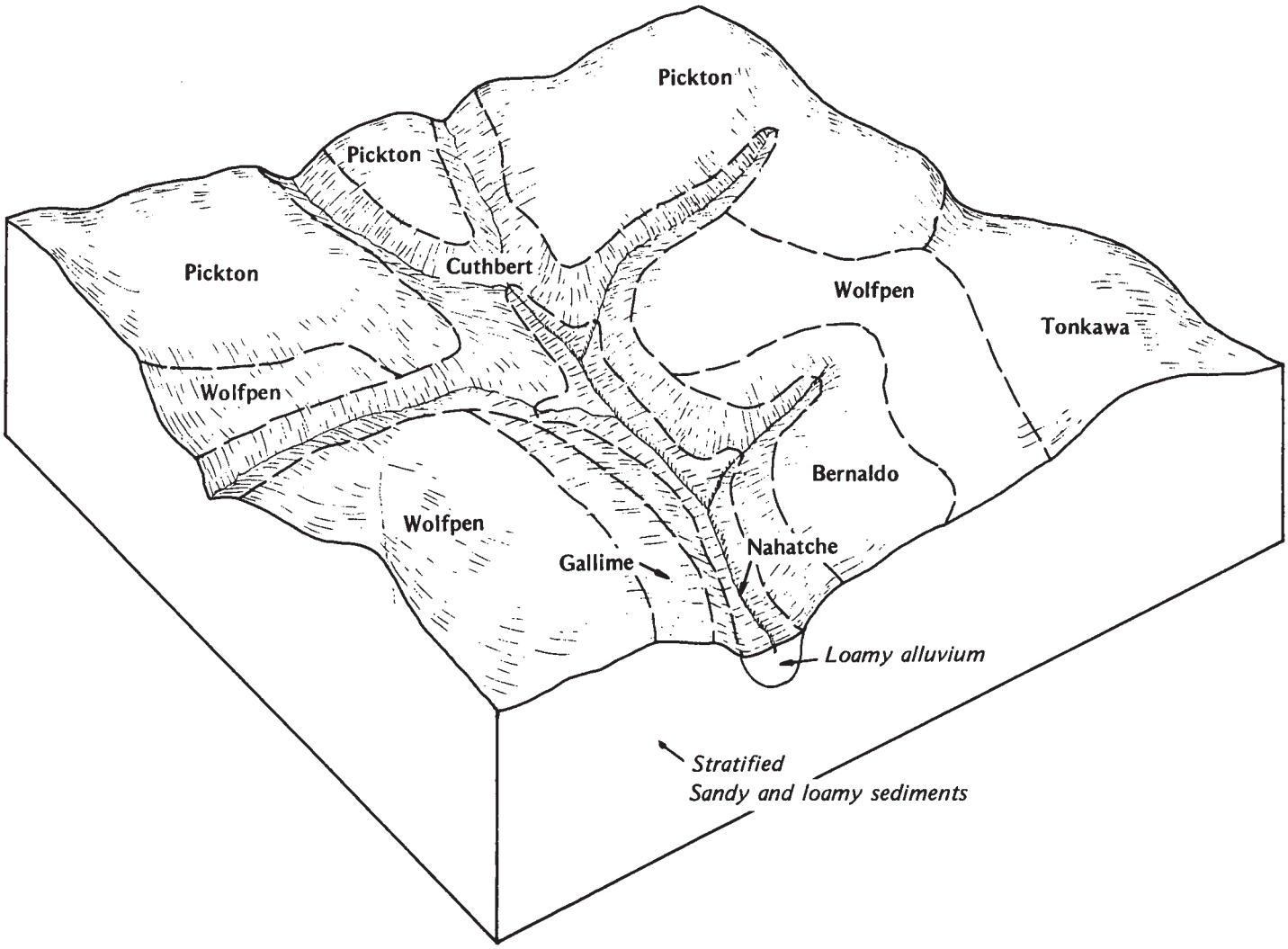


Figure 1.—Typical pattern of soils and underlying material in Pickton-Wolfpen map unit.

The sandy Tonkawa and Larue soils are on broad high ridgetops and side slopes. The loamy Cuthbert soils are on the lower side slopes, the loamy Nahatche soils are on bottom lands of major streams, and the loamy Bernaldo soils are on broad ridges of the lower hills.

These soils are used mainly as pasture, but some areas are cultivated.

Potential for pasture and cultivated crops is medium and the deep sandy surface layer is the most restrictive feature. Suitable pasture grasses are deep rooted plants such as Coastal bermudagrass and lovegrass. If these soils are cultivated, the main crops are peas, peanuts, and corn.

Potential for woodland is also medium. Potential for most urban uses of these areas, is medium. Corrosivity to concrete is the most limiting feature. Potential for recreational use is medium, mainly because of the sandy surface layer.

2. Woodtell-Freestone

Loamy, very slowly permeable and slowly permeable, moderately well drained, gently sloping to moderately steep soils

This map unit is made up of soils that have slopes of 1 to 15 percent. It covers about 9 percent of the county. Woodtell soils make up about 49 percent of the unit; Freestone soils, about 11 percent; and other soils, such as Cuthbert, Bernaldo, Wolfpen, Pickton, and Nahatche soils, the remaining 40 percent.

The gently sloping to moderately steep Woodtell soils are on narrow ridgetops and side slopes on uplands. These soils typically have a surface layer of friable loam about 8 inches thick. It is very dark grayish brown and medium acid in the upper part and is brown and slightly acid in the lower part. From 8 to 20 inches is firm, very strongly acid, red clay. Below this, to a depth of 80 inches, is firm, very strongly acid, mottled clay loam over firm, very strongly acid, mottled sandy clay loam.

The gently sloping Freestone soils are on broad ridgetops on uplands. These soils typically have a surface layer of very friable, strongly acid, brown fine sandy loam about 14 inches thick. From 14 to 34 inches is firm, strongly acid, brownish yellow sandy clay loam over firm, very strongly acid, mottled brownish sandy clay loam. Below this, to a depth of 80 inches, is very firm clay that is very strongly acid. It is mottled in the upper part and is moderately alkaline and gray in the lower part.

The loamy Cuthbert soils are on side slopes. The loamy Bernaldo soils are on broad ridgetops of the lower hills. The sandy Wolfpen and Pickton soils are on the higher ridgetops and side slopes, and the loamy Nahatche soils are on bottom lands.

The soils of this map unit are used mainly as pasture, but some small areas are cultivated.

Potential for pasture is high. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, lovegrass, and bahiagrass.

Potential for cultivated crops is medium. The hazard of erosion is the main limiting feature. If these soils are cultivated the main crops are corn, peas, and peanuts.

Potential for woodland is also medium. Potential for most urban uses of these soils is low. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and wetness are the most limiting features. Potential for recreational use is medium, mainly because of slow permeability and wetness.

3. Bernaldo

Loamy, moderately permeable, well drained, gently sloping soils

This map unit is made up of soils that have slopes of 1 to 4 percent. It covers about 5 percent of the county. Bernaldo soils make up about 75 percent of the unit, and other soils, such as Gallime, Wolfpen, Larue, Freestone, and Nahatche soils make up the remaining 25 percent.

Bernaldo soils are on broad low ridgetops on uplands. These soils typically have a surface layer of very friable, fine sandy loam about 16 inches thick. It is brown and slightly acid in the upper part and yellowish brown and medium acid in the lower part. Below this, to a depth of 80 inches, is friable, sandy clay loam. It is strongly acid and brownish in the upper part and is very strongly acid and mottled brownish and grayish in the lower part.

The loamy Gallime and Freestone soils are on slightly higher, broad ridgetops than Bernaldo soils. The sandy Wolfpen and Larue soils are on high ridgetops and side slopes, and the loamy Nahatche soils are on bottom lands.

The soils of this unit are used mainly as pasture. Some areas are cultivated, and some areas are used for commercial timber.

Potential for pasture is high. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, lovegrass, and bahiagrass.

Potential for cultivated crops is high. The hazard of erosion is the main limiting feature. If these soils are cultivated, the main crops are corn, peas, and peanuts. Potential for woodland is also high. Potential for most urban uses is medium. Low strength and wetness are the most limiting features. Potential for recreational use is high.

4. Cuthbert-Trawick

Gravelly, loamy, moderately slowly permeable, well drained, moderately steep to steep soils

This map unit is made up of soils that have slopes of 12 to 30 percent. It covers about 4 percent of the county. Very gravelly Cuthbert soils make up about 36 percent of the unit; Trawick soils, about 14 percent; and other soils, such as Kirvin, Elrose, Larue, Pickton, and nongravelly Cuthbert soils, the remaining 50 percent (fig. 2).

The moderately steep to steep Cuthbert soils are on side slopes on uplands. These soils typically have a surface layer of very friable, slightly acid, brown very gravelly fine sandy loam about 4 inches thick. From 4 to 24 inches is firm, very strongly acid, red clay containing ironstone fragments. Below this, to a depth of 62 inches, is very firm, very strongly acid, stratified layers of strong brown sand, soft sandstone, and gray shale.

The moderately steep Trawick soils are on side slopes on uplands. These soils typically have a surface layer of very friable, slightly acid, dark reddish brown gravelly fine sandy loam about 7 inches thick. Below this, to a depth of 72 inches, is firm red clay that is medium acid in the upper part and very strongly acid in the lower part. The lower part also contains partially weathered glauconite.

The less sloping loamy Kirvin and Elrose soils are on foot slopes. The sandy Larue and Pickton soils are on high narrow ridgetops.

The soils of this map unit are used mainly as woodland. They are not suited for cultivated crops.

Potential for woodland is medium. Steep slopes, gravel content, and occasional rock outcrops are the most limiting features. Native trees are mainly shortleaf pine and various species of hardwoods.

Potential for pasture is medium. They are difficult to establish because of steep slopes, gravel content, and occasional rock outcrops. Suitable pasture grasses are Coastal bermudagrass, bahiagrass, and lovegrass.

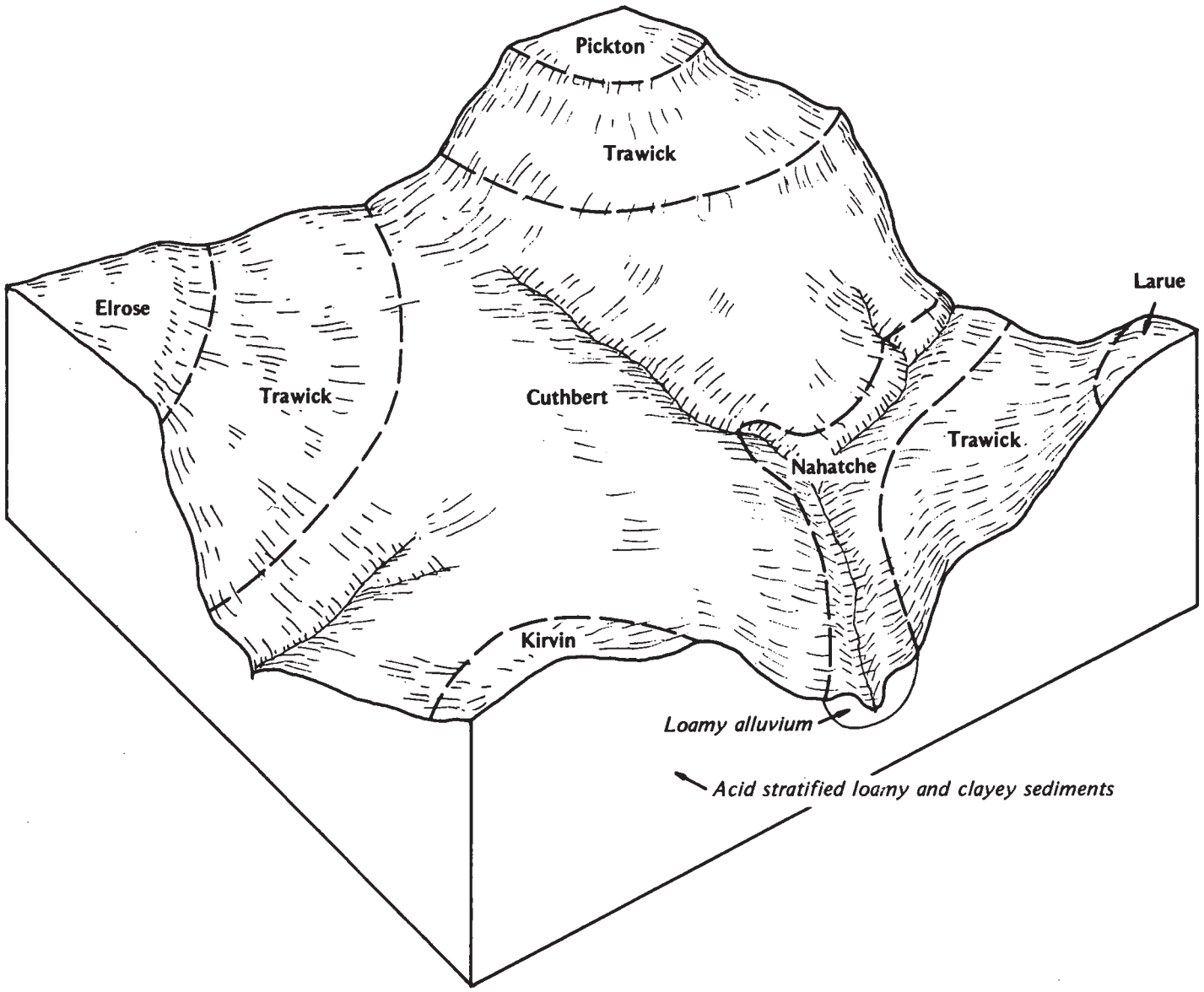


Figure 2.—Typical pattern of soils and underlying material in Cuthbert-Trawick map unit.

Potential for most urban uses is low. Slope and low strength are the most limiting features. Potential for recreational use is low. Slope and gravel on the surface restrict use of this map unit for camp areas, picnic areas, playgrounds, and paths and trails.

Savannah soils on terraces and uplands

This group of soils makes up about 23 percent of the county. The major soils are in the Axtell, Freestone, Derly, Rader, Crockett, and Deport series. These are nearly level to strongly sloping soils on terraces and uplands. They have a loamy or clayey surface layer and loamy or clayey underlying layers. They are moderately well drained to somewhat poorly drained and are very slowly permeable to slowly permeable.

Most areas of the soils are in pasture or woodland. A much smaller acreage is in crops. Improved pastures consist mainly of Coastal bermudagrass, common bermudagrass, or lovegrass. Wooded areas are in hardwood trees, mainly post oak. If these soils are cultivated, the main crop is corn.

5. Axtell-Freestone

Loamy, very slowly permeable and slowly permeable, moderately well drained, gently sloping to strongly sloping soils

This map unit is made up of soils that have slopes of 1 to 12 percent. It covers about 17 percent of the county. Axtell soils make up about 50 percent of the unit; Freestone soils, about 20 percent; and other soils, such as Silawa, Dutek, Styx, Eufaula, Kaufman, Trinity, and Nahatche soils, the remaining 30 percent (fig. 3).

The gently sloping to strongly sloping Axtell soils are on broad ridgetops and side slopes on terraces. These soils typically have a surface layer of friable, medium acid, brown loam about 6 inches thick. From 6 to 13 inches is very firm, very strongly acid, red clay loam. From 13 to 48 inches is very firm, mottled brownish and grayish clay. The clay is very strongly acid in the upper part and slightly acid in the lower part.

From 48 to 80 inches is stratified gray shale and yellowish brown soft sandstone.

The gently sloping Freestone soils are on broad ridgetops on terraces. These soils typically have a surface layer of very friable, strongly acid, brown fine sandy loam about 14 inches thick. Extending from 14 to 34 inches is firm, strongly acid, brownish yellow sandy clay loam over firm, very strongly acid, mottled brownish sandy clay loam. Below this, to a depth of 80 inches, is very firm clay that is very strongly acid and mottled in the upper part and is moderately alkaline and gray in the lower part.

The sandy Dutek, Styx, and Eufaula soils and the loamy Silawa soils are on broad ridgetops and on side slopes. The loamy Nahatche soils are on bottom lands.

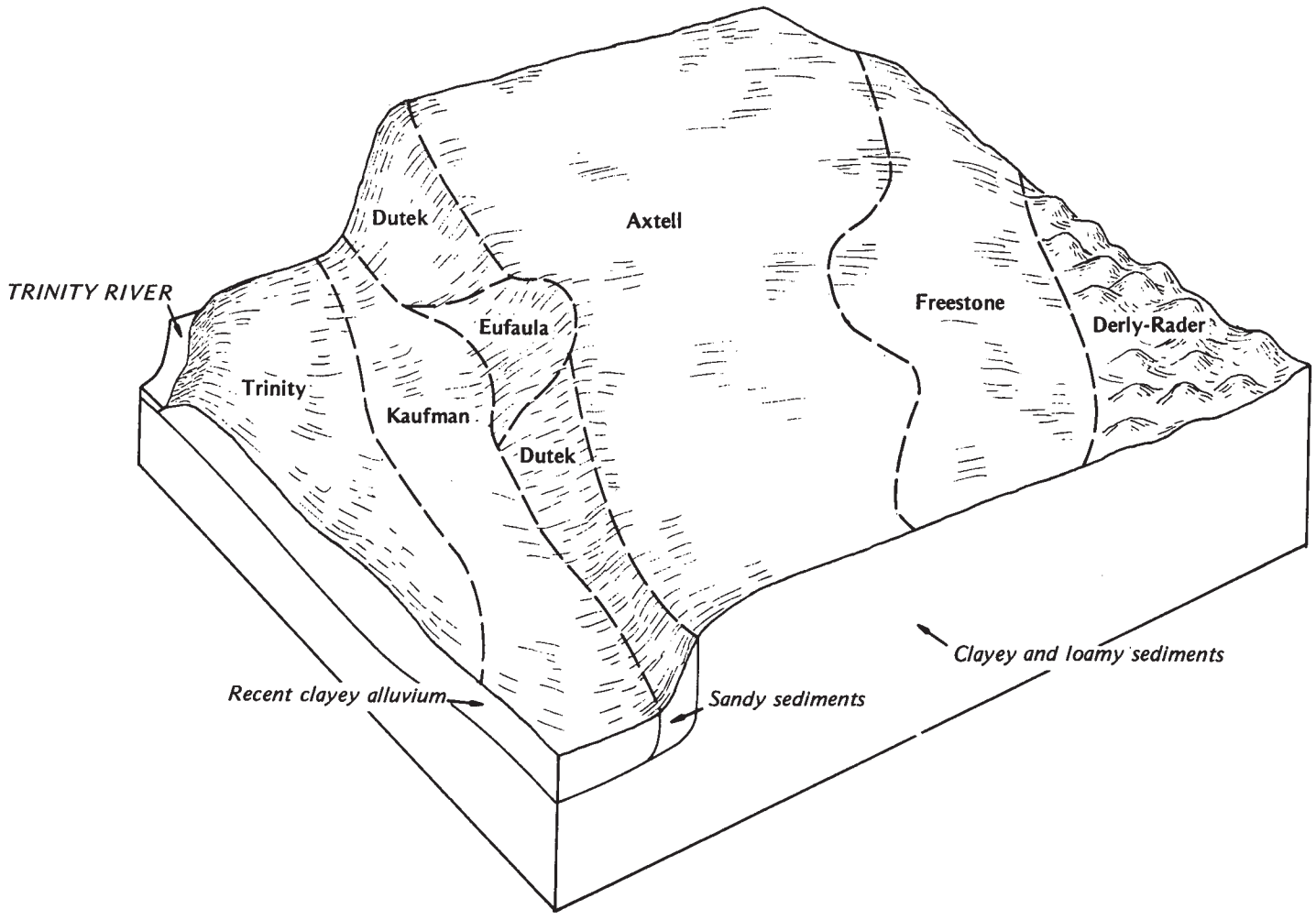


Figure 3.—Typical pattern of soils and underlying material in Axtell-Freestone map unit.

The soils of this unit are used as pasture, but some small areas are cultivated.

Potential for pasture is medium. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, and lovegrass. Potential for cultivated crops is medium. The hazard of erosion is the main limiting feature. If cultivated, the main crop is corn.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, low strength, wetness, and corrosivity to uncoated steel are the most limiting features. Potential for recreational use is only medium, mainly because of very slow and slow permeability and wetness.

6. Derly-Rader

Loamy, very slowly permeable, poorly drained and moderately well drained, nearly level soils

This map unit is made up of soils that have slopes of 0 to 1 percent. It covers about 4 percent of the county. Derly and Rader soils make up about 70 percent of the unit; and other soils, such as Axtell, Freestone, Wilson, Deport, and Burleson soils, the remaining 30 percent.

The nearly level Derly soils are on broad flats on terraces. These soils typically have a surface layer of friable loam about 11 inches thick. It is grayish brown and slightly acid in the upper part and light brownish gray and medium acid in the lower part. Below this, to a depth of 65 inches, is very firm, dark grayish brown clay. It is strongly acid in the upper part and is neutral in the lower part.

The nearly level Rader soils are on broad flats and occur as mounds or low meandering ridges on terraces. These soils typically have a surface layer of very friable, brownish fine sandy loam about 28 inches thick. It is medium acid in the upper part and strongly acid in the lower part. From 28 to 44 inches is friable, very strongly acid, yellowish brown and strong brown sandy clay loam surrounded by light brownish gray sandy material. Below this, to a depth of 72 inches, is very firm, mottled brownish and reddish clay. It is very strongly acid in the upper part and strongly acid in the lower part.

The loamy Axtell soils are on ridgetops and side slopes. The loamy Freestone and Wilson soils are in broad, gently sloping areas. The clayey Deport and Burleson soils are in broad, nearly level to gently sloping areas.

The soils of this unit are used mainly as pasture.

Potential for pasture, cultivated crops, and woodland is medium. Wetness is the main limiting feature. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, bahiagrass, and fescuegrass.

Potential for most urban uses is low. Wetness, corrosivity to uncoated steel, low strength, and shrinking and swelling with changes in moisture are the most limiting features. Potential for recreational use is low, mainly because of wetness and very slow permeability.

7. Crockett

Loamy, very slowly permeable, moderately well drained, gently sloping soils

This map unit is made up of soils that have slopes of 1 to 3 percent. It covers about 1 percent of the county. Crockett soils make up about 60 percent of the unit; and other soils, such as Axtell, Wilson, Normangee, Derly, and Rader soils, make up the remaining 40 percent.

Crockett soils are in broad areas on uplands. These soils typically have a surface layer of friable, medium acid, brown loam about 9 inches thick. From 9 to 14 inches is very firm, slightly acid, mottled dark reddish brown, olive brown, and dark grayish brown clay. From 14 to 43 inches is very firm, moderately alkaline, olive brown and light olive brown clay. From 43 to 80 inches is stratified shale and loamy material.

The loamy Wilson soils are slightly lower in the landscape than Crockett soils. The loamy Axtell soils are on ridgetops and side slopes. The loamy Normangee soils are on side slopes between drains, and the loamy Derly and Rader soils are in broad areas of mounds.

The soils of this unit are used mainly as pasture. They are unsuitable for woodland.

Potential for pasture is high. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, bahiagrass, and lovegrass.

Potential for cultivated crops is low. The hazard of erosion is the main limiting feature. If these soils are cultivated, the main crop is corn.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture and low strength are the main limiting features. Potential for recreational use varies. The unit has high potential for picnic areas or paths and trails. It has medium potential for camp areas or playgrounds because of slow permeability.

8. Deport

Clayey, very slowly permeable, somewhat poorly drained, nearly level soils

This map unit is made up of soils that have slopes of 0 to 1 percent. It covers about 1 percent of the county. Deport soils make up about 55 percent of the unit; and other soils, such as Burleson, Derly, Rader, and Wilson soils, make up the remaining 45 percent.

Deport soils are in broad areas on terraces. These soils typically are very firm, grayish clays to a depth of 70 inches. Reaction is slightly acid in the surface layer and is medium acid to moderately alkaline in the lower part of the profile.

The clayey Burleson soils are in slightly higher broad areas than Deport soils. The loamy Wilson soils are slightly lower in the landscape, and the loamy Derly and Rader soils are on broad flats covered by mounds.

The soils of this unit are used mainly as pasture. They are unsuitable for woodland.

Potential for pasture is medium. Wetness is the main limiting feature. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, and fescuegrass.

Potential for cultivated crops is medium. Wetness is the main limiting feature. If these soils are cultivated, the main crop is grain sorghum.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, wetness, corrosivity to uncoated steel, and low strength are the main limiting features. Potential for recreational use is low. Wetness and a clayey surface layer are the limiting features.

Forested soils on bottom lands

This group of soils makes up about 14 percent of the county. The major soils are in the Nahatche, Trinity, and Kaufman series. These are nearly level to gently sloping soils on flood plains. They have a loamy or clayey surface layer and loamy or clayey underlying layers. They are somewhat poorly drained and are moderately permeable or very slowly permeable.

Most areas of the soils are in pasture or woodland. A small acreage that is protected from flooding by levees is in crops. Improved pastures consist mainly of Coastal bermudagrass, common bermudagrass, bahiagrass, and fescuegrass. Wooded areas are in hardwood trees. Grain sorghum is the main crop.

9. Nahatche

Loamy, moderately permeable, somewhat poorly drained, nearly level soils

This map unit is made up of soils that have slopes of 0 to 1 percent. It covers about 7 percent of the county. Nahatche soils make up about 75 percent of the unit; and other soils, such as Gladewater, Kaufman, and Trinity soils, make up the remaining 25 percent.

Nahatche soils are on bottom lands. These soils typically have a surface layer of friable, strongly acid, dark grayish brown loam about 5 inches thick. The next layer is about 8 inches of very friable, medium acid, brown fine sandy loam. The next layer from 13 to 75 inches is firm, slightly acid or neutral clay loam that is in shades of gray.

The clayey Gladewater, Kaufman, and Trinity soils are on bottom lands.

These soils are used mainly as pasture.

Potential for pasture and woodland is high. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, bahiagrass, and fescuegrass.

These soils are unsuitable for cultivated crops. Flooding is the main limiting feature.

Potential for urban and recreational uses is low. Flooding and wetness are the main limiting features.

10. Trinity-Kaufman

Clayey, very slowly permeable, somewhat poorly drained, nearly level to gently sloping soils

This map unit is made up of soils that have slopes of 0 to 3 percent. It covers about 7 percent of the county. Trinity soils make up about 50 percent of the unit; Kaufman soils, about 20 percent; and other soils, such as Gladewater, Nahatche, Eufaula, Dutek, and Silawa soils, make up the remaining 30 percent.

Trinity soils are on flood plains. These soils typically are very firm, moderately alkaline, very dark gray clay to a depth of 80 inches.

The Kaufman soils are on flood plains. These soils typically are very firm clay to a depth of 80 inches. They are black and neutral in the surface layer and are gray and moderately alkaline in the lower part of the profile.

The clayey Gladewater soils are on the lower, wetter areas in the bottom lands. The loamy Nahatche soils are on flood plains of smaller creeks. The loamy and sandy Dutek, Silawa, and Eufaula soils are on terraces.

These soils are mostly hardwood forest. They have high potential for this use. Some areas have been cleared and established to pasture, and some areas protected by levees are cultivated.

Potential for pasture is high. Suitable pasture grasses are Coastal bermudagrass, common bermudagrass, and fescuegrass.

Potential for cultivated crops is high where the soils are protected from flooding and unsuited where not protected. If they are cultivated, the main crop is grain sorghum.

Potential for most urban uses is low. Flooding is the main limiting feature. Potential for recreational uses is low because of flooding.

Broad land use considerations

The map units in Henderson County vary widely in their potential for major land uses. For each land use, the potential of each map unit in relation to the other map units is indicated in the map unit description. Kinds of soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of various land-use practices and the hazard of continued soil-related problems after such practices have been installed. The ratings do not consider soil location in relation to existing transportation systems or markets.

Kinds of land uses considered include pasture, cultivated crops, woodland, urban use, and recreation. Pasture refers to land in improved grasses, such as Coastal bermudagrass, lovegrass, and bahiagrass. Cultivated farm crops grown in the survey area include corn, grain sorghum, peas, and peanuts. Woodland refers to land capable of producing commercial timber. Urban uses include land used for residential, commercial, and industri-

al sites. Recreation uses include nature study trails, wilderness, picnic and camp areas, and playgrounds.

In general, the kind of soils is the most important factor in land use in Henderson County.

Presently about 55 percent of the county is used for pasture, about 34 percent for woodland, and about 3 percent for cultivated crops. However, about 46 percent of the county has high potential for pasture, and about 54 percent has medium potential. About 19 percent of the county has high potential for woodland, about 62 percent has medium potential, and about 19 percent has low potential. About 5 percent of the county has high potential for cultivated crops, 76 percent has medium potential, and 19 percent has low potential. This means that about 2 percent of the county could be converted from pasture to cultivated farmland.

The trend in recent years has been a decrease in the acreage used as woodland and an increase in the acreage used as pasture.

There has also been an increase in the number of acres used for urban development and recreational development. The urban and recreational development has been mainly around Cedar Creek Reservoir and Lake Palestine.

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

Soil maps for detailed planning

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

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

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

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

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

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

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

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

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

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

1—Axtell loam, 1 to 5 percent slopes. This gently sloping soil is on old terraces. Slopes are mainly smooth or convex. Areas are irregular in shape and range from 10 to several hundred acres.

This soil has a surface layer of friable, medium acid, brown loam about 6 inches thick. The next layer is about 7 inches of very firm, very strongly acid, red clay loam. From 13 to 28 inches is very firm, very strongly acid, mottled pale brown, brown, red, and strong brown clay. Between depths of 28 and 48 inches, the soil is very firm, slightly acid, light brownish gray clay that has dark yellowish brown and brownish yellow mottles. From a depth of 48 to 80 inches is stratified gray shale and light gray and yellowish brown soft sandstone.

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

Included with this soil in mapping are small areas of Freestone, Silawa, Styx, and Dutek soils. Also included are small areas of eroded and gravelly Axtell soils. Included soils make up less than 15 percent of any mapped area.

This Axtell soil is used primarily for pasture, hay production, and wildlife habitat. A few small areas are used for corn.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. The Coastal bermudagrass pastures may be overseeded with singletary peas, sweetclover, or arrowleaf clover in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is high.

Potential is high for woodland wildlife habitat, medium for openland wildlife habitat, and low for wetland wildlife habitat. The small amount of grain and seed crops and grasses and legumes grown on this soil limits the potential for openland wildlife habitat. The absence of shallow water areas is the limiting factor for use as wetland wildlife habitat.

This soil has low potential for crops. The hazard of erosion, the clayey subsoil, and the droughty nature of the soil are the main limiting factors. The addition of lime and a complete fertilizer increases yields.

Potential for growing native grasses is medium. Potential for woodland is low.

Potential is low for most urban uses. Shrinking and swelling with changes in moisture, low strength, very slow permeability, and corrosivity to uncoated steel are the main limitations. Potential for development of camp areas and playgrounds is low because of very slow permeability. Potential for development of picnic areas and paths and trails is high.

This soil is in capability subclass IVe; woodland group 4c.

2—Axtell loam, 5 to 12 percent slopes. This sloping to strongly sloping soil is on old terraces. Slopes are mainly smooth or convex. Areas are oblong and range from 15 to several hundred acres.

This soil has a surface layer of friable, strongly acid brown loam about 9 inches thick. The next layer is about 11 inches of very firm, very strongly acid, red clay that has brownish yellow mottles. From 20 to 31 inches is very firm, strongly acid, brownish yellow clay that has yellowish red, red, and gray mottles. From a depth of 31 to 50 inches is very firm, medium acid, yellowish brown clay that has gray mottles. From 50 to 76 inches is very firm, slightly acid, yellowish brown clay and strata of gray loamy material.

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

Included with this soil in mapping are small areas of Silawa, Styx, and Dutek soils. Also included are small areas of Axtell soils, eroded. Included soils make up less than 15 percent of any mapped area.

This Axtell soil is used primarily for pasture and wildlife habitat.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. The Coastal bermudagrass pastures may be overseeded with singletary peas, sweetclover, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

Potential is high for woodland wildlife habitat, medium for openland wildlife habitat, and low for wetland wildlife habitat. The small amount of grain and seed crops and grasses and legumes limits the potential of this soil for openland wildlife habitat. The absence of shallow water areas is the limiting factor for use as wetland wildlife habitat.

This soil is not suited to crops.

Potential for growing native grasses is medium. Potential for woodland is low.

Potential is low for most urban uses. Shrinking and swelling with changes in moisture, low strength, very slow permeability, corrosivity to uncoated steel, and slope are the main limitations. Potential for development of camp areas and playgrounds is low because of very slow permeability. Potential is medium for picnic areas because of slope and high for paths and trails.

This soil is in capability subclass VIe; woodland group 4c.

3—Bernaldo fine sandy loam, 1 to 4 percent slopes. This gently sloping soil is on terraces and uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from 10 to several hundred acres.

This soil has a surface layer of very friable, slightly acid, brown fine sandy loam about 8 inches thick. The

next layer is about 8 inches of very friable, medium acid, yellowish brown fine sandy loam. From a depth of 16 to 45 inches is friable, strongly acid, yellowish brown sandy clay loam. From 45 to 57 inches is friable, very strongly acid, brownish yellow sandy clay loam that has red mottles and about 20 percent light gray vertical streaks and pockets of uncoated sand. Between depths of 57 and 80 inches is friable, very strongly acid, mottled yellowish brown, red, and light brownish gray sandy clay loam that has about 10 percent light gray vertical streaks 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 moderate.

Included with this soil in mapping are small areas of Gallime, Wolfpen, Larue, and Freestone soils. Also included are small areas of a Bernaldo soil with slopes of more than 4 percent.

Included soils make up less than 15 percent of any mapped area.

This Bernaldo soil is used for pasture, hay production, crops and woodland.

This soil has high potential for pastures of Coastal bermudagrass, bahiagrass, and lovegrass. The Coastal bermudagrass pastures may be overseeded with arrowleaf clover, crimson clover, vetch, or singletary peas (fig. 4). These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is high.

Potential is high for crops such as peas, corn, and peanuts. The hazard of erosion is the main limiting feature. Residues from crops should be left on or near the surface to help control erosion, aid in water infiltration, and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields on this soil.

This soil has high potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from fire increases production.

Potential is high for openland and woodland wildlife habitat. It is low for wetland wildlife habitat because of absence of shallow water areas.

Potential for native grasses is low.

This soil has medium potential for most urban uses. Wetness and low strength are the main limitations. Potential is high for development of camp areas, picnic areas, and paths and trails. Potential for development of playgrounds is only medium because of slope.

This soil is in capability subclass IIIe; woodland group 2o.

Figure 4.—A good stand of arrowleaf clover on Bernaldo fine sandy loam, 1 to 4 percent slopes.

4—Bernaldo-Urban land complex, 1 to 4 percent slopes. This gently sloping complex is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and follow the boundaries of urban expansion. Areas of this complex range from 50 to 200 acres.

This complex is 35 to 75 percent Bernaldo soils, 15 to 50 percent Urban land, and 10 to 15 percent other soils. The soils and Urban land making up this complex are so intricately mixed that separation is not feasible at the scale used in mapping.

Bernaldo soils have a surface layer of very friable, slightly acid, brown fine sandy loam about 8 inches thick. The next layer is about 8 inches of very friable, medium acid, yellowish brown fine sandy loam. From a depth of 16 to 45 inches is firm, strongly acid, yellowish brown sandy clay loam. From 45 to 57 inches is friable, very strongly acid, brownish yellow sandy clay loam that has red mottles and about 20 percent light gray vertical streaks and pockets of uncoated sand. From 57 to 80 inches is friable, very strongly acid, mottled yellowish brown, red, and light brownish gray sandy clay loam and about 10 percent light gray vertical streaks of uncoated sand.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. They are typically used for single unit dwellings, streets, driveways, schools, and churches.

Included with this complex in mapping are small areas of Gallime, Wolfpen, Larue, and Freestone soils.

This map unit has medium potential for most urban uses. Wetness and low strength are the main limitations. Lawns and gardens are easily established.

This complex is not placed in any interpretive grouping.

5—Burleson clay, 0 to 1 percent slopes. This nearly level soil is on old terraces. Slopes are mainly smooth. Soil areas are irregular in shape and range from about 20 to several hundred acres.

This soil has a surface layer of very firm, medium acid, very dark gray clay about 5 inches thick. The next layer is about 25 inches of very firm, medium acid, black clay. From a depth of 30 to 51 inches is very firm, slightly acid, gray clay that has black vertical streaks. From 51 to 76 inches the soil is very firm, moderately alkaline, light brownish gray clay. Between the depths of 76 and 80 inches, it is very firm, moderately alkaline, gray and strong brown 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.

Included with this soil in mapping are small areas of Wilson, Derly, Deport, and Crockett soils. Also included are small areas of a Burleson soil that has slopes of 1 to 3 percent. Included soils make up less than 15 percent of any mapped area.

This Burleson soil is used mainly for pasture. Small grain for winter forage is grown in some areas. This soil has high potential for pastures of Coastal bermudagrass. Potential for hay production is high. In the fall, Coastal bermudagrass pastures should be overseeded with vetch or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer increases grass production.

Potential is high for crops such as grain sorghum. Residues from these crops should be left on or near the surface of the soil to aid in water infiltration and to maintain organic-matter content. Nitrogen and phosphorous fertilizer increases yields.

Potential is high for native plants. It is medium for openland wildlife habitat and is low for wetland wildlife habitat. This soil is not suited to woodland.

This Burleson soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, corrosion of uncoated steel, low strength, and the clayey nature of the soil are the most limiting features. Potential is medium for recreational development because of the clayey texture.

This soil is in capability subclass IIw.

6—Crockett loam, 1 to 3 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Soil areas are irregular in shape and range from about 20 to several hundred acres.

This soil has a surface layer of friable, medium acid brown loam about 9 inches thick. The next layer is about 5 inches of very firm, slightly acid, mottled dark reddish brown, olive brown, and dark grayish brown clay. From 14 to 33 inches is very firm, moderately alkaline, olive brown clay that has brownish mottles. From 33 to 43 inches is very firm, moderately alkaline, light olive brown clay. From a depth of 43 to 80 inches is yellow, gray, light gray, and dark grayish brown stratified shale and loamy material.

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

Included with this soil in mapping are small areas of Wilson, Axtell, Burleson, Derly, and Deport soils. Also included are small areas of Crockett soils that have slopes of 0 to 1 percent and 3 to 5 percent. Included soils make up less than 15 percent of any mapped area.

This Crockett soil is used primarily for pasture and hay production. A few small areas are used for corn.

This soil has high potential for pastures of Coastal bermudagrass and lovegrass. In the fall Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is high.

This soil has low potential for crops. The hazard of erosion, the clayey subsoil, and the droughty nature of the soil are the main limiting factors. If the soil is used for crops, the residue should be left on or near the surface to help control erosion and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields.

This soil has high potential for openland wildlife habitat and low potential for wetland wildlife habitat.

Potential for native grasses is medium. This soil is not suited to woodland.

This soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, low strength, very slow permeability, and corrosivity to uncoated steel are the main limitations. Potential for development of camp areas and playgrounds is medium because of very slow permeability. Potential is high for development of picnic areas and paths and trails.

This soil is in capability subclass IIIe.

7—Cuthbert fine sandy loam, 8 to 20 percent slopes. This strongly sloping to moderately steep soil is on uplands. Slopes are mainly smooth or convex. Areas are oblong and generally follow breaks into drainageways. Soil areas range from 10 to several hundred acres.

This soil has a surface layer of very friable, medium acid, very dark grayish brown fine sandy loam about 3 inches thick. The next layer, from 3 to 8 inches is very friable, medium acid, brown fine sandy loam. From a depth of 8 to 16 inches is very firm, very strongly acid, red clay that has yellowish red mottles. From 16 to 30 inches is very firm, very strongly acid, mottled red and yellowish red clay and light brownish gray partially weathered shale and strata of strong brown soft sandstone. Between the depths of 30 and 65 inches is extremely acid, stratified, strong brown soft sandstone, light gray shale, and red clay.

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

Included with this soil in mapping are small areas of Wolfpen, Pickton, Kirvin, and Trawick soils. Also included are small areas of eroded and very gravelly Cuthbert soils.

Included soils make up less than 20 percent of any mapped area.

This soil is used primarily for pasture, wildlife habitat, and woodland.

This soil has medium potential for pastures of Coastal bermudagrass or bahiagrass. The Coastal bermudagrass pastures may be overseeded with vetch, arrowleaf clover, or crimson clover in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Hay production is not feasible because of the slope.

This soil has high potential for openland and woodland wildlife habitat. Good management includes maintaining adequate cover, food, and water supply, and protecting the area from burning.

This soil has medium potential for woodland. The hazard of erosion is the main limiting feature. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from fire, increases production.

Potential for native grasses is low. This soil is not suited to crops.

This soil has low potential for most urban uses. Strong slope, moderately slow permeability, low strength, and corrosivity to concrete are the main limitations. Potential for development of camp areas and picnic areas is only medium and for playgrounds is low because of slope. Potential for paths and trails is high.

This soil is in capability subclass VIe; woodland group 4c.

8—Cuthbert very gravelly fine sandy loam, 12 to 30 percent slopes. This moderately steep to steep soil is on side slopes of uplands. Slopes are mainly smooth or convex. Areas are oblong and range from about 20 to several hundred acres.

This soil has a surface layer of very friable, slightly acid, brown very gravelly fine sandy loam about 4 inches thick. The next layer, from 4 to 24 inches, is very firm, very strongly acid, red clay that is about 3 percent ironstone fragments. From a depth of 24 to 45 inches is very firm, very strongly acid, stratified strong brown sand and soft sandstone that has lenses and fragments of light brownish gray shale and red clay flows. From 45 and 62 inches is very firm, very strongly acid, stratified, strong brown and red soft sandstone, sand, and gray shale.

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

Included with this soil in mapping are small areas of Trawick, Kirvin, and Elrose soils. Also included are small areas of Cuthbert stony soils. Included soils make up less than 20 percent of any mapped area.

This Cuthbert soil is used primarily for wildlife habitat and woodland. Some areas are used for pasture.

Potential is high for woodland wildlife habitat and medium for openland wildlife habitat. The small amount of grain and seed crops limits the potential of this soil for openland wildlife habitat.

This soil has medium potential for woodland. The hazard of erosion, equipment limitation, and plant competition are the main limiting features. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from fire increases production.

Potential is medium for pastures of Coastal bermudagrass and low for pastures of bahiagrass. The Coastal bermudagrass pastures may be overseeded with vetch,

arrowleaf clover, or crimson clover in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases production. Hay production is not feasible on this soil.

Potential for native grasses is low. This soil is not suited to crops.

This soil has low potential for most urban uses. Strong slope, shallow depth to rock, low strength, and corrosivity to concrete are the main limitations. Potential for recreational development is low because of slope.

This soil is in capability subclass VIIe; woodland group 4r.

9—Deport clay, 0 to 1 percent slopes. This nearly level soil is on old terraces. Slopes are mainly smooth or slightly concave. Areas are irregular in shape and range from about 25 to several hundred acres.

This soil has a surface layer of very firm, slightly acid, dark gray clay about 6 inches. The next layer is about 21 inches of very firm, medium acid, gray clay that has yellowish brown mottles. From a depth of 27 to 52 inches is very firm, neutral, dark gray clay that has olive and brown mottles. From a depth of 52 to 70 inches is very firm, moderately alkaline, grayish brown clay that has yellowish brown mottles.

This soil is somewhat poorly drained. Surface runoff is medium. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Burleson, Derly, Axtell, Crockett, and Wilson soils. Also included are small areas of a Deport soil that has slopes of 1 to 3 percent and a similar soil that has chroma of 2 or more. Included soils make up less than 20 percent of any mapped area.

This soil is used primarily for pasture. A few areas are used for crops.

This Deport soil has medium potential for pastures of Coastal bermudagrass, tall fescuegrass, and bahiagrass. Pastures are difficult to establish because of the clayey surface layer. The Coastal bermudagrass pastures may be overseeded with singletary peas, vetch, or white clover in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer and sometimes lime increase grass production. Potential for hay production is medium.

This soil has medium potential for crops. Wetness is the main limiting feature. When used for crops, residues from crops should be left on or near the surface of the soil. This aids in water infiltration and helps maintain organic-matter content of the soil. Nitrogen and phosphorous fertilizer increases yields.

This soil has medium potential for openland wildlife habitat, low for wetland wildlife habitat, and is not suited for woodland wildlife habitat. The small amount of grain and seed crops and grasses and legumes limits the potential of this soil for openland wildlife habitat.

Potential is medium for native grasses. This soil is not suited to woodland.

This soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, wetness, and very slow permeability are the main limitations. Potential for recreational development is low because of a clayey surface layer and wetness.

This soil is in capability subclass IIIw.

10—Derly-Rader complex. This nearly level complex is on old terraces. Slopes are mainly smooth or concave and range from 0 to 1 percent. Areas are irregular in shape and range from about 20 to 1,000 acres.

About 40 to 50 percent of this complex is Derly soils, about 30 to 40 percent Rader soils, and about 15 to 25 percent other soils. These soils are so intricately mixed or small in area that they cannot be shown separately at the scale used in mapping. Derly soils dominate the complex and are in the intermound position. Rader soils are on the mounds. The mounds of Rader soils are from 25 to 75 feet in diameter and are 1 to 3 feet higher than the intermound lows. The size of the mounds and pattern of occurrence vary within soil areas of the complex as well as from one soil area to another.

The Derly soil has a surface layer of friable, slightly acid, grayish brown loam about 7 inches thick. The next layer, from 7 to 11 inches, is friable, medium acid, light brownish gray loam. From 11 to 21 inches is very firm, strongly acid, dark grayish brown clay that is about 20 percent tongues and pockets of light brownish gray loam. From a depth of 21 to 29 inches is very firm, strongly acid, grayish brown clay that has yellowish brown and strong brown mottles. From 29 to 43 inches is very firm, medium acid, dark grayish brown clay that has yellowish brown mottles. From 43 to 65 inches is very firm, neutral, gray and grayish brown clay that has red, yellow, and brownish yellow mottles.

This Derly soil is poorly drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is high. The hazard of erosion is slight.

The Rader soil has a surface layer of very friable, medium acid, brown fine sandy loam about 6 inches thick. The next layer is about 22 inches of very friable, strongly acid, yellowish brown fine sandy loam. From a depth of 28 to 44 inches is friable, very strongly acid, yellowish brown and strong brown sandy clay loam surrounded by light brownish gray sandy material. From 44 to 65 inches is very firm, very strongly acid, grayish brown clay that has red and yellowish red mottles. From 65 to 72 inches is very firm, strongly acid, mottled grayish brown, red, and yellowish red clay.

This Rader soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and available

water capacity is medium. The hazard of erosion is slight.

Included with this complex in mapping are small areas of Axtell, Wilson, and Deport soils. Also included are soils similar to Derly and Rader soils that are at the base of mounds. Included soils make up less than 25 percent of any mapped area.

This complex is used primarily for pasture.

Potential is medium for pastures of Coastal bermudagrass, tall fescuegrass, and bahiagrass. The Coastal bermudagrass pastures may be overseeded with white clover or singletary peas in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases production.

This complex has medium potential for wildlife habitat.

Potential is medium for crops. Mounds may need to be leveled if used for crops.

Potential for woodland is medium on the Derly soils in this complex. Suitable trees are water oak, willow oak, and sweetgum. The Rader soils are not suited to woodland.

Potential for native grasses is medium.

This complex has low potential for most urban uses. Shrinking and swelling with changes in moisture, wetness, corrosivity to uncoated steel, low strength, and very slow permeability are the main limitations. Potential for recreational development of this complex is low because of wetness and very slow permeability.

This complex is in capability subclass IIIw; woodland group 4w.

11—Dutek loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on high stream terraces. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to 500 acres.

This soil has a surface layer of very friable, slightly acid, brown loamy fine sand about 5 inches thick. The next layer is about 6 inches of very friable, neutral, brown loamy fine sand. From 11 to 34 inches is very friable, slightly acid, brown loamy fine sand. From a depth of 34 to 55 inches is firm, slightly acid, yellowish red sandy clay loam. From 55 to 67 inches is friable, strongly acid, yellowish red sandy clay loam. Between 67 and 80 inches is friable, neutral, strong brown fine sandy loam.

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

Included with this soil in mapping are small areas of Axtell, Freestone, Silawa, Styx, and Eufaula soils. Included soils make up less than 20 percent of any mapped area.

This Dutek soil is used primarily for pasture and hay production. A few small areas are planted to corn.

This soil has medium potential for pastures. The Coastal bermudagrass pastures map be overseeded with singletary peas, vetch, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is medium.

This soil has low potential for crops. The hazard of erosion is the main limiting feature when used for crops. Residues from crops should be left at or near the surface to help control erosion and maintain organic-matter content of the soil. The addition of lime and a complete fertilizer increases crop yields.

Potential is medium for openland and woodland wildlife habitat. The small amount of grain and seed crops and grasses and legumes limits the potential of this soil for openland wildlife habitat. The limited amount of trees restricts the potential for woodland wildlife habitat.

Potential for native grasses is medium. This soil is not suited to woodland.

This soil has high potential for most urban uses. Potential is low for recreational development. The sandy nature of the soil is the main limiting feature.

This soil is in capability subclass IIIe.

12—Dutek loamy fine sand, 5 to 12 percent slopes. This sloping to strongly sloping soil is on terraces. Slopes are mainly smooth or convex. Areas are oblong and range from about 15 to several hundred acres.

This soil has a surface layer of very friable, neutral, brown loamy fine sand about 9 inches thick. The next layer is about 12 inches of very friable, slightly acid, brown loamy fine sand. From a depth of 21 to 34 inches is firm, medium acid, red sandy clay loam. From 34 to 45 inches is friable, medium acid, red sandy clay loam. From 45 to 61 inches is friable, strongly acid, mottled red and yellowish red fine sandy loam. From 61 to 80 inches is friable, medium acid, mottled brown and strong brown fine sandy loam.

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

Included with this soil in mapping are small areas of Axtell, Silawa, and Styx soils. Included soils make up less than 15 percent of any mapped area.

This Dutek soil is used primarily for pasture and wildlife habitat.

This soil has low potential for pastures of Coastal bermudagrass and lovegrass. The Coastal bermudagrass pastures, however, may be overseeded with singletary peas, vetch, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

Potential is medium for openland and woodland wildlife habitat. The small amount of grain and seed crops and grasses and legumes limits the potential of this soil for openland wildlife habitat. The limited amount of trees restricts the potential for woodland wildlife habitat.

Potential for crops is low because of the hazard of erosion. Potential for native grasses is medium. This soil is not suited to woodland.

This soil has high potential for most urban uses. Slope is the main limiting feature. Potential for recreational development is low. Slope and the sandy nature of the soil are the main limiting features.

This soil is in capability subclass IVe.

13—Elrose fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. Slopes are mainly plain or convex. Areas are irregular in shape and range from 10 to several hundred acres.

This soil has a surface layer of very friable, medium acid, reddish brown fine sandy loam about 9 inches thick. The next layer is about 12 inches of firm, medium acid, red sandy clay loam. From a depth of 21 to 37 inches the soil is firm, medium acid, red sandy clay loam. From 37 to 69 inches it is firm, strongly acid, dark red sandy clay loam. From 69 to 80 inches it is firm, strongly acid, red sandy clay loam.

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

Included with this soil in mapping are small areas of Larue, Trawick, Kirvin, and Bernaldo soils. Included soils make up less than 15 percent of any mapped area.

This Elrose soil is used primarily for pasture, hay production, and woodland. Some areas are used for crops such as corn and peanuts.

This soil has high potential for pastures. The bermudagrass pastures may be overseeded with arrowleaf clover, vetch, crimson clover, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is high.

This soil has high potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

This soil has medium potential for crops. The hazard of erosion is the main limiting feature. The addition of lime and a complete fertilizer increases yields on this soil.

Potential is high for openland and woodland wildlife habitat. It is low for native grasses.

This soil has high potential for most urban uses. Potential is high for development of camp areas, picnic areas, and paths and trails. Potential for playgrounds is only medium because of slope.

This soil is in capability subclass IIIe; woodland group 2o.

14—Eufaula fine sand, 1 to 8 percent slopes. This gently sloping to sloping soil is on terraces. Slopes are mainly plain or convex. Areas are irregular in shape and range from about 10 to 300 acres.

This soil has a surface layer of very friable, medium acid, brown fine sand about 12 inches thick. From 12 to 44 inches is very friable, medium acid, light brown fine sand. The next layer, from 44 to 71 inches, is very friable, slightly acid, light brown fine sand with lamellae of yellowish red sandy loam. Between 71 and 80 inches is very friable, slightly acid, reddish yellow fine sand with lamellae of yellowish red sandy loam.

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

Included with this soil in mapping are small areas of Dutek, Styx, and Silawa soils. Also included is a soil that is fine sand throughout. Included in some areas is a similar soil that has a sandy loam or sandy clay loam subsoil. Included soils make up less than 20 percent of any mapped area.

This Eufaula soil is used primarily for pasture, hay production, and wildlife habitat.

This soil has low potential for pastures of Coastal bermudagrass and lovegrass. The Coastal bermudagrass pastures may be overseeded with vetch or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for Coastal bermudagrass hay is low.

Potential is medium for openland wildlife habitat because only a small amount of grain and seed crops and grasses and legumes is available.

This soil is not suited to crops. Potential for native vegetation is low. This soil is not suited to woodland.

This soil has high potential for most urban uses. The sandy nature of this soil limits its potential for some uses. Potential is medium for development of camp areas and picnic areas. Potential for development of playgrounds and paths and trails is low.

This soil is in capability subclass VIe.

15—Ferris clay, 4 to 8 percent slopes. This gently sloping to sloping soil is on old terraces. Slopes are mainly plain or convex. Soil areas are irregular in shape and range from about 20 to 200 acres.

This soil has a surface layer of very firm, moderately alkaline, dark grayish brown clay about 7 inches thick. The next layer is about 7 inches of very firm, moderately alkaline, olive brown clay that has common dark grayish brown coatings on the peds. From 14 to 41 inches the soil is very firm, moderately alkaline, light olive brown clay that has common dark grayish brown mottles. From 41 and 65 inches it is very firm, moderately alkaline, yellowish brown clay.

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

Included with this soil in mapping are small areas of Axtell, Silawa, and Deport soils. Also included in some areas is a similar soil that is darker in color than Ferris soil. Included soils make up less than 15 percent of any mapped area.

This Ferris soil is used primarily for pasture and wildlife habitat.

This soil has low potential for pastures of Coastal bermudagrass and lovegrass. Establishment of grasses is slow because of the clayey surface layer. Slope and the clayey texture restrict water intake in this soil. The pastures of Coastal bermudagrass may be overseeded with vetch, sweetclover, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer increases grass production. Potential for hay production is low.

Potential is medium for openland wildlife habitat because only a small amount of grain and seed crops and grasses and legumes is available.

Potential for native vegetation is high. This soil is not suited to crops or woodland.

This soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, and very slow permeability are the main limitations. Potential for recreational development is medium. The clayey surface layer, very slow permeability, and slope are the main limiting features.

This soil is in capability subclass VIe.

16—Freestone fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on old terraces and uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to several hundred acres.

This soil has a surface layer of very friable, strongly acid, brown fine sandy loam about 5 inches thick (fig. 5). The next layer is very friable, strongly acid, brown fine sandy loam about 9 inches thick. From 14 to 23 inches is firm, strongly acid, brownish yellow sandy clay loam with red and pale brown mottles. From a depth of 23 to 34 inches is firm, very strongly acid, mottled brownish yellow, pale brown, and red sandy clay loam and pockets and streaks of light brownish gray uncoated sand (fig. 6). From 34 to 45 inches is very firm, very strongly acid, mottled grayish brown and yellowish brown clay. From 45 to 59 inches the soil is very firm, neutral, mottled brownish yellow, light brownish gray, and gray clay. From 59 to 80 inches it is very firm, moderately alkaline, gray clay that has yellowish brown mottles.

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

Included with this soil in mapping are small areas of Axtell, Woodtell, Bernaldo, Derly, Rader, and Kirvin soils. Included soils make up less than 15 percent of any mapped areas.

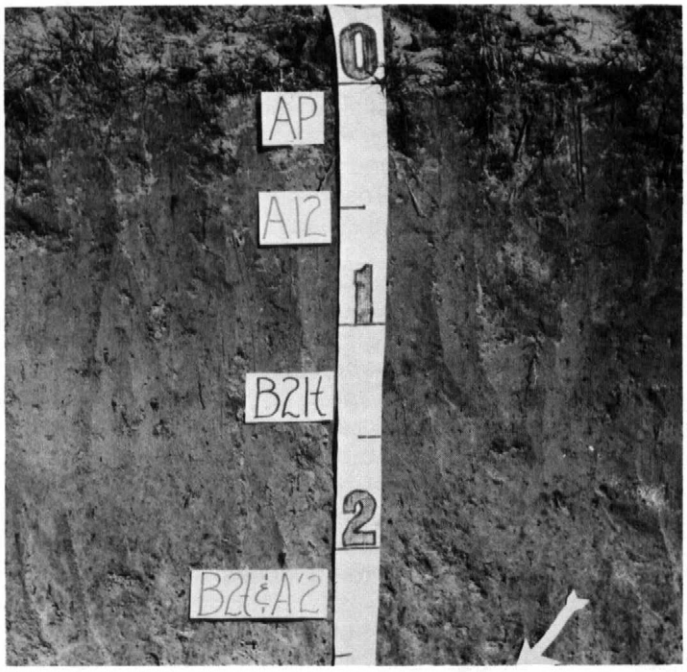


Figure 5.—Upper profile of Freestone fine sandy loam, 1 to 3 percent slopes.

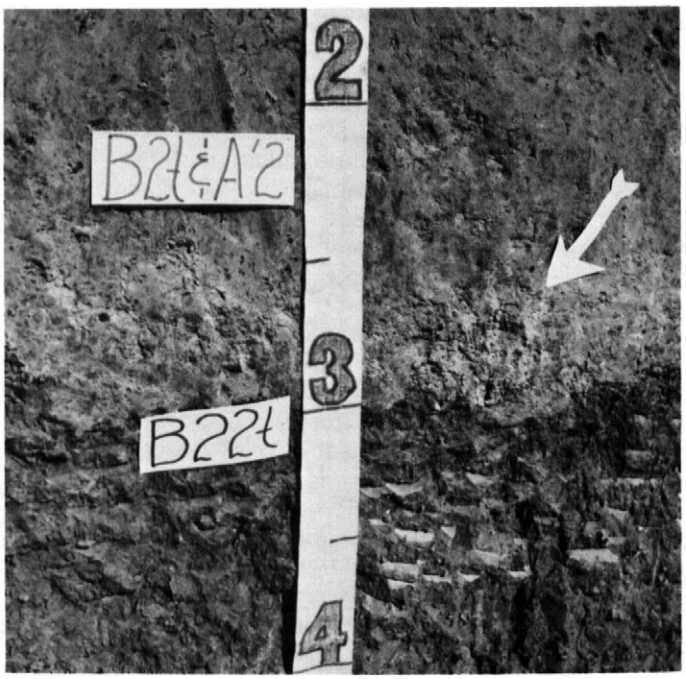


Figure 6.—Lower profile of Freestone fine sandy loam, 1 to 3 percent slopes.

This Freestone soil is used primarily for pasture and hay production. A few small areas are used for corn, peas, and peanuts.

This soil has high potential for pastures of Coastal bermudagrass, bahiagrass, and lovegrass. The Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, crimson clover, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production on this soil. Potential for hay production is high.

Potential is high for crops such as corn, peas, and peanuts. Crop residues should be left on or near the surface to help control erosion, aid in water infiltration, and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields on this soil.

Potential for openland and woodland wildlife habitat is high. Potential for woodland is medium.

This soil has low potential for native vegetation.

Potential is low for most urban uses. Corrosivity to uncoated steel, wetness, slow permeability, and a subsoil that shrinks and swells with changes in moisture are the main limitations. Potential for development of camp areas, picnic areas, and playgrounds is medium. Potential for paths and trails is high. Wetness and slow permeability are the main limiting features.

This soil is in capability subclass IIe; woodland group 3w.

17—Gallime fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on terraces and uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from 5 to several hundred acres.

This soil has a surface layer of very friable, medium acid, brown fine sandy loam 10 inches thick. The next layer is 18 inches of very friable, slightly acid, light yellowish brown fine sandy loam. From 28 to 47 inches is friable, strongly acid, yellowish brown sandy clay loam that has red mottles. From 47 to 62 inches the soil is firm, strongly acid, yellowish brown sandy clay loam that has yellowish red and yellow mottles and light brownish gray sand coatings. From 62 to 80 inches it is firm, very strongly acid, mottled red, light gray, and yellow sandy clay loam and streaks and pockets of light brownish gray uncoated sand.

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

Included with this soil in mapping are small areas of Bernaldo, Kirvin, Pickton, and Wolfpen soils. Included soils make up less than 15 percent of any mapped area.

This Gallime soil is used primarily for pasture and hay production. Some areas are used for crops such as corn, peas, and peanuts.

This soil has high potential for pastures of Coastal bermudagrass, bahiagrass, and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with arrowleaf clover, crimson clover, vetch, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases yields. Potential for hay production is high.

This soil has high potential for crops (fig. 7). Residue from crops should be left on or near the surface of the soil to help control erosion, aid in water infiltration, and maintain organic-matter content. Addition of lime and a complete fertilizer increases yields on this soil.

This soil has high potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for woodland or openland wildlife habitat is high. Potential for native grasses is low.

This soil has medium potential for most urban uses. Corrosivity to concrete, shrink-swell, wetness, and low strength are the main limitations. Potential for development of camp areas, picnic areas, and paths and trails is high. Potential for playgrounds is medium because of slope.

This soil is in capability subclass IIIe; woodland group 2o.

18—Gladewater clay, frequently flooded. This nearly level soil is on bottom lands. Slopes are mainly smooth or concave. Areas are oblong and are a few hundred feet to about 1 mile wide. Soil areas range from about 25 to several thousand acres. This soil generally floods one to two times a year. Flooding usually lasts for a few days to a week and is most likely to occur during the months of September through May.

Typically, the surface layer is very firm, slightly acid, very dark gray clay about 6 inches thick. The next layer, from 6 to 29 inches, is very firm, very strongly acid, grayish brown clay that has yellowish brown mottles. From a depth of 29 to 44 inches is very firm, strongly acid, dark gray clay that has olive mottles. From 44 to 67 inches is very firm, neutral, very dark gray clay that has brownish mottles.

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

Included with this soil in mapping are small areas of Kaufman and Trinity soils. Also included in some areas are soils similar to the Gladewater soil that are covered with a loamy overwash. Included soils make up less than 15 percent of any mapped area.

This Gladewater soil is used primarily for wildlife habitat and pasture.

Figure 7.—Corn on Gallime fine sandy loam, 1 to 5 percent slopes.

This soil has medium potential for openland, woodland, or wetland wildlife habitat. The small amount of grain and seed crops, grasses and legumes, wild herbaceous plants, shrubs, and wetland plants grown on this soil limits the potential for wildlife habitat.

Potential is medium for pastures of Coastal bermudagrass and fescuegrass. The Coastal bermudagrass pastures may be overseeded with singletary peas or white clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and nitrogen and phosphorous fertilizer increases grass production. Potential for hay production is low because of flooding.

Potential for woodland is medium. Potential for native vegetation is medium. This soil is not suited to crops.

This soil has low potential for most urban uses. Flooding, very slow permeability, shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and low strength are the main limitations. Potential for recreational development is low. Flooding and the clayey surface layer are the main limiting features.

This soil is in capability subclass Vw; woodland group 2w.

19—Kaufman clay, rarely flooded. This nearly level to gently sloping soil is on bottom lands. Slopes are mainly smooth or convex and range from 0 to 3 percent. Areas are oblong and average several hundred acres. This soil is protected from flooding by levees.

This soil has a surface layer of very firm, neutral, black clay about 11 inches thick. The next layer is about 22 inches of very firm, neutral, black clay that has brownish yellow mottles. The next layer, from 33 to 69 inches, is very firm, moderately alkaline, very dark gray clay with intersecting slickensides up to 8 inches wide. From 69 to 80 inches is very firm, moderately alkaline, gray clay that has calcium carbonate concretions.

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

Included with this soil in mapping are small areas of Trinity and Gladewater soils. Also included in some areas are clayey soils covered by a loamy overwash. Included soils make up less than 15 percent of any mapped area.

This Kaufman soil is used primarily for pastures and wildlife habitat. Some areas are used for grain sorghum.

This soil has high potential for pastures. The pastures of Coastal bermudagrass may be overseeded with singletary peas or white clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer increases grass production.

This soil has high potential for woodland wildlife habitat and medium potential for openland and wetland wildlife habitat. The small amount of grain and seed crops and grasses and legumes grown on this soil limits the potential for openland wildlife habitat. The small amount of wetland plants limits the potential for wetland wildlife habitat.

This soil has high potential for producing grain sorghum, corn, cotton, and small grains. Residue from these crops should be left on or near the surface of the soil to aid in water infiltration and to maintain organic-matter content.

Potential for hardwood trees is high. Potential for native vegetation is medium.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, very slow permeability, shrinking and swelling with changes in moisture, and rare flooding are the main limitations. Potential for recreational development is low. Rare flooding and the clayey surface are the main limiting features.

This soil is in capability subclass IIw; woodland group 1w.

20—Kaufman clay, frequently flooded. This is a nearly level to gently sloping soil on bottom lands. Slopes are mainly smooth or concave and range from 0 to 3 percent. Areas are oblong and are a few hundred feet to about 0.5 mile wide. Soil areas range from about 100 to several hundred acres. The soil generally floods at least one to two times a year. Flooding usually lasts for a few days to a few weeks. Flooding is most likely to occur during the months of November through May.

This soil has a surface layer of very firm, neutral, black clay about 10 inches thick. The next layer is 14 inches of very firm, moderately alkaline, black clay. From a depth of 24 to 59 inches is very firm, moderately alkaline, very dark gray clay that has light yellowish brown mottles. From 59 to 68 inches is very firm, moderately alkaline, dark gray clay that has light olive brown mottles.

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

Included with this soil in mapping are small areas of Trinity and Gladewater soils. Also included in some areas are clayey soils covered by a loamy overwash. Included soils make up less than 15 percent of any mapped area.

This Kaufman soil is used primarily for wildlife habitat and pasture.

This soil has high potential for woodland wildlife habitat, medium potential for wetland wildlife habitat, and low potential for openland wildlife habitat. The small amount of wetland plants limits the potential for wetland wildlife habitat. The small amount of grain and seed crops and grasses and legumes grown on this soil limits the potential for openland wildlife habitat.

This soil has high potential for pastures. The pastures of Coastal bermudagrass may be overseeded with singletary peas or white clover. The plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer increases grass production.

Potential for producing hardwood trees is high. Potential for native vegetation is medium. This soil is not suited to crops.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, very slow permeability, shrinking and swelling with changes in moisture, and flooding are the main limitations. Potential for recreational development is low. Flooding and the clayey surface layer are the main limiting features.

This soil is in capability subclass Vw; woodland group 1w.

21—Kirvin fine sandy loam, 2 to 5 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to 150 acres.

This soil has a surface layer of very friable, medium acid, dark brown fine sandy loam about 8 inches thick. The next layer is about 3 inches of very friable, strongly acid, brown fine sandy loam. The next layer is about 15 inches of firm, very strongly acid, red clay. From 26 to 34 inches is firm, very strongly acid, red clay that has many strong brown mottles. From a depth of 34 to 55 inches this soil is firm, very strongly acid, red and yellowish red sandy clay loam. From a depth of 55 to 70 inches it is red and strong brown sandy clay loam and a few thin strata of gray shale.

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

Included with this soil in mapping are small areas of Bernaldo, Cuthbert, Freestone, Wolfpen, and Larue soils. Also included is a Kirvin soil that has a gravelly fine sandy loam surface layer. Included soils make up less than 15 percent of any mapped area.

This Kirvin soil is used primarily for pasture and woodland.

This soil has high potential for pastures of Coastal bermudagrass, bahiagrass, and lovegrass. The Coastal bermudagrass pasture may be overseeded with arrowleaf clover, vetch, or crimson clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production. Potential for hay production is high.

This soil has medium potential for woodland (fig. 8). Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

This soil has medium potential for crops such as corn and peanuts. Residue from crops should be left on or near the surface to aid in water infiltration, to control erosion, and to maintain organic-matter content of the soil.

Potential is high for openland and woodland wildlife habitat. It is low for native vegetation.

This soil has medium potential for most urban uses. Corrosivity to concrete, low strength, and shrinking and swelling with changes in moisture are the main limitations. Potential is high for development of picnic areas and paths and trails. Potential for camp areas and playgrounds is only medium because of moderately slow permeability.

This soil is in capability subclass IIIe; woodland group 3o.

22—Kirvin-Urban land complex, 2 to 5 percent slopes. This gently sloping complex is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and follow the boundaries of urban development. Areas range from about 20 to 100 acres.

This complex is 40 to 65 percent Kirvin soils, 15 to 50 percent Urban land, and 10 to 15 percent minor soils. The soils and Urban land making up this complex are so intricately mixed that separation is not feasible at the scale used in mapping.

Kirvin soils have a surface layer of very friable, medium acid, brown fine sandy loam about 8 inches thick. The next layer is about 3 inches of very friable, strongly acid, brown fine sandy loam. The next layer is about 15 inches of firm, very strongly acid, red clay. From 26 to 34 inches is firm, very strongly acid, red clay that has many strong brown mottles. From a depth of 34 to 55 inches is firm, very strongly acid, red and yellowish red sandy clay loam. From 55 to 70 inches is red and strong brown sandy clay loam and a few thin strata of gray shale.

Figure 8.—Natural reseeding of shortleaf pine on Kirvin fine sandy loam, 2 to 5 percent slopes.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. Typical structures are single unit dwellings, streets, driveways, sidewalks, schools, and churches.

Included with this complex in mapping are small areas of Bernaldo, Cuthbert, and Wolfpen soils.

This map unit has medium potential for most urban uses. Corrosivity to concrete, low strength, and shrinking and swelling with changes in moisture are the main limitations. Potential is high for development of picnic areas and paths and trails. Potential for camp areas and playgrounds is only medium because of permeability. Potential for lawns and gardens is high.

This complex is not placed in any interpretive grouping.

23—Kirvin soils, graded. These are gently sloping soils on uplands. Slopes are mainly smooth and range from 2 to 5 percent. Areas are irregular in shape and range from 5 to l00 acres.

This map unit is broadly defined, and its composition is more variable than that of most other map units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

Some areas have been surface mined for ironstone gravel. Areas are not uniform and they occur without regularity on the landscape. This soil is extremely variable. The removal of topsoil makes soil reclamation and revegetation difficult. Some areas are barren, and some areas have poor stands of grasses and weeds.

Typically, the surface layer is very friable, medium acid, brown gravelly fine sandy loam about 3 inches thick. The next layer is about 7 inches of firm, very strongly acid, red clay loam. From a depth of 10 to 32 inches is firm, very strongly acid, mottled red, light brownish gray, and yellowish brown sandy clay loam. From 32 to 54 inches is very strongly acid, light gray shale and red, yellowish red, and strong brown soft sandstone. A discontinuous layer of ironstone rock starts at about 54 inches.

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

Included with these soils in mapping are areas of Elrose, Cuthbert, and Trawick soils. Included soils make up less than 40 percent of any mapped area.

The Kirvin soils are used primarily for wildlife habitat and pasture.

Potential is high for woodland wildlife habitat. Potential for openland wildlife habitat is medium because only a small amount of grain and seed crops and grasses and legumes is available.

Potential is medium for pastures of Coastal bermudagrass and bahiagrass. The Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, or crimson clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

These soils have medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for native vegetation is low. These soils are not suited to crops.

Potential is medium for most urban uses. Corrosivity to concrete, low strength, and shrinking and swelling with changes in moisture are the main limiting features. Potential is medium for development of camp areas, picnic areas, and paths and trails. Permeability and small stones are the main limitations. Potential for playgrounds is low because of small stones.

These soils are in capability subclass VIe; woodland group 4c.

24—Larue loamy fine sand, 1 to 8 percent slopes. This gently sloping to sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to 300 acres.

This soil has a surface layer of very friable, strongly acid, brown loamy fine sand about 7 inches thick. The next layer, from 7 to 34 inches, is very friable, medium acid, brown loamy fine sand. From 34 to 48 inches is firm, slightly acid, red sandy clay loam. From 48 to 63 inches is firm, slightly acid, red sandy clay loam that has strong brown 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 small areas of Elrose, Trawick, Wolfpen, Kirvin, and Bernaldo soils. Also included is a soil that is similar to the Larue soil except the surface layer and subsoil are less than 60 inches thick. Included soils make up less than 15 percent of any mapped area.

This Larue soil is used primarily for pasture and woodland.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. The Coastal bermudagrass pastures may be overseeded with vetch, arrowleaf clover, or crimson clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay production is medium. The addition of lime and a complete fertilizer increases grass and hay production.

This soil has medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and pro-

tecting the woodland from burning, increases timber production.

Potential for crops such as corn, peas, and peanuts is medium. Potential for woodland wildlife habitat is high. Potential for openland wildlife habitat is medium.

This soil has medium potential for native vegetation.

This soil has high potential for most urban uses. Corrosivity to concrete, seepage, and slope are limitations. Potential for recreational development is medium. The sandy surface layer is the main limiting feature.

This soil is in capability subclass IIIe; woodland group 3s.

25—Leagueville-Henco complex, 1 to 5 percent slopes. This gently sloping complex is on bottoms of narrow drainageways and on short side slopes along drainageways. This complex has a high water table during most of the year. Slopes are mainly smooth or concave. Areas are long and narrow and range from about 20 to 200 acres.

About 40 to 55 percent of this complex is Leagueville soils, about 25 to 50 percent Henco soils, and about 10 to 20 percent other soils. These soils are so intricately mixed or small in area that they cannot be shown separately at the scale used in mapping. Leagueville soils generally are on a slightly lower position than the Henco soils.

The Leagueville soil has a surface layer of very friable, strongly acid, very dark gray fine sand about 3 inches thick. The next layer is about 10 inches of very friable, medium acid, dark grayish brown fine sand. Extending from 13 to 29 inches is very friable, medium acid, very pale brown fine sand. From a depth of 29 to 5l inches is friable, extremely acid, gray sandy clay loam that has yellowish brown and brown mottles. From 51 to 80 inches is friable, very strongly acid, light gray fine sand that has pockets and streaks of strong brown, gray, yellowish brown, and light yellowish brown sandy clay loam.

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

The Henco soil in this complex has a surface layer of very friable, strongly acid, grayish brown loamy fine sand about 8 inches thick. The next layer is about 7 inches of very friable, medium acid, pale brown loamy fine sand. From 15 to 44 inches is very friable, medium acid, light gray loamy fine sand. From a depth of 44 to 62 inches is firm, very strongly acid, light gray uncoated loamy fine sand that has mottles, streaks, and pockets of yellowish brown, strong brown, and light gray sandy clay loam. From 62 to 72 inches is very friable, very strongly acid, light gray loamy fine sand that has yellow mottles.

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

Included with this complex in mapping are small areas of Wolfpen, Lufkin, and Nahatche soils. Also included in some areas is a soil that is gray sand throughout.

This complex is used primarily for wildlife habitat.

This complex has medium potential for openland, woodland, and wetland wildlife habitat. The small amount of grain and seed crops and wetland plants are the main limiting features.

Potential is medium for pastures of Coastal bermudagrass and fescuegrass. The Coastal bermudagrass pastures may be overseeded with vetch or white clover in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Proper management of pastures could be difficult because of the high water table in this complex.

Potential for woodland is medium. Equipment limitation, seedling mortality, and plant competition are the main limiting features.

This complex has low potential for native vegetation. This complex is not suited to crops.

This complex has low potential for most urban uses. Corrosivity to concrete and uncoated steel, wetness, and seepage are the main limitations. Potential for recreational development is low. Wetness is the main limiting feature.

This complex is in capability subclass Vw; woodland group 3w.

26—Lufkin-Raino complex. This complex is on nearly level, moundy, uplands. Slopes are mainly smooth or convex and range from 0 to 1 percent. Areas of soil are irregular in shape and range from 20 to 300 acres.

About 40 to 55 percent of this complex is Lufkin soils, about 30 to 40 percent Raino soils, and about 10 to 20 percent other soils. These soils are so intricately mixed or small in area that they cannot be shown separately at the scale used in mapping. Lufkin soils dominate the complex and are between the mounds. Raino soils are on the mounds. The mounds of Raino soils range from 25 to 100 feet in diameter and are 1 to 3 feet higher than the intermound lows. Individual mounds are spaced 25 to about 500 feet apart. In some areas Raino soils occupy small low ridges that meander through the lows between mounds. The size of the mounds and the patterns of occurrence vary within soil areas as well as from one soil area to another.

The Lufkin soil has a surface layer of friable, slightly acid, dark grayish brown loam about 6 inches thick. The next layer is about 4 inches of friable, strongly acid, light brownish gray loam. From a depth of 10 to 30 inches is very firm, very strongly acid, grayish brown clay. From 30 to 44 inches is very firm, very strongly acid, dark gray clay. From a depth of 44 to 60 inches is very firm, moderately alkaline, light brownish gray, grayish brown, and brownish yellow clay.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability is very slow, and available water capacity is medium. The hazard of erosion is slight.

The Raino soil in this complex has a surface layer of friable, medium acid, dark grayish brown loam about 5 inches thick. The next layer is 5 inches of friable, medium acid, brown loam. From a depth of 10 to 29 inches is friable, very strongly acid, dark yellowish brown loam. From a depth of 29 to 35 inches is friable, very strongly acid light brownish gray loam and yellowish brown sandy clay loam. From a depth of 35 to 44 inches is very firm, very strongly acid, grayish brown clay that has yellowish brown and red mottles and also has streaks and pockets of uncoated sand and silt. From 44 to 64 inches is very firm, very strongly acid, mottled grayish brown, gray, and yellowish brown clay. The next layer, from 64 to 72 inches, is firm, very strongly acid, mottled gray, grayish brown, red, and yellowish brown clay loam.

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.

Included with this complex in mapping are small areas of Woodtell and Freestone soils. Also included at the base of mounds are soils similar to Lufkin and Raino soils.

This complex is used primarily for pasture and wildlife habitat.

This complex has medium potential for pastures of Coastal bermudagrass, bahiagrass, and fescuegrass. The Coastal bermudagrass pastures may be overseeded with white clover or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass production.

This complex has high potential for woodland wildlife habitat. Potential for openland and wetland wildlife habitat is medium. The small amount of grain and seed crops and wild herbaceous plants grown on this soil are the main limiting features for openland wildlife habitat. The small amount of wetland plants and shallow water areas limits the potential for wetland wildlife habitat.

Potential for crops is medium. Wetness is the main limiting feature. Potential for woodland is low.

This complex has medium potential for native vegetation.

This complex has low potential for most urban uses. Corrosivity to uncoated steel, permeability, wetness, low strength, and shrinking and swelling with changes in moisture are the main limitations. Potential for development of camp areas and playgrounds is low. Potential for picnic areas and paths and trails is only medium. Wetness and very slow permeability are the main limiting features.

This complex is in capability subclass IIIw; woodland group is 5w for Lufkin soil and 3w for Raino soil.

27—Nahatche loam, frequently flooded. This soil is on nearly level flood plains of large streams. Slopes are mainly smooth or concave and range from 0 to 1 percent. Areas follow the meander of the streams and range from about 200 feet to 1 mile wide. Areas range from about 20 acres to several thousand acres. This soil floods on the average of one to two times a year (fig. 9). The duration of flooding is usually 2 to 7 days. Flooding is most likely to occur during the months of November through May.

About half of this map unit has a loam surface layer, about 1/4 has a fine sandy loam surface layer, and 1/4 has a clay loam surface layer. These textures do not occur in a regular pattern.

This Nahatche soil typically has a surface layer of friable, strongly acid, dark grayish brown loam about 5 inches thick (fig. 10). The next layer is about 8 inches of very friable, medium acid, brown fine sandy loam. From a depth of 13 to 30 inches is firm, slightly acid, grayish brown clay loam that has yellowish red mottles. From 30 to 75 inches is firm, neutral, dark gray clay loam.

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

Included with this unit in mapping are areas of a similar soil that is gray throughout. Also included is a similar soil that is sandier and one that is on low ridges and has a thick brown surface layer. Included soils make up less than 30 percent of any mapped area.

This map unit is used primarily for pasture and wildlife habitat.

This map unit has high potential for pastures of Coastal bermudagrass, common bermudagrass, bahiagrass, and fescuegrass. The bermudagrass pastures may be overseeded with white clover or singletary peas in the fall. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

Potential is medium for woodland and wetland wildlife habitat. Potential for openland wildlife habitat is low because only a small amount of grain and seed crops and grasses and legumes is available.

Potential for woodland is high. Potential for native vegetation is low. This map unit is not suited to crops because of flooding.

Potential is low for most urban uses. Flooding, wetness, and corrosivity to uncoated steel are the main limitations. Potential for recreational development is low. Flooding and wetness are the main limiting features.

This soil is in capability subclass Vw; woodland group 1w.

28—Normangee clay loam, 2 to 5 percent slopes, eroded. This gently sloping soil is on old terraces and uplands. Slopes are mainly smooth or complex. Areas

Figure 9.—Flooding along a large creek bottom on Nahatche loam, frequently flooded.

are irregular in shape and range from about 25 to several hundred acres.

This soil has a surface layer of firm, slightly acid, very dark grayish brown clay loam about 3 inches thick. The next layer is about 7 inches of very firm, slightly acid, brown clay. From 10 to 19 inches is very firm, moderately alkaline, brown clay. From a depth of 19 to 39 inches is very firm, moderately alkaline, light olive brown clay. From 39 to 72 inches is stratified light olive brown, yellowish brown, and dark gray shale and clay.

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

Included with this soil in mapping are small areas of Crockett, Axtell, and Wilson soils. Also included are small areas of a similar soil that is shallower. Included soils make up less than 20 percent of any mapped area.

This Normangee soil is used primarily for pasture and wildlife habitat.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of a complete fertilizer increases grass production.

Potential is medium for openland wildlife habitat because only a small amount of seed and grain crops is available. Potential for wetland wildlife habitat is low because of the lack of wetland plants and shallow water areas. This soil is not suited to woodland wildlife habitat.

Potential for crops is low because of the hazard of erosion. Potential for native vegetation is medium. This soil is not suited to woodland.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, very slow permeability, shrinking and swelling with changes in moisture, and low strength are the main limitations. Potential for development of picnic areas and paths and trails is medium. Potential for camp areas and playgrounds is low. Very slow permeability and the clayey surface layer are the main limiting features.

This soil is in capability subclass IVe.

29—Pickton loamy fine sand, 1 to 8 percent slopes. This gently sloping to sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to 1,000 acres.

This soil has a surface layer of very friable, slightly acid loamy fine sand about 50 inches thick. The surface layer is brown in the upper part and light yellowish brown in the lower part. The next layer is about 26 inches of

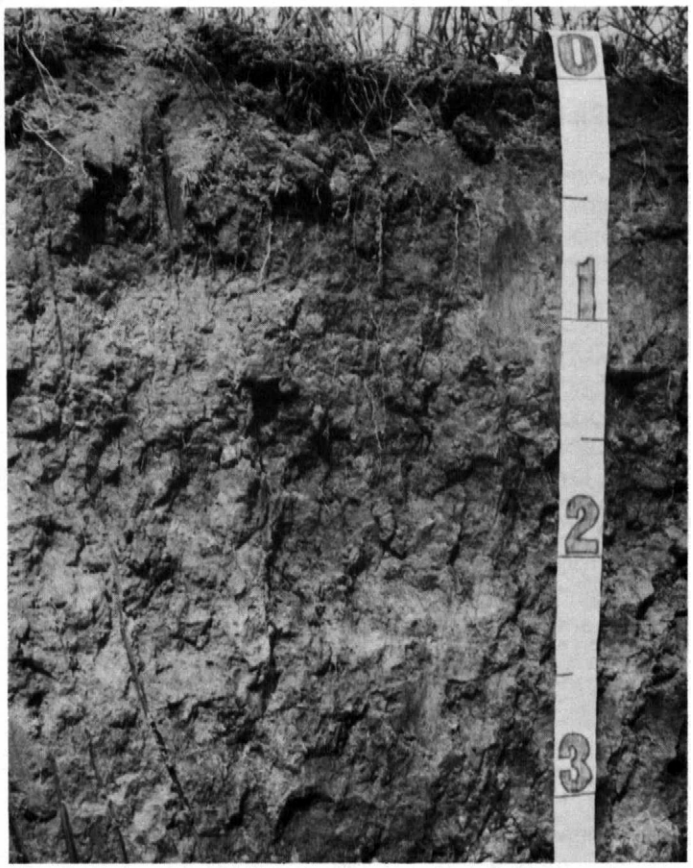


Figure 10.—Profile of Nahatche loam, frequently flooded.

firm, medium acid, strong brown sandy clay loam. From 76 to 80 inches is firm, medium acid, strong brown sandy clay loam that has yellowish red mottles and vertical streaks and pockets of light gray sand.

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 small areas of Wolfpen, Larue, Gallime, and Tonkawa soils. Included soils make up less than 15 percent of any mapped area.

This Pickton soil is used for pasture, hay, cultivated crops, and woodland.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass may be overseeded with vetch or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass production.

This soil has medium potential for crops such as corn, peas, and peanuts (fig. 11). Residue from these crops should be left on or near the surface of the soil to help reduce erosion and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields.

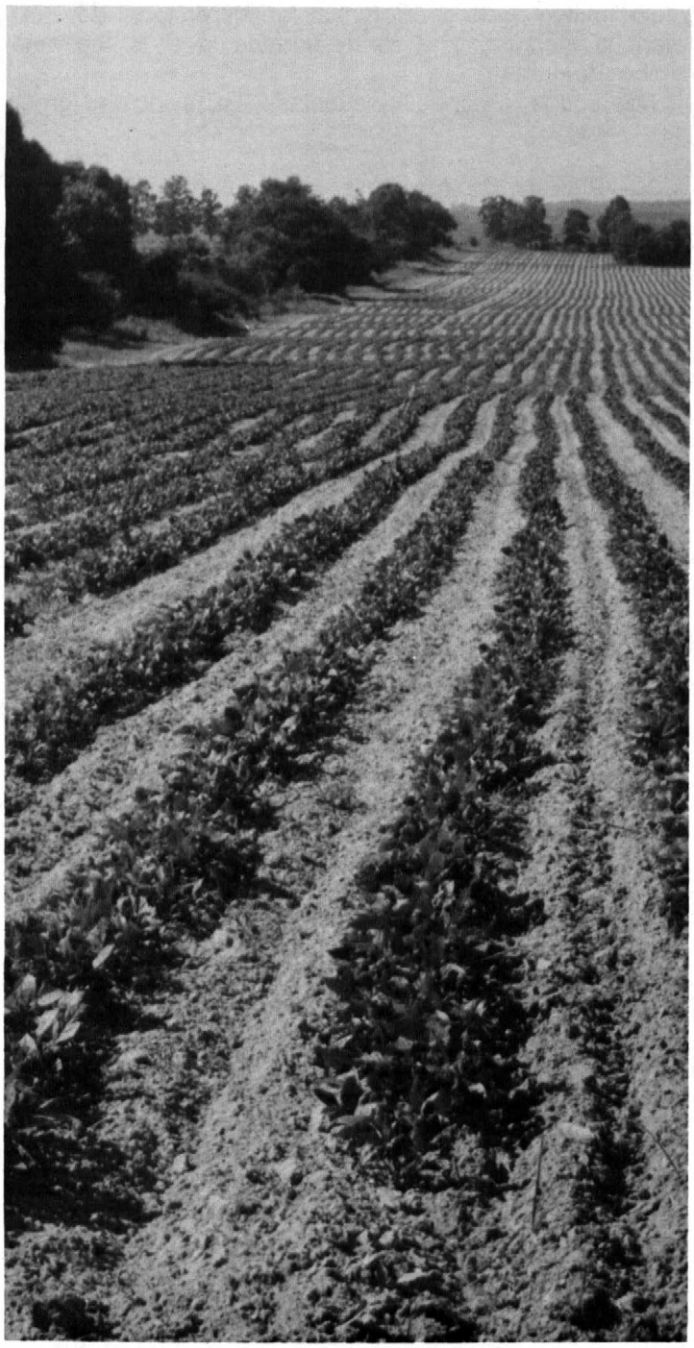


Figure 11.—Peanuts on Pickton loamy fine sand, 1 to 8 percent slopes.

Potential for woodland is medium. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for woodland and openland wildlife habitat is medium. Potential for native vegetation is low.

This soil has medium potential for most urban uses. Slope, seepage, and the sandy surface layer are the main limiting features. Potential for recreational development is medium. The sandy surface layer is the main limiting feature.

This soil is in capability subclass IIIe; woodland group 4s.

30—Pickton loamy fine sand, 8 to 15 percent slopes. This strongly sloping to moderately steep soil is on uplands. Slopes are mainly smooth or convex. Areas are oblong and range from about 10 to several hundred acres.

This soil has a surface layer of very friable, medium acid, brown loamy fine sand about 10 inches thick. The next layer, from 10 to 42 inches, is very friable, medium acid, very pale brown loamy fine sand. From 42 to 60 inches is firm, strongly acid, reddish yellow and light brownish gray sandy clay loam. From 60 to 72 inches is firm, strongly acid, light brownish gray and reddish yellow sandy clay loam.

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

Included with this soil in mapping are small areas of Wolfpen, Larue, and Cuthbert soils. Included soils make up less than 15 percent of any mapped area.

This Pickton soil is used primarily for pasture and woodland.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass may be overseeded with vetch or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

This soil has medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for crops is low. Slope is the main limiting feature.

This soil has medium potential for openland and woodland wildlife habitat. Potential for native vegetation is low.

This soil has low potential for most urban uses. Slope, seepage, and the sandy surface layer are the main limitations. Potential for development of camp areas, picnic areas, and paths and trails is medium. Potential for playgrounds is low. Slope and the sandy surface layer are the main limiting features.

This soil is in capabiltiy subclass IVe; woodland group 4s.

31—Pickton-Urban land complex, 1 to 8 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and follow the boundaries of urban expansion. Areas of this complex range from about 50 to 500 acres.

This complex is 40 to 70 percent Pickton soils, 15 to 50 percent Urban land, and 10 to 15 percent minor soils. The soils and Urban land making up this complex are so intricately mixed that separation was not feasible at the scale used in mapping.

Pickton soils have a surface layer of very friable, slightly acid loamy fine sand about 50 inches thick. The surface layer is brown in the upper part and light yellowish brown in the lower part. The next layer is about 26 inches of firm, medium acid, strong brown sandy clay loam. From 76 to 80 inches is firm, medium acid, strong brown sandy clay loam that has red mottles and vertical streaks and pockets of gray sand.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. They are typically used for single unit dwellings, streets, driveways, sidewalks, schools, and churches.

Included with this complex in mapping are small areas of Wolfpen, Tonkawa, and Larue soils.

This map unit has medium potential for most urban uses. Slope, seepage, and a sandy surface layer are the main limitations. Potential for recreational development is medium. Potential for lawns and gardens is medium.

This complex is not placed in any interpretive group.

32—Pits. There are about 900 acres in the county delineated as pits. They range in size from about 3 acres to 200 acres. Gravel, clay, and sand have been removed from them. Some of them have been smoothed and revegetated.

These pits are located throughout the county. The largest, in the western part of the county on the Trinity River bottoms, are gravel pits. The washed gravel was sold for road and building material. These pits range up to about 200 acres in size and are being enlarged by digging. Their average depth is about 25 feet. These pits are mainly on clayey Trinity and Kaufman soils. The clayey material was removed to expose the gravel below.

Clay pits are located near Athens and Malakoff. The clay removed from these pits was used in manufacturing brick. These pits range up to about 50 acres. Their average depth is about 20 feet. Some of these pits that are abandoned contain water much of the year. Clay pits are mostly on Axtell, Woodtell, and Freestone soils.

The smaller pits in the county are sand pits that were dug for building and fill material. These pits range up to

about 10 acres. Average depth is about 10 feet. Sand pits are mostly on Pickton, Tonkawa, and Eufaula soils.

Pits are not placed in any interpretive grouping.

33—Silawa fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on old terraces. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to several hundred acres.

This soil has a surface layer of very friable, medium acid, dark grayish brown fine sandy loam about 3 inches thick. From 3 to 15 inches is very friable, slightly acid, brown fine sandy loam. From a depth of 15 to 29 inches is firm, medium acid, red sandy clay loam. From a depth of 29 to 37 inches is firm, strongly acid, red sandy clay loam that has brownish yellow mottles. From 37 to 64 inches is friable, medium acid, yellowish red sandy clay loam. From a depth of 64 to 80 inches is friable, medium acid, yellowish red fine sandy loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium.

Included with this soil in mapping are small areas of Axtell, Freestone, Dutek and Styx soils. Also included are small areas of a soil similar to the Silawa soil but has a red clayey subsoil. Included soils make up less than 15 percent of any mapped area.

This Silawa soil is used primarily for pasture and hay production.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with singletary peas, vetch, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass yields.

Potential is medium for crops such as corn or peanuts. Residue from these crops should be left on or near the surface of the soil to help control erosion and to maintain organic-matter content.

Potential for openland wildlife habitat is high. Potential for wetland wildlife habitat is low. This soil is not suited to woodland wildlife habitat.

Potential is medium for native vegetation. This soil is not suited to woodland.

This soil has high potential for most urban uses. Corrosivity to concrete, low strength, and seepage are limitations. Potential for development of camp areas, picnic areas, and paths and trails is high. Potential for playgrounds is only medium because of slope.

This soil is in capability subclass IIIe.

34—Silawa fine sandy loam, 5 to 12 percent slopes. This sloping to strongly sloping soil is on terraces. Slopes are mainly smooth or convex. Areas are oblong and range from about 15 to several hundred acres.

This soil has a surface layer of friable, slightly acid, brown fine sandy loam about 5 inches thick. The next layer is about 3 inches of friable, slightly acid, yellowish brown fine sandy loam. From a depth of 8 to 16 inches is firm, slightly acid, red sandy clay loam. From 16 to 25 inches is firm, strongly acid, yellowish red sandy clay loam. From 25 to 38 inches is friable, strongly acid, yellowish red sandy clay loam. From a depth of 38 to 53 inches is friable, medium acid, strong brown sandy loam. From 53 to 70 inches is very friable, strongly acid, strong brown fine sand.

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

Included with this soil in mapping are small areas of Axtell, Dutek, and Styx soils. Also included are small areas of a soil that is similar to the Silawa soil but has a red clayey subsoil. Included soils make up less than 15 percent of any mapped area.

This Silawa soil is used primarily for pasture.

This soil has low potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with singletary peas, vetch, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

This soil is not suitable for crops.

Potential for openland wildlife habitat is high. Potential for wetland wildlife habitat is low. This soil is not suited to woodland wildlife habitat.

Potential is medium for native vegetation. This soil is not suited to woodland.

This soil has high potential for most urban uses. Corrosivity to concrete, low strength, seepage, and slope are the main limitations. Potential for development of camp areas, picnic areas, and paths and trails is high. Potential for playgrounds is only medium because of slope.

This soil is in capability subclass VIe.

35—Styx loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on terraces. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 15 to several hundred acres.

This soil has a surface layer of very friable, slightly acid, brown loamy fine sand about 3 inches thick. The next layer is about 7 inches of very friable, slightly acid, dark yellowish brown loamy fine sand. The next layer, from 10 to 22 inches, is very friable, slightly acid, yellowish brown loamy fine sand. From 22 to 31 inches is firm, very strongly acid, brownish yellow sandy clay loam. From 31 to 45 inches is firm, very strongly acid, mottled light yellowish brown, light brownish gray, and red sandy clay loam. From 45 to 67 inches is firm, very strongly acid, mottled light brownish gray, red, and light yellowish brown sandy clay loam. From 67 to 80 inches is firm,

very strongly acid, light brownish gray sandy clay loam that has red and light yellowish brown mottles.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium.

Included with this soil in mapping are small areas of Freestone, Silawa, Dutek, Eufaula and Axtell soils. Included soils make up less than 15 percent of any mapped area.

This Styx soil is used primarily for pasture and hay production.

Potential is medium for pastures of Coastal bermudagrass and lovegrass. In the fall the Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass production.

This soil has low potential for crops such as corn and peanuts. The hazard of erosion is the main limiting feature. Residue from crops should be left on or near the surface of the soil to help control erosion and maintain organic-matter content.

Potential for openland wildlife habitat is medium because only a small amount of grain and seed crops and grasses and legumes is available. Potential for wetland wildlife habitat is low. This soil is not suited to woodland wildlife habitat.

This soil has medium potential for native vegetation. This soil is not suited to woodland.

Potential is medium for most urban uses. Wetness, seepage, and corrosivity to concrete are the main limitations. Potential for recreational development is medium. The sandy surface layer is the main limiting feature.

This soil is in capability subclass IIIe.

36—Tonkawa fine sand, 1 to 5 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 15 to several hundred acres.

This soil has a surface layer of very friable, slightly acid, brown fine sand about 7 inches thick (fig. 12). The next layer is about 49 inches of loose, slightly acid, brown fine sand. From 56 to 80 inches is loose, slightly acid, light yellowish 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 moderate.

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

This Tonkawa soil is used mainly for pasture and hay production. A few areas are used for crops such as peas and peanuts.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with vetch. This plant adds nitrogen to the soil and provides grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass

Figure 12.—Profile of Tonkawa fine sand, 1 to 5 percent slopes. This soil formed in thick sandy deposits.

production. Potential for Coastal bermudagrass hay is medium.

This soil has low potential for crops. Low available water capacity is the main limiting factor when it is used for crops. Residues from crops should be left at or near the surface of the soil to help control erosion and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields.

Potential for wildlife habitat and woodland is low. Potential for native grasses is low (fig. 13).

This soil has high potential for most urban uses. Potential for recreational development is low. The sandy nature of the soil is the main limiting factor.

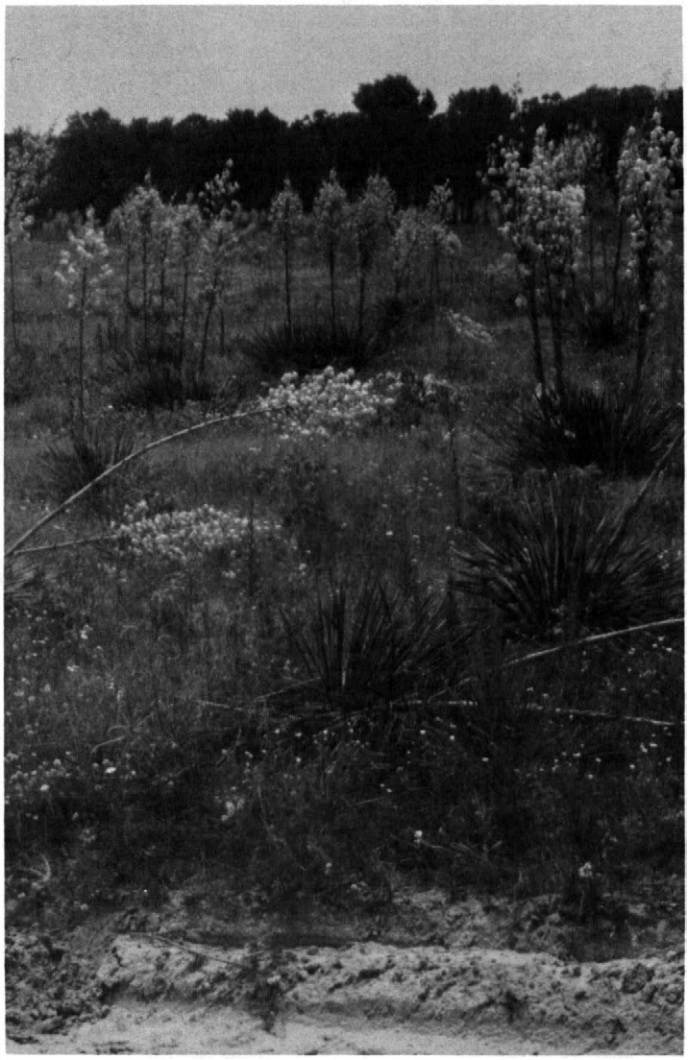


Figure 13.—Yucca plants on an area of Tonkawa fine sand, 1 to 5 percent slopes.

This soil is in capability subclass IVs; woodland group 5s.

37—Tonkawa fine sand, 5 to 12 percent slopes. This sloping to strongly sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are oblong and range from about 20 to several hundred acres.

This soil has a surface layer of very friable, slightly acid, brown fine sand about 7 inches thick. The next layer is about 20 inches of loose, slightly acid, light yellowish brown fine sand that has brown mottles. The next layer, from 27 to 51 inches, is loose, slightly acid, pale brown fine sand that has brown mottles. From 51 to 68 inches is loose, slightly acid, white fine sand that has yellow mottles. From a depth of 68 to 80 inches is loose, slightly acid, very pale brown fine sand that has yellow and yellowish red mottles.

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

Included with this soil in mapping are small areas of Pickton and Wolfpen soils. Also included in some areas is a gray wet sand located along toe slopes. Included soils make up less than 15 percent of any mapped area.

This Tonkawa soil is used primarily for pasture.

This soil has low potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with vetch. This plant adds nitrogen to the soil and provides grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

Potential is low for crops. Slope and low available water capacity are the main limiting features.

Potential for wildlife habitat and woodland is low. Potential for native vegetation is low.

This soil has medium potential for most urban uses. Slope, seepage, and the sandy nature of the soil are the most limiting features. Potential for recreational development is low. Slope and the sandy nature of the soil are the most limiting features.

This soil is in capability subclass IVe; woodland group 5s.

38—Tonkawa-Urban land complex, 1 to 5 percent slopes. This gently sloping complex is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and generally follow the boundaries of urban expansion. Areas of this complex range from about 100 to 600 acres.

This complex is 35 to 75 percent Tonkawa soils, 15 to 50 percent Urban land, and 10 to 15 percent other soils. The soils and Urban land making up this complex are so intricately mixed that separation was not feasible at the scale used in mapping.

Tonkawa soils have a surface layer of very friable, slightly acid, brown fine sand about 7 inches thick. The

next layer is about 49 inches of loose, slightly acid, brown fine sand. From 56 to 80 inches is loose, slightly acid, light yellowish brown fine sand.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. They are typically used for single unit dwellings, streets, driveways, sidewalks, schools, and churches.

Included with this complex in mapping are small areas of Pickton and Wolfpen soils.

This map unit has high potential for most urban uses. Potential for recreational development is low. Potential for lawns and gardens is low. Low available water capacity and the sandy nature of the soil are the main limiting features.

This complex is not placed in any interpretive group.

39—Trawick gravelly fine sandy loam, 12 to 20 percent slopes. This moderately steep soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 50 to 500 acres.

This soil has a surface layer of very friable, slightly acid, dark reddish brown gravelly fine sandy loam about 7 inches thick. The next layer is about 20 inches of firm, medium acid, red clay. The next layer, from 27 to 40 inches, is firm, very strongly acid, red clay that has strong brown mottles. From 40 to 72 inches is red, strong brown, and yellowish brown clay and partially weathered glauconite.

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

Included with this soil in mapping are small areas of Cuthbert, Kirvin, and Pickton soils. Also included are small areas of Trawick stony soils and Trawick soils that are about 40 to 50 percent gravel. Also included are small areas that have less than 12 percent slope. Included soils make up less than 20 percent of any mapped areas.

This Trawick soil is used primarily for woodland and wildlife habitat. Some of the less sloping areas are used for pasture.

This soil has medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines, and protecting the woodland from burning, increases timber production.

This soil has high potential for woodland and openland wildlife habitat. Potential for wetland wildlife habitat is low.

This soil has medium potential for pastures of Coastal bermudagrass. In the fall, the Coastal bermudagrass pastures may be overseeded with arrowleaf clover, vetch, or crimson clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

Potential for native vegetation is low. This soil is not suited to crops.

This soil has low potential for most urban uses. Slope, depth to rock, and low strength are the main limiting features. Potential for development of paths and trails is medium. Slope is the main limiting feature. Potential for camp areas, picnic areas, and playgrounds is low because of slope.

This soil is in capability subclass VIe; woodland group 4r.

40—Trinity clay, rarely flooded. This is a nearly level soil on bottom lands. Slopes are smooth or concave and are less than 1 percent. Areas are oblong and range from several hundred to several thousand acres. This soil is protected from flooding by levees.

This soil has a surface layer of very firm, moderately alkaline, very dark gray clay about 4 inches thick. The next layer is about 11 inches of very firm, moderately alkaline, very dark gray clay. The next layer, from 15 to 22 inches, is very firm, moderately alkaline, very dark gray clay that has calcium carbonate concretions. From a depth of 22 to 27 inches is very firm, moderately alkaline, very dark gray clay that has calcium carbonate concretions and olive mottles. From a depth of 27 to 37 inches is very firm, moderately alkaline, very dark gray clay that has brownish mottles. From 37 to 62 inches is very firm, moderately alkaline, black clay that has olive and brownish mottles and calcium carbonate concretions. From 62 to 72 inches is very firm, moderately alkaline, very dark grayish brown and very dark gray clay.

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

Included with this soil in mapping are small areas of Kaufman and Gladewater soils. Also included in some areas are dark clayey soils covered with a loamy overwash. Included soils make up less than 15 percent of any mapped area.

This Trinity soil is used primarily for pasture. Some areas are used for crops, mainly grain sorghum.

This soil has high potential for pastures. In the fall, pastures of Coastal bermudagrass may be overseeded with singletary peas or white clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay is high. Nitrogen and phosphorous fertilizer increases grass production.

This soil has high potential for crops such as grain sorghum and cotton. Residue from these crops should be left on or near the surface of the soil to aid in water infiltration and to maintain organic-matter content. Nitrogen and phosphorous fertilizer increases yields.

This soil has high potential for hardwood timber production. Potential for openland wildlife habitat is medium.

Potential for woodland wildlife habitat is high, and potential for wetland wildlife habitat is low.

Potential for native vegetation is medium.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, wetness, very slow permeability, rare flooding, shrinking and swelling with changes in moisture, and low strength are the main limitations. Potential for recreational development is low. Wetness, very slow permeability, and the clayey surface layer are the main limiting features.

This soil is in capability subclass IIw; woodland group 1w.

41—Trinity clay, frequently flooded. This is a nearly level soil on bottom lands.

Slopes are smooth or concave and are less than 1 percent. Areas are oblong and are a few hundred feet to about one mile wide. Soil areas range from about 100 acres to several thousand acres. This soil generally floods one or two times a year. Flooding usually lasts for about one week to one month. Flooding is most likely to occur during the months of November through May.

This soil has a surface layer of very firm, moderately alkaline, very dark gray clay about 6 inches thick. The next layer is about 11 inches of very firm, moderately alkaline, very dark gray clay that has a few yellowish mottles. From a depth of 17 to 60 inches is very firm, moderately alkaline, very dark gray clay that has light olive brown mottles. From 60 to 80 inches is very firm, moderately alkaline, dark gray clay that has many olive mottles.

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

Included with this soil in mapping are small areas of Kaufman and Gladewater soils. Also included in some areas are dark clayey soils covered with a loamy overwash. Included soils make up less than 15 percent of any mapped area.

This Trinity soil is used primarily for pasture and wildlife habitat.

This soil has high potential for pastures of Coastal bermudagrass. In the fall, the Coastal bermudagrass pastures may be overseeded with singletary peas or white clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Nitrogen and phosphorous fertilizer increases grass production.

Potential is medium for openland and woodland wildlife habitat because only a small amount of grain and seed crops, grasses and legumes, and wild herbaceous plants is available. Potential for wetland wildlife habitat is low. The small amount of wetland plants and lack of shallow water areas limit the potential of this soil for wetland wildlife habitat.

This soil has high potential for hardwood timber.

Potential for native vegetation is medium. This soil is not suited to crops because of flooding.

This soil has low potential for most urban uses. Flooding, wetness, very slow permeability, corrosivity to uncoated steel, and shrinking and swelling with changes in moisture are the main limitations. Potential for recreational development is low. Flooding, wetness, very slow permeability, and the clayey surface layer are the main limiting features.

This soil is in capability subclass Vw; woodland group 1w.

42—Wilson loam, 0 to 1 percent slopes. This nearly level soil is on terraces. Slopes are smooth or concave. Areas are irregular in shape and range from about 5 to 200 acres.

This soil has a surface layer of friable, medium acid, grayish brown loam about 6 inches thick. The next layer is about 34 inches of very firm, medium acid, very dark gray clay. From 40 to 47 inches is very firm, neutral, dark grayish brown clay that has common gypsum crystals. From a depth of 47 to 71 inches is very firm, neutral, light brownish gray clay that has common yellowish brown and brownish yellow mottles and common gypsum crystals.

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

Included with this soil in mapping are small areas of Crockett, Axtell, Derly, and Rader soils. Included soils make up less than 15 percent of any mapped area.

This Wilson soil is used primarily for pasture.

This soil has medium potential for pastures of Coastal bermudagrass. In the fall, the Coastal bermudagrass may be overseeded with white clover or singletary peas. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. Potential for Coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass production.

Potential is medium for crops such as corn and grain sorghum. Residue from these crops should be left on or near the surface of the soil to aid in water infiltration and maintain organic-matter content.

This soil has medium potential for openland and wetland wildlife habitat. This soil is not suited to woodland wildlife habitat.

Potential for native vegetation is medium. This soil is not suited to woodland.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, very slow permeability, wetness, shrinking and swelling with changes in moisture, and low strength are the main limitations. Potential for recreational development is low because of wetness and very slow permeability.

This soil is in capability subclass IIIw.

43—Wolfpen loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 10 to several hundred acres.

This soil has a surface layer of very friable, neutral, loamy fine sand about 28 inches thick. The surface layer is brown in the upper part and pale brown in the lower part. The next layer is about 15 inches of firm, medium acid, yellowish brown sandy clay loam. From 43 to 65 inches is firm, strongly acid, mottled gray, yellowish brown, and red sandy clay loam. From 65 to 80 inches is firm, very strongly acid, gray sandy clay loam that has red and brownish yellow mottles.

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

Included with this soil in mapping are small areas of Pickton, Gallime, Bernaldo, and Larue soils. Also included are small areas of a soil that is similar to the Wolpen soil but has a gray subsoil. Included soils make up less than 15 percent of any mapped area.

This Wolfpen soil is used for pasture; for cultivated crops, such as corn, peas, and peanuts; and for woodland.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with vetch or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when bermudagrass is dormant. Potential for Coastal bermudagrass hay is medium. The addition of lime and a complete fertilizer increases grass production.

This soil has high potential for crops (fig. 14). Residue from crops should be left on or near the surface of the soil to help control erosion and maintain organic-matter content. The addition of lime and a complete fertilizer increases yields.

Potential for woodland is medium (fig. 15). Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

This soil has high potential for woodland wildlife habitat, medium potential for openland wildlife habitat, and low potential for wetland wildlife habitat.

Potential for native vegetation is low.

This soil has medium potential for most urban uses. Wetness, seepage, and the sandy surface layer are the main limiting features. Potential for recreational development is medium. The sandy surface layer is the main limiting feature.

This soil is in capability subclass IIIs; woodland group 3s.

44—Wolfpen loamy fine sand, 5 to 12 percent slopes. This sloping to strongly sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are oblong and range from about 20 to 200 acres.

This soil has a surface layer of very friable, medium acid, dark grayish brown loamy fine sand about 5 inches thick. The next layer, from 5 to 24 inches, is very friable, strongly acid, pale brown loamy fine sand. From a depth

Figure 14.—Blackeyed peas on Wolfpen loamy fine sand, 1 to 5 percent slopes.

of 24 to 35 inches is firm, very strongly acid, strong brown sandy clay loam that has red and brownish yellow mottles. From 35 to 60 inches is firm, very strongly acid, mottled gray, red, and brownish yellow sandy clay loam.

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

Included with this soil in mapping are small areas of Pickton, Larue, and Cuthbert soils. Also included are small areas of a soil that is wetter than Wolfpen soils. Included soils make up less than 15 percent of any mapped area.

This Wolfpen soil is used primarily for pasture and woodland.

Figure 15.—A plantation of loblolly pine on Wolfpen loamy fine sand, 1 to 5 percent slopes.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with vetch or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

This soil has medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for crops is medium. This soil has high potential for woodland wildlife habitat, medium potential for openland wildlife habitat, and low potential for wetland wildlife habitat.

Potential for native vegetation is low.

This soil has medium potential for most urban uses. Slope, wetness, seepage, and the sandy surface layer are the most limiting features. Potential for development of camp areas, picnic areas, and paths and trails is medium. Potential for playgrounds is low. Slope and the sandy surface layer are the main limiting features.

This soil is in capabiltiy subclass IVe; woodland group 3s.

45—Woodtell loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. Slopes are mainly smooth or convex. Areas are irregular in shape and range from about 5 to several hundred acres.

This soil has a surface layer of friable, medium acid, very dark grayish brown loam about 5 inches thick. The next layer is about 3 inches of friable, slightly acid, brown loam. The next layer, from 8 to 20 inches, is firm, very strongly acid, red clay that has brownish yellow mottles. From 20 to 31 inches is firm, very strongly acid, mottled red, brownish yellow, light brownish gray, and pale brown clay loam. From a depth of 31 to 54 inches is firm, very strongly acid, light brownish gray sandy clay loam that has red and and brownish yellow mottles. From 54 to 80 inches is alternating layers of yellowish red, pale brown, and brownish yellow sandy clay loam and sandy loam.

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

Included with this soil in mapping are small areas of Freestone, Cuthbert, and Wolfpen soils. Also included are small areas of eroded Woodtell soils and gravelly Woodtell soils. Included soils make up less than 15 percent of any mapped area.

This Woodtell soil is used primarily for pasture and hay.

Potential is high for pastures or hay of Coastal bermudagrass. In the fall, the Coastal bermudagrass may be overseeded with singletary peas, sweetclover, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

This soil has medium potential for crops. The hazard of erosion is the main limiting feature.

Potential is high for openland and woodland wildlife habitat. Potential is low for wetland wildlife habitat.

This soil has medium potential for woodland. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for native vegetation is low.

This soil has low potential for most urban uses. Corrosivity to concrete, shrinking and swelling with changes in moisture, and low strength are the main limitations. Potential for development of camp areas and playrounds is low because of very slow permeability. Potential for picnic areas is medium because of wetness. Potential for paths and trails is high.

This soil is in capability subclass IIIe; woodland group 4c.

46—Woodtell loam, 5 to 15 percent slopes. This sloping to moderately steep soil is on uplands. Slopes are mainly smooth or convex. Areas are oblong and range from about 20 to several hundred acres.

This soil has a surface layer of friable, slightly acid, very dark grayish brown loam about 4 inches thick. The next layer is about 6 inches of very firm, very strongly acid, red clay that has common brown mottles. From 10 to 31 inches is very firm, very strongly acid, red clay that has many strong brown mottles. From a depth of 31 to 42 inches is very firm, very strongly acid, mottled red, yellowish red, and gray clay. From 42 to 71 inches is stratified olive gray and strong brown loamy and clayey material.

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

Included with this soil in mapping are small areas of Cuthbert and Wolfpen soils. Also included are small areas of Woodtell gravelly soils and eroded Woodtell soils. Included soils make up less than 15 percent of any mapped area.

This Woodtell soil is used primarily for pasture and wildlife habitat.

This soil has medium potential for pastures of Coastal bermudagrass and lovegrass. In the fall, the Coastal bermudagrass pastures may be overseeded with singletary peas, sweetclover, or arrowleaf clover. These plants add nitrogen to the soil and provide grazing early in spring when the bermudagrass is dormant. The addition of lime and a complete fertilizer increases grass production.

This soil has high potential for openland and woodland wildlife habitat. Potential for wetland wildlife habitat is low.

This soil is not suited to crops.

Potential for woodland is medium. Proper woodland management, such as selective cutting; removal of undesirable trees, shrubs, and vines; and protecting the woodland from burning, increases timber production.

Potential for native vegetation is low.

This soil has low potential for most urban uses. Corrosivity to concrete, slope, shrinking and swelling with changes in moisture, and low strength are the main limitations. Potential for development of camp areas and playgrounds is low because of very slow permeability and slope. Potential for picnic areas is medium because of wetness and slope. Potential for paths and trails is high.

This soil is in capability subclass VIe; woodland group 4c.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

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

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 350,000 acres in the survey area was used for crops and pasture in 1967 (*3*). Of this total, about 310,000 acres was used for permanent pasture. About 70,000 acres is used for both hay production and grazing; 17,000 for row crops, mainly peanuts, peas and corn; and 3,000 acres for close-growing crops such as wheat and oats.

The soils in Henderson County have good potential for increased production of food. Many acres of potentially good cropland is currently used as woodland or pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

Soil erosion is the major concern on most of the cropland and pasture in Henderson County. If slope is more than 1 percent, erosion is a hazard. Axtell, Elrose, Wolfpen, Woodtell, and Dutek soils, for example, have slopes of 1 to 5 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the

surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Axtell, Woodtell, and Crockett soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water available for municipal use, for recreation, and for fish and wildlife.

Erosion control provides protective surface cover, reduces runoff, and increases infiltration of the soil. A cropping system that keeps a vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the production capacity of the soil. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and, when they are returned to the soil, provide nitrogen and improve tilth for the following crop. Information on erosion control practices for each kind of soil is available in local offices of the Soil Conservation Service.

Soil fertility is naturally low in most soils in the survey area. Most are naturally acid. The soils on flood plains, such as Trinity and Kaufman soils, have a higher pH (are less acid) and are naturally higher in plant nutrients than most other soils.

Many soils on uplands are strongly acid in their natural state. If they have never been limed, applications of ground limestone are required for good crop and pasture growth. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Soil Conservation Service or the Texas Agricultural Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

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

Most of the soils used for crops in the survey area have a surface layer that is sandy or loamy and light in color and low in content of organic matter. Generally the structure of such soils is weak. Regular addition of crop residue, manure, and other organic material can help raise the level of organic matter and improve soil structure.

Fall plowing is generally not a good practice on the light colored soils because many of them are sloping and are subject to damaging erosion if they are plowed in the fall.

Tilth is also a concern on the dark Burleson, Deport, Trinity, and Kaufman soils because they are clayey and often stay wet until late in spring. If they are wet when plowed, they tend to be very cloddy when dry, and good seedbeds are difficult to prepare. Fall plowing on such soils generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown but could be grown if economic conditions were favorable. Latest information and suggestions for growing special crops can be obtained from the local offices of the Texas Agricultural Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops and pasture under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

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

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

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides erosion control and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Texas Agricltural Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when

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

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

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

Class I soils have few limitations that restrict their use. (None in county)

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

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

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

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

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

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

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production. (None in county)

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

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

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

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Native grazing land management and productivity

About 15,000 acres in Henderson County is rangeland which supports a native plant community of predominantly native grasses. The areas are scattered throughout the western part of the county and are generally small in size. Improved pastures are now established in most areas that once produced a native grass plant community. The farm income derived from grazing native vegetation is very small when compared to that from other farm operations.

The native vegetation of this survey area has been greatly depleted by continued excessive use. Much of the acreage remaining is now covered with brush and weeds. The amount of forage produced may be less than half of that originally produced. Productivity can be increased by using management that is effective for specific kinds of soils.

Where climate and topography are about the same, differences in the kind and amount of vegetation that can be produced are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 7 shows, for each kind of soil, the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 7.

Total production refers to the amount of vegetation that can be expected to grow annually in well managed areas that are supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation produced in favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are

well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the vegetation in relation to its potential. Condition is determined by comparing the present plant community with the potential natural plant community on a particular soil. The more closely the existing community resembles the potential community, the better the condition. The objective in management is to control grazing so that the plants growing on a soil are about the same in kind and amount as the potential natural plant community for that soil. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on native grazing land is control of grazing so the kinds and amounts of plants that make up the potential plant community are re-established. Controlling brush and weeds are also important management concerns. If sound management based on the soil survey information and native grazing land inventories is applied, the potential is good for increasing the productivity of an area.

Woodland management and productivity

About 34 percent of Henderson County is woodland. There are two main forest cover types in the survey area.

The largest type is in the western two-thirds of the county and consists of mainly hardwood trees. Scattered throughout this area are fields that once were cultivated but now have been planted to loblolly or slash pine. Post oak, hickory, sweetgum, blackjack oak, and red oak are the main species on the uplands. The wetter Trinity, Kaufman, and Gladewater soils on bottom lands along the Trinity River and Cedar Creek produce species such as water oak, green ash, and cottonwood.

The second forest type is in the eastern third of the survey area and is a mixed pine and hardwood forest. Shortleaf pine is the main species of the area. Common hardwood trees are post oak, sweetgum, red oak, and hickory. Plantations of loblolly or slash pine are on some once cultivated fields. Both of these forest types support numerous understory shrubs and grasses.

Woodland products account for about 6 percent of the agricultural income in Henderson County. Some of these woodland products are pulpwood, railroad ties, and firewood. The production of firewood is becoming increasingly important because of demand from large urban centers near the survey area.

Potential for commercial timber production varies greatly for soils within the survey area. Potential for woodland of each soil is discussed in the section 'Soil maps for detailed planning."

Table 8 contains information useful to woodland owners or forest managers. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each such soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 8 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

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

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

tion, a need for special equipment or management, or a hazard in the use of equipment.

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

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

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

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

Engineering

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

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

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

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

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

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

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

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

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

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

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

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

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

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

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

soil slippage are hazards if absorption fields are installed on sloping soils.

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

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

Sewage lagoon areas are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

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

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

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

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

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as

moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

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

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

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

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

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

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

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

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

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

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 12 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

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

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

vegetation; and resistance to water erosion, soil slipping, and piping.

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

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

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

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

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

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

Wildlife habitat

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

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

In table 14, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that

restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

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

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

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

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

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

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.

Woodland wildlife consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants.

Wetland wildlife consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow.

Soil properties

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

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

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

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

Engineering properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 in the standard terms used by the U.S. Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

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

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 18. The estimated classification, without group index numbers, is given in table 15. Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

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

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

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

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

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

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil

features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

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

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

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

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss 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 of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

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

The four hydrologic groups are:

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

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

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

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

Flooding is the temporary covering of soil with water from overflowing streams or with runoff from adjacent slopes. Water standing for short periods after rains is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

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

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

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

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

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

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 18.

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for moist soil.

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

Axtell series

The Axtell series consists of deep, loamy soil on old terraces. These soils formed in acid to alkaline clayey sediments. Native vegetation consists of hardwood trees and tall and mid grasses. Slope ranges from 1 to 12 percent.

Typical pedon of Axtell loam, 1 to 5 percent slopes; from the intersection of Texas Highway 31 and Farm Road 90 in Malakoff, 7.2 miles north on Farm Road 90, 0.35 mile south on county road, and 250 feet west in pasture:

A1—0 to 3 inches; brown (10YR 4/3) loam; weak fine granular structure; hard, friable; many fine and medium roots; few chert pebbles up to 2 inches across; medium acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) loam; massive; hard, friable; many fine to coarse roots; few chert

pebbles up to 2 inches across; medium acid; abrupt wavy boundary.

B21t—6 to 13 inches; red (2.5YR 4/6) clay loam; common fine distinct strong brown mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm; common fine roots; continuous clay films on surface of peds; few chert pebbles up to 2 inches across; very strongly acid; clear wavy boundary.

B22t—13 to 28 inches; mottled pale brown (10YR 6/3), brown (10YR 5/3), red (2.5YR 4/8), and strong brown (7.5YR 5/8) clay; moderate coarse prismatic structure parting to fine and medium angular blocky; extremely hard, very firm; common very fine roots; continuous clay films on surface of peds; few chert pebbles up to 2 inches across; very strongly acid; gradual wavy boundary.

B3—28 to 48 inches; light brownish gray (10YR 6/2) clay; many fine and medium distinct dark yellowish brown (10YR 4/4) and brownish yellow (10YR 6/8) mottles; moderate coarse prismatic structure parting to coarse subangular blocky; extremely hard, very firm; common fine roots; patchy clay films on surface of peds; common soft black masses; few fine gypsum crystals; few chert pebbles; slightly acid; gradual wavy boundary.

C—48 to 80 inches; stratified gray (5Y 6/1) shale and light gray (10YR 7/2) and yellowish brown (10YR 5/8) soft sandstone; strata are 1/4 inch to 7 inches; extremely hard, very firm; common soft black masses; common gypsum crystals up to 3/4 inch across; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. Few to common chert pebbles are in some pedons.

The A horizon ranges from 5 to 14 inches in thickness. It is brown, dark grayish brown, grayish brown, or pale brown. Reaction ranges from strongly acid through slightly acid.

The B21t horizon is red or reddish brown. In most pedons it has few to many mottles in shades of yellow, brown, and gray. Texture is clay loam or clay. Reaction is very strongly acid or strongly acid. The B22t and B3 horizons are mottled in colors similar to the B21t horizon or have matrix colors of grayish brown, light grayish brown, light olive gray, olive brown, or light olive brown. Reaction is slightly acid or neutral.

The C horizon is clay loam or stratified shale and soft sandstone. It has calcium carbonate concretions and gypsum crystals in some pedons. Reaction ranges from slightly acid through moderately alkaline.

Bernaldo series

The Bernaldo series consists of deep, loamy soils on terraces and uplands. These soils formed in loamy, acid, unconsolidated sediments under forest vegetation. Slope ranges from 1 to 4 percent.

Typical pedon of Bernaldo fine sandy loam, 1 to 4 percent slopes; from the intersection of Texas Highway 31 and Texas Highway 19 in Athens, 5.6 miles north on Texas Highway 19, 3.8 miles northeast on county road, 0.6 mile east on winding county road, and 650 feet east in pasture:

Ap—0 to 8 inches; brown (10YR 5/3) fine sandy loam; weak fine granular structure; soft, very friable; many fine and medium roots; common worm casts; slightly acid; clear smooth boundary.

A2—8 to 16 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; slightly hard, very friable; many fine and medium roots; common worm casts; medium acid; clear wavy boundary.

B21t—16 to 45 inches; yellowish brown (10YR 5/8) sandy clay loam; common fine distinct strong brown mottles; moderate medium subangular blocky structure; hard, friable; common very fine roots; patchy clay films on surface of peds; few worm casts; few fine and medium ironstone pebbles; strongly acid; gradual wavy boundary.

B22t&A'2—45 to 57 inches; brownish yellow (10YR 6/8) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; hard, friable; common fine roots; about 20 percent light gray vertical streaks and pockets of uncoated sand; very strongly acid; clear wavy boundary.

B23t&A'2—57 to 80 inches; mottled yellowish brown (10YR 5/8), red (2.5YR 4/8), and light brownish gray (10YR 6/2) sandy clay loam; weak medium and coarse subangular blocky structure; hard, friable; patchy clay films on surface of peds; about 10 percent light gray vertical streaks of uncoated sand; very strongly acid.

Thickness of the solum is more than 60 inches.

The A horizon ranges from 6 to 17 inches in thickness. It is brown, pale brown, dark grayish brown, dark yellowish brown, or yellowish brown. The A2 horizon can be one to two units higher in value and one to two units higher in chroma. Reaction ranges from strongly acid through slightly acid.

The B2t horizon is yellowish brown, light yellowish brown, brownish yellow, or strong brown. Mottles in colors and shades of brown, red, and gray are in most pedons. Colors that have chromas of 2 or less are below a depth of 30 inches. The B2t&A'2 horizon has the same colors as the B2t horizon and has 5 to 20 percent vertical streaks and pockets of uncoated sand. The horizon is sandy clay loam or loam. Reaction ranges from very strongly acid through slightly acid.

Burleson series

The Burleson series consists of deep, clayey soils on uplands. These soils formed in alkaline clayey sediments. Native vegetation consists mainly of tall and mid grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Texas Highway 274 and Farm Road 85 in Seven points, 7.1 miles west on Farm Road 85, 0.7 mile north on Farm Road 2613, 0.7 mile west on county road, 0.5 mile north on county road, and 2,000 feet east in pasture on a microknoll:

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay; moderate coarse subangular blocky structure parting to fine subangular blocky; extremely hard, very firm, sticky and plastic; common fine roots; common pressure faces on surface of peds; medium acid; clear smooth boundary.

A1—5 to 30 inches; black (10YR 2/1) clay; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common intersecting slickensides in lower part; many pressure faces on surface of peds; medium acid; diffuse wavy boundary.

AC—30 to 51 inches; gray (10YR 5/1) clay; many black (10YR 2/1) vertical streaks along cracks; few fine faint mottles in shades of brown; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common intersecting slickensides; common pressure faces on surface of peds; few soft black masses; slightly acid; gradual wavy boundary.

C1—51 to 76 inches; light brownish gray (2.5Y 6/2) clay; common fine distinct light olive brown mottles; massive; extremely hard, very firm; common intersecting slickensides; moderately alkaline; diffuse wavy boundary.

C2—76 to 80 inches; distinctly and coarsely mottled gray (10YR 6/1) and strong brown (7.5YR 5/6) clay; massive; extremely hard, very firm; few intersecting slickensides; common soft black masses; common calcium carbonate concretions; calcareous in spots; moderately alkaline.

Thickness of the solum ranges from 50 to 76 inches. It is clayey throughout. Intersecting slickensides begin at a depth of about 20 inches. When the soil is dry, cracks 0.5 inch to 2.0 inches wide extend to a depth of 20 inches or more. Cycles of microknolls and microdepressions are repeated each 7 to 15 feet. Color values of less than 3.5 extend to a depth of about 24 to 30 inches on microknolls and to 40 to 50 inches in microdepressions.

The A horizon is very dark gray or black. Reaction ranges from medium acid through neutral.

The AC horizon is dark gray or gray and has vertical streaks of very dark gray or black clay from the horizon above. Most pedons have few to common brownish or olive brown mottles. Reaction is slightly acid or neutral.

The C horizon is gray, light grayish brown, or strong brown or is mottled in these colors. Calcium carbonate concretions range from none to common below a depth of about 50 inches. Reaction is moderately alkaline, and the soil is calcareous in some pedons.

The Burleson soils in this survey area have an AC horizon that is slightly acid or netural, rather than mildly alkaline as is characteristic of Burleson soils elsewhere. They are considered taxadjuncts in this respect. This difference, however, does not affect their use and behavior.

Crockett series

The Crockett series consists of deep, loamy soils on uplands. These soils formed in alkaline clays or shale interbedded with loamy material. Native vegetation consists mainly of tall and mid grasses. Slope ranges from 1 to 3 percent.

Typical pedon of Crockett loam, 1 to 3 percent slopes; from the intersection of Farm Road 85 and Farm Road 90 in Gun Barrel City, 2.6 miles south on Farm Road 90, 1.1 miles east on county road, and 100 feet south in field:

Ap—0 to 4 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; hard, friable; common fine roots; medium acid; clear smooth boundary.

A1—4 to 9 inches; brown (10YR 4/3) loam; massive; hard, friable; common fine roots; medium acid; abrupt wavy boundary.

B21t—9 to 14 inches; distinctly and coarsely mottled dark reddish brown (5YR 3/4), olive brown (2.5Y 4/4), and dark grayish brown (2.5Y 4/2) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; few vertical streaks of brown loam along old cracks; slightly acid; gradual wavy boundary.

B22t—14 to 33 inches; olive brown (2.5Y 4/4) clay; common fine distinct dark grayish brown and few fine faint brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common slickensides; few vertical streaks of brown loam along old cracks; moderately alkaline; gradual wavy boundary.

B3—33 to 43 inches; light olive brown (2.5Y 5/4) clay; few fine faint brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; few slickensides; moderately alkaline; gradual wavy boundary.

C—43 to 80 inches; yellow (10YR 7/8), gray (10YR 6/1), light gray (10YR 7/1), and dark grayish brown (10YR

4/2) stratified layers of shale and loamy soil material; extremely hard, very firm; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. Calcium carbonate concretions and gypsum crystals are in the lower part of some pedons.

The A horizon ranges from 4 to 9 inches in thickness. It is very dark grayish brown, dark brown, brown, or dark grayish brown. Reaction is medium acid or slightly acid.

The dominant horizon color, degree, and distinctness of mottling in the upper B2t horizon is variable within distances of a few feet, ranging from prominently mottled in shades of brown, yellow, red, and olive to a matrix of reddish brown with few to common mottles of olive, yellow, and brown. Texture is clay. Reaction is slightly acid or neutral. The lower B2t and B3 horizons have matric colors in shades of olive, brown, and red. Reaction ranges from neutral through moderately alkaline.

The C horizon is clay, silty clay loam, or stratified shale and loamy soil material in shades of gray, yellow, and brown.

Cuthbert series

The Cuthbert series consists of moderately deep, loamy soils on uplands. These soils formed in acid stratified loamy and clayey sediments. Native vegetation consists mainly of pine and hardwood trees. Slope ranges from 8 to 30 percent.

Typical pedon of Cuthbert fine sandy loam, 8 to 20 percent slopes; from the intersection of Farm Road 314 and Texas Highway 31 in Brownsboro, 3.0 miles west on Texas Highway 31 and 200 feet south in pasture:

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; soft, very friable; many fine roots; few pebbles up to 1 inch across; medium acid; clear wavy boundary.

A2—3 to 8 inches; brown (10YR 5/3) fine sandy loam; massive; soft, very friable; many fine roots; few pebbles up to 1 inch across; medium acid; clear wavy boundary.

B2t—8 to 16 inches; red (2.5YR 4/6) clay; common fine distinct yellowish red mottles; moderate fine and medium blocky structure; extremely hard, very firm; common fine and medium roots; continuous clay films on ped surfaces; very strongly acid; gradual smooth boundary.

B3&C—16 to 30 inches; yellowish red (5YR 5/8) clay, mottled with red (2.5YR 4/6), and light brownish gray (10YR 6/2) partially weathered shale; few strata of strong brown (7.5YR 5/8) soft sandstone; weak coarse blocky structure; very hard, very firm; patchy clay films on surface of peds; very strongly acid; gradual wavy boundary.

C—30 to 65 inches; stratified layers of strong brown (7.5YR 5/8) soft sandstone, light gray (10YR 7/1) partially weathered shale, and red (2.5YR 4/6) clay; few fine mica flakes; strata are from 1/8 inch to 3 inches thick; extremely acid.

Thickness of the solum ranges from 20 to 40 inches.

The A horizon ranges from 4 to 13 inches in thickness. It is brown, grayish brown, dark grayish brown, or very dark grayish brown except for the A2 horizon, which is one or two units of value higher in color. Coarse fragments of ironstone make up 0 to 60 percent of the volume. Reaction ranges from strongly acid through slightly acid.

In most pedons the B2t horizon has few to common mottles in shades of brown, yellow, or gray. Gray colors are due to partially weathered shale fragments. In some pedons the B2t horizon is 1 to 10 percent ironstone pebbles. Reaction is very strongly acid or strongly acid.

The B3&C horizon is mottled in shades of red, brown, yellow, and gray. It is clay, sandy clay, or sandy clay loam. Reaction ranges from extremely acid through strongly acid.

The C horizon is sandy clay loam, sandy loam, or stratified shale and soft sandstone. Reaction ranges from extremely acid through strongly acid.

Deport series

The Deport series consists of deep, clayey soils on old terraces. These soils formed in alkaline clayey sediments. Native vegetation consists of mid and tall grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Deport clay, 0 to 1 percent slopes; from the intersection of Texas Highway 31 and Texas Highway 274 in Trinidad, 2.8 miles north on Texas Highway 274, 0.5 mile east on county road, and 0.3 mile south in pasture on a microknoll.

Ap—0 to 6 inches; dark gray (10YR 4/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; common fine faint brownish stains; few fine soft black masses; slightly acid; clear wavy boundary.

AC1g—6 to 27 inches; gray (10YR 5/1) clay; many fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse angular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; many pressure faces; common intersecting slickensides; few fine soft black masses; medium acid; gradual wavy boundary.

AC2g—27 to 52 inches; dark gray (5Y 4/1) clay; common fine faint pale olive and brown mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; many intersecting slickensides; few fine soft black masses; neutral; clear wavy boundary.

C—52 to 70 inches; grayish brown (2.5Y 5/2) clay; few fine distinct yellowish brown mottles; massive; extremely hard, very firm; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. Intersecting slickensides begin about 15 to 20 inches below the soil surface. Cycles of microknolls and microdepressions are repeated each 10 to 20 feet. Microknolls are 2 to 5 inches higher than microdepressions. Most pedons contain few to common soft black masses, and some pedons contain calcium carbonate concretions in the lower part.

The A horizon is very dark gray or dark gray. When value is less than 3.5, the depth is less than 12 inches. Reaction ranges from slightly acid through mildly alkaline.

The ACg horizon is dark gray, gray, olive gray, or grayish brown. It is mottled in shades of brown, yellow, or olive in most pedons. Reaction ranges from slightly acid through moderately alkaline.

The C horizon is grayish brown, light brownish gray, pale olive, light olive brown, or strong brown.

Derly series

The Derly series consists of deep, loamy soils on old terraces. These soils formed in clayey sediments. Native vegetation consists of hardwood trees and mid and short grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Derly loam, in an area of Derly-Rader complex; from the intersection of Farm Road 85 and Farm Road 90 in Gun Barrel City, 3.4 miles south on Farm Road 90, 0.5 mile south on county road, and 50 feet west in woods:

A1—0 to 7 inches; grayish brown (10YR 5/2) loam; common fine distinct brown mottles; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; few fine soft black masses; slightly acid; clear wavy boundary.

A2g—7 to 11 inches; light brownish gray (10YR 6/2) loam; common fine and medium distinct yellowish brown (10YR 5/6) and few medium distinct brown (10YR 4/3) mottles; weak coarse subangular blocky structure; slightly hard, friable; common fine and medium roots; common fine pores; few fine soft black masses; medium acid; clear wavy boundary.

Bg&Ag—11 to 21 inches; dark grayish brown (10YR 4/2) clay; common fine distinct brown mottles within the Bg material; moderate medium subangular blocky structure; about 20 percent tongues and pockets of light brownish gray (10YR 6/2) loam that are 1/4 to 1 inch wide and 1 to 6 inches long; extremely hard, very firm; common fine and medium roots; strongly acid; gradual wavy boundary.

B21tg—21 to 29 inches; grayish brown (10YR 5/2) clay; many fine and medium distinct yellowish brown (10YR 5/6) and few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common sand and silt coatings along cracks; strongly acid; gradual wavy boundary.

B22tg—29 to 43 inches; dark grayish brown (10YR 4/2) clay; common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common light gray sand coatings on surface of peds; medium acid; gradual wavy boundary.

B23tg—43 to 65 inches; gray (10YR 5/1) and grayish brown (10YR 5/2) clay; common fine and medium prominent red (2.5YR 4/8) and common fine and medium distinct yellow (10YR 7/8) and brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common light gray sand coatings on surface of peds; neutral.

Thickness of the solum is more than 60 inches.

The A1 or Ap horizon is very dark grayish brown, dark grayish brown, or grayish brown. In most pedons it has few to common brownish or yellowish mottles. Reaction is medium acid or slightly acid.

The A2g horizon is grayish brown or light brownish gray. In most pedons it has few common brownish or yellowish mottles. Texture is loam or fine sandy loam. Reaction is strongly acid or medium acid.

The Bg&Ag horizon is dark grayish brown, grayish brown, or light brownish gray. In most pedons it has few to common brownish or yellowish mottles. Texture is clay or clay loam. Tongues and pockets of A2g material make up 15 to 30 percent of this horizon. Reaction ranges from very strongly acid through medium acid.

The B2tg horizon is dark grayish brown, grayish brown, light brownish gray, or gray. In most pedons it has few to many yellowish brown, brownish yellow, strong brown, yellow, or red mottles. Reaction ranges from very strongly acid through medium acid in the upper part and from medium acid through neutral in the lower part.

Dutek series

The Dutek series consists of deep, sandy soils on high stream terraces. These soils formed in loamy or sandy sediments. Native vegetation consists of hardwood trees and mid and tall grasses. Slope ranges from 1 to 12 percent.

Typical pedon of Dutek loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 274 and Farm Road 1667 in Trinidad, 1.5 miles south on Farm Road 1667, 0.8 mile west on oil-top road, and 700 feet north in pasture:

Ap—0 to 5 inches; brown (7.5YR 4/4) loamy fine sand; weak fine subangular blocky structure parting to fine

granular; soft, very friable; many fine roots; slightly acid; clear smooth boundary.

A1—5 to 11 inches; brown (7.5YR 4/4) loamy fine sand; weak fine and medium subangular blocky structure; loose, very friable; common fine roots; neutral; gradual wavy boundary.

A2—11 to 34 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose, very friable; few fine roots; slightly acid; clear wavy boundary.

B2t—34 to 55 inches; yellowish red (5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; hard, firm; few fine roots; patchy clay films; slightly acid; diffuse wavy boundary.

B3—55 to 67 inches; yellowish red (5YR 5/8) sandy clay loam; few fine faint reddish mottles; weak coarse subangular blocky structure; hard, friable; patchy clay films; strongly acid; diffuse wavy boundary.

C—67 to 80 inches; strong brown (7.5YR 5/6) fine sandy loam; massive; slightly hard, friable; neutral.

Thickness of the solum is more than 60 inches.

The A horizon ranges from 20 to 40 inches thick. It is dark brown, brown, dark yellowish brown, or strong brown. When value is less than 3.5, thickness is less than 10 inches. Reaction is slightly acid or neutral.

The B2t and B3 horizons are yellowish red, red, or strong brown. Reaction ranges from strongly acid through slightly acid.

The C horizon is yellowish red or strong brown. Reaction is strongly acid or medium acid.

Elrose series

The Elrose series consists of deep, loamy soils on uplands. These soils formed in marine sediments that contain glauconite. Native vegetation consists mainly of pine and hardwood trees. Slope ranges from 1 to 5 percent.

Typical pedon of Elrose fine sandy loam, 1 to 5 percent slopes; from the intersection of the Anderson-Henderson County line and Texas Highway 155, 0.6 mile north on Texas Highway 155, 0.5 mile west on county road, and 0.65 mile north on private road in pasture:

Ap—0 to 9 inches; reddish brown (5YR 4/4) fine sandy loam; weak fine and medium granular structure; slightly hard, very friable; common fine roots; medium acid; clear wavy boundary.

B21t—9 to 21 inches; red (10R 4/6) sandy clay loam; moderate medium subangular blocky structure; very hard, firm; few fine roots; patchy clay films on surface of peds; few fine ironstone pebbles; medium acid; clear wavy boundary.

B22t—21 to 37 inches; red (2.5YR 4/6) sandy clay loam; weak medium and coarse subangular blocky structure; very hard, firm; few fine roots; patchy clay films on surface of peds; few fine ironstone pebbles; medium acid; gradual wavy boundary.

B23t—37 to 69 inches; dark red (2.5YR 3/6) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; few fine roots; patchy clay films on surface of peds; common fine ironstone pebbles; strongly acid; gradual wavy boundary.

B3—69 to 80 inches; red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; patchy clay films on surface of peds; few fine ironstone pebbles; strongly acid.

Thickness of the solum is more than 60 inches. Ironstone pebbles range from 0 to 10 percent by volume throughout the soil.

The A horizon is reddish brown, yellowish red, or brown. Reaction is medium acid or slightly acid.

The B2t horizon is dark red, red, or yellowish red. Texture is sandy clay loam or clay loam. Reaction ranges from very strongly acid through slightly acid. The B3 horizon is red. Some pedons have few to common yellowish red, strong brown, brownish yellow, or yellow mottles. Reaction ranges from very strongly acid through slightly acid.

The C horizon, when present, is red massive sandy clay loam that has streaks of fine sandy loam or stratified layers of sandy and loamy material. Reaction is strongly acid or medium acid.

Eufaula series

The Eufaula series consists of deep, sandy soils on terraces. These soils formed in sandy sediments. Native vegetation consists of mid and tall grasses. Slopes range from 1 to 8 percent.

Typical pedon of Eufaula fine sand, 1 to 8 percent slopes; from the common intersection of Farm Road 90, Farm Road 59 and county road in Cross Roads, 2.4 miles southwest on county road, 1,000 feet east along fence line, and 25 feet south of fence in old field:

Ap—0 to 6 inches; brown (10YR 4/3) fine sand; weak medium subangular blocky structure; loose, very friable; many fine roots; medium acid; clear smooth boundary.

A1—6 to 12 inches; brown (10YR 4/3) fine sand; weak medium and coarse subangular blocky structure; loose, very friable; common fine roots; medium acid; clear wavy boundary.

A21—12 to 44 inches; light brown (7.5YR 6/4) fine sand; common fine and medium faint strong brown (7.5YR 5/8) mottles; single grained; loose, very friable; common fine roots; medium acid; diffuse wavy boundary.

A22&B21t—44 to 71 inches; light brown (7.5YR 6/4) fine sand (A22); single grained; loose, very friable; with lamellae and pockets of yellowish red (5YR 4/6)

sandy loam (B21t); lamellae are massive; slightly hard, very friable; wavy and discontinuous 1/8 to 1/2 inch thick; pockets up to 1 inch across; slightly acid; gradual wavy boundary.

A22&B22t—71 to 80 inches; reddish yellow (7.5YR 7/8) fine sand (A22); single grained; loose, very friable; lamellae and pockets of yellowish red (5YR 4/6) sandy loam (B22t); lamellae are massive; slightly hard, very friable; wavy and discontinuous up to 1/2 inch thick; pockets up to 1 inch across; slightly acid.

Thickness of the solum is more than 72 inches.

The Ap or A1 horizon is brown, dark brown, dark grayish brown, or dark yellowish brown. The A2 horizon is brownish yellow, light yellowish brown, light brown, or reddish yellow. Reaction ranges from medium acid through neutral.

The Bt horizon is strong brown or yellowish red. In some pedons a few streaks and pockets of uncoated sand are in the lower part. In some pedons the Bt horizon has wavy discontinuous lamellae or it is continuous. Texture is loamy fine sand or sandy loam. Reaction ranges from strongly acid through slightly acid.

Ferris series

The Ferris series consists of deep, clayey soils on old terraces. These soils formed in calcareous clayey sediments, that are outcrops of older clays and marls. Native vegetation consists mainly of mid and tall grasses. Slope ranges from 4 to 8 percent.

Typical pedon of Ferris clay, 4 to 8 percent slopes; from the intersection of Texas Highway 274 and Farm Road 85 in Seven Points, 2.1 miles west on Farm Road 85, 1.5 miles south on county road, 0.45 mile west on county road, and 100 feet north in pasture:

A11—0 to 7 inches; dark grayish brown (2.5Y 4/2) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; calcareous; moderately alkaline; clear wavy boundary.

A12—7 to 14 inches; olive brown (2.5Y 4/4) clay; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common dark grayish brown coatings on surface of peds; common fine calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

AC—14 to 41 inches; light olive brown (2.5Y 5/4) clay; common fine distinct dark grayish brown mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common medium intersecting slickensides; common calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

C—41 to 65 inches; yellowish brown (10YR 5/4) clay; massive; extremely hard, very firm; few slickensides; common calcium carbonate concretions up to 1/2 inch across; common fine soft black masses; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. It is clay or silty clay. Intersecting slickensides begin at a depth of about 15 inches. Reaction is moderately alkaline, and the soil is calcareous throughout.

The A horizon is very dark grayish brown, dark grayish brown, olive gray, olive, or olive brown. When value is less than 3.5, depth is less than 10 inches.

The AC horizon is olive, yellowish brown, olive brown, light olive brown, olive yellow, or pale olive. It has brownish or grayish mottles in most pedons. Calcium carbonate concretions range from common to many.

The C horizon is gray, olive, yellowish brown, light olive brown, or olive yellow. In some pedons it is mottled in the above colors.

Freestone series

The Freestone series consists of deep, loamy soils on old terraces and uplands. These soils formed in acid and alkaline clayey sediments. Native vegetation consists mainly of hardwood trees and mid and tall grasses. Slope ranges from 1 to 3 percent.

Typical pedon of Freestone fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 175 and Texas Highway 31 in Athens, 5.3 miles west on Texas Highway 31 and 300 feet south in pasture:

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam; common fine distinct yellowish red mottles; weak medium subangular blocky structure parting to fine granular; slightly hard, very friable; common fine and medium roots; common worm casts; strongly acid; clear wavy boundary.

A1—5 to 14 inches; brown (7.5YR 4/4) fine sandy loam; weak fine and medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; common worm casts; common soft black masses; common ironstone pebbles up to 1/4 inch across; strongly acid; clear wavy boundary.

B21—14 to 23 inches; brownish yellow (10YR 6/6) sandy clay loam; common medium distinct red (2.5YR 4/8) and pale brown (10YR 6/3) mottles; moderate medium and coarse subangular blocky structure; hard, firm; common very fine and fine roots; continuous clay films on surface of peds; common soft black masses; strongly acid; clear wavy boundary.

B22t&A'2—23 to 34 inches; mottled brownish yellow (10YR 6/6), pale brown (10YR 6/3), and red (2.5YR 4/8) sandy clay loam; few medium grayish brown (10YR 5/2) mottles; moderate fine and medium su-

bangular blocky structure; hard, firm; common very fine and fine roots; patchy clay films; common soft black masses; light brownish gray uncoated sand along surfaces of some peds with streaks and pockets 1/4 to 2 1/2 inches wide and 1 to 7 inches long that make up about 20 percent of the mass; very strongly acid; abrupt wavy boundary.

B23t—34 to 45 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common soft black masses; continuous clay films; common slickensides up to 3 inches long; very strongly acid; gradual wavy boundary.

B24t—45 to 59 inches; mottled brownish yellow (10YR 6/6), light brownish gray (10YR 6/2), and gray (10YR 6/1) clay; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; extremely hard, very firm; few fine roots; many soft black masses; continuous clay films; few pitted calcium carbonate concretions up to 1/2 inch across; common slickensides up to 3 inches long; neutral; gradual wavy boundary.

B3—59 to 80 inches; gray (10YR 6/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to coarse subangular blocky; extremely hard, very firm; few fine roots between peds; many soft black masses; common clay films; common slickensides; common pitted calcium carbonate concretions; few pebbles up to 1/2 inch across; moderately alkaline.

The solum ranges from 60 to over 100 inches thick. The A horizon ranges from 7 to 20 inches thick. It is brown or pale brown. Reaction ranges from strongly acid through neutral.

The B21t horizon is brownish yellow, yellowish brown, or strong brown. There are few to common red, pale brown, or dark brown mottles. Texture is sandy clay loam or loam. Clay content ranges from 18 to 35 percent. Reaction ranges from very strongly acid through slightly acid.

The B22t&A'2 horizon is mottled with the same colors as the B21t horizon. The A'2 material is light gray or light brownish gray and makes up 5 to 20 percent of the matrix. Texture is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

The lower part of the B2t horizon is mottled in shades of gray, red, brown, and yellow. The texture is sandy clay loam, sandy clay, or clay. Reaction ranges from very strongly acid through slightly acid. The B3 horizon is in shades of gray and has mottles in shades of red, brown, and yellow. Reaction ranges from medium acid through moderately alkaline.

Gallime series

The Gallime series consists of deep, loamy soils on terraces and uplands. These soils formed in loamy, acid, unconsolidated sediments. Native vegetation consists of pine and hardwood trees and mid and tall grasses. Slope ranges from 1 to 5 percent slopes.

Typical pedon of Gallime fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 31 and Farm Road 773 in Murchison, 5.6 miles east on Texas Highway 31, 0.3 mile south on county road, and 1,000 feet east in cultivated field:

Ap—0 to 10 inches; brown (10YR 5/3) fine sandy loam; weak medium subangular blocky structure; soft, very friable; common fine roots; medium acid; abrupt smooth boundary.

A2—10 to 28 inches; light yellowish brown (10YR 6/4) fine sandy loam; common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; soft, very friable; common fine roots; many fine pores; common worm casts; common soft black masses; few coarse rounded pebbles; slightly acid; clear smooth boundary.

B21t—28 to 47 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium prominent red (2.5YR 4/8) mottles; weak coarse blocky structure parting to weak fine and medium subangular blocky; slightly hard, friable; few fine roots; few medium pores; patchy clay films; few ironstone pebbles up to 1.5 inches across; strongly acid; gradual wavy boundary.

B22t&A'2—47 to 62 inches; yellowish brown (10YR 5/6) sandy clay loam; many coarse distinct yellowish red (5YR 5/6) and common fine and medium distinct yellow (10YR 7/8) mottles; moderate coarse subangular blocky structure; hard, firm; few medium pores; patchy clay films on surfaces of peds; few vertical streaks of slightly brittle red sandy loam; about 5 percent streaks and coatings of light brownish gray uncoated sand and silt on surfaces of some peds; strongly acid; gradual wavy boundary.

B23t&A'2—62 to 80 inches; mottled red (2.5YR 4/8), light gray (10YR 7/1), and yellow (10YR 7/8) sandy clay loam; weak coarse subangular blocky structure; hard, firm; about 15 percent light brownish gray uncoated sand and silt in streaks, pockets, and coatings along surfaces of peds; few patchy clay films; very strongly acid.

The solum ranges from 60 to over 100 inches thick. The A horizon is 20 to 40 inches thick. Reaction ranges from strongly acid through neutral. The Ap or A1 horizon is brown, dark brown, dark grayish brown, or yellowish brown. The A2 horizon is 1 to 3 units of value lighter in color than the A1.

The B2t horizon is yellowish brown, brownish yellow, strong brown, or yellowish red. There are few to common mottles in shades of red, brown, and gray. Mottles with chroma of 2 or less are below a depth of 30 inches. Texture throughout the B2t horizon is sandy clay loam, clay loam, or loam, and clay content ranges from 18 to 35 percent. Reaction ranges from very strongly acid through slightly acid.

The B2t&A'2 horizon is mottled in shades of red, brown, yellow, and gray. The A'2 soil material consists of streaks, pockets, and coatings of uncoated sand and silt grains making up 5 to 20 percent of the horizon. Texture is sandy clay loam, clay loam, or loam. Reaction ranges from very strongly acid through medium acid.

Gladewater series

The Gladewater series consists of deep, clayey soils on bottom lands. These soils formed in clayey alluvium. Native vegetation consists of hardwood trees and water-tolerant grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Gladewater clay, frequently flooded; from the intersection of Texas Highway 31 and Farm Road 90 in Malakoff, 3.0 miles south on Farm Road 90, 2.15 miles west on county road, 1.0 mile west on county road, 0.9 mile north on pasture road, 0.5 mile west on pasture road, and 50 feet north in Cedar Creek bottom:

A1—0 to 6 inches; very dark gray (10YR 3/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common brownish stains along root channels; slightly acid; clear wavy boundary.

B21g—6 to 29 inches; grayish brown (10YR 5/2) clay; common fine distinct yellowish brown mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; very strongly acid; gradual wavy boundary.

B22g—29 to 44 inches; dark gray (10YR 4/1) clay; common fine faint olive mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common slickensides; strongly acid; gradual wavy boundary.

Cg—44 to 67 inches; very dark gray (10YR 3/1) clay; common fine faint brownish mottles; massive; extremely hard, very firm, sticky and plastic; common slickensides; neutral.

The solum ranges from 33 to about 50 inches thick. It is clayey throughout.

The A horizon is black, very dark gray, or dark gray and is medium acid or slightly acid.

The B2g horizons are dark gray, grayish brown, or olive gray. Most pedons contain few to common yellowish, brownish, or olive mottles. The B2g horizons range from very strongly acid through medium acid.

The Cg horizons are very dark gray, dark gray, or gray and contain common to many mottles of light yellowish brown, light olive brown, or yellowish brown. The Cg horizons range from medium acid through moderately alkaline.

Henco series

The Henco series consists of deep, sandy soils on uplands. These soils formed in sandy and loamy sediments. Native vegetation consists of hardwood trees and mid and tall grasses. Slope ranges from 1 to 5 percent.

Typical pedon of Henco loamy fine sand, in an area of Leagueville-Henco complex, 1 to 5 percent; from the intersection of U.S. Highway 175 and Farm Road 607 in Larue, 4.7 miles north on Farm Road 607, 1.45 miles east on county road, and 100 feet north in pasture:

A11—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand; common medium distinct brown (10YR 4/3), pale brown (10YR 6/3), and common fine distinct strong brown mottles; weak medium subangular blocky structure; soft, very friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.

A12—8 to 15 inches; pale brown (10YR 6/3) loamy fine sand; common fine distinct brownish yellow and yellowish brown mottles; weak coarse subangular blocky structure; soft, very friable; common fine, medium, and coarse roots; medium acid; gradual wavy boundary.

A2g—15 to 44 inches; light gray (2.5Y 7.2) loamy fine sand; common fine distinct brownish yellow and strong brown mottles; single grained; loose, very friable; common fine and medium roots; medium acid; gradual wavy boundary.

A&B—44 to 62 inches; light gray (10YR 7/1) uncoated loamy fine sand; vertically oriented mottles, streaks, and pockets of yellowish brown (10YR 5/8), strong brown (7.5YR 5/8), and light gray (10YR 7/1) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; few fine roots; very strongly acid; gradual wavy boundary.

Cg—62 to 72 inches; light gray (10YR 7/1) loamy fine sand; common medium distinct yellow (10YR 7/6) mottles; single grained; loose, very friable; very strongly acid.

The solum ranges from 60 to more than 80 inches thick. It ranges from very strongly acid through slightly acid in the A horizon and is very strongly acid or strongly acid in the lower horizon. Base saturation at 72 inches ranges from 20 to 35 percent.

The A horizon is 40 to 64 inches thick. The A11 horizon has colors of very dark gray, very dark grayish brown, dark grayish brown, or grayish brown. When value is less than 3.5, the horizon is less than 10 inches

thick. The A12 horizon has colors of grayish brown, light brownish gray, or pale brown. The A2 horizon has colors of gray, light brownish gray, light gray, pale brown, or very pale brown. In most pedons it is mottled in shades of brown and yellow.

The A material of the A&B horizon is gray, light brownish gray, or light gray loamy fine sand, fine sand, or fine sandy loam. Tongues of A material make up 50 to 70 percent of the upper part of the A&B horizon and 30 to 50 percent of the lower part. The B material is yellowish brown, brownish yellow, yellow, strong brown, yellowish red, gray, or light gray. The horizon is typically mottled in these colors. It is sandy clay loam, sandy loam, or fine sandy loam.

The C horizon is fine sand or loamy fine sand. In some pedons it has yellowish or brownish mottles.

Kaufman series

The Kaufman series consists of deep, clayey soils on bottom lands. These soils formed in alkaline clayey sediments. Native vegetation consists mainly of hardwood trees. Slope ranges from 0 to 3 percent.

Typical pedon of Kaufman clay, rarely flooded; from the common intersection of Farm Road 59, a county road, and Farm Road 90 in Cross Roads; southwest on county road 2.6 miles, west on county road 0.1 mile, west on pasture road 0.8 mile, and north of road 200 feet in pasture:

A11—0 to 11 inches; black (10YR 2/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common very fine and fine roots; shiny ped faces; neutral; clear wavy boundary.

A12—11 to 33 inches; black (10YR 2/1) clay; common fine faint brownish yellow mottles; moderate coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common slickensides up to 3 inches wide; shiny ped faces; neutral; diffuse wavy boundary.

A13—33 to 69 inches; very dark gray (10YR 3/1) clay; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots along surface of peds; many intersecting slickensides up to 8 inches wide tilted 45 to 60 degrees; few fine soft black masses; common calcium carbonate concretions; moderately alkaline; diffuse wavy boundary.

ACg—69 to 80 inches; gray (10YR 5/1) clay; grayish brown (2.5Y 5/2) mottles on surface of peds; weak coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, very firm; common soft powdery calcium carbonate on surface of peds; about 10 percent calcium carbonate concretions; calcareous; moderately alkaline.

Thickness of the solum is more than 60 inches. The soil is clayey throughout, and clay content ranges from 60 to 80 percent. It is calcareous below a depth of 24 inches in a few pedons. Slickensides begin at a depth of about 20 inches. When the soil is dry, there are cracks 0.5 inch to 3 inches wide at a depth of 20 inches. Undisturbed areas have gilgai microrelief in which the microknolls are only slightly higher than the microdepressions.

The A horizon is black or very dark gray and has brownish yellow mottles in the lower part. Reaction ranges from neutral through moderately alkaline.

The ACg horizon is very dark gray, dark gray, or gray. It has few to common olive and brown mottles in some pedons. Reaction is moderately alkaline. The ACg horizon has common calcium carbonate concretions in most pedons.

Kirvin series

The Kirvin series consists of deep, loamy soils on uplands. These soils formed in acid, loamy and clayey sediments. Native vegetation consists of pine and hardwood trees and mid and tall grasses. Slope ranges from 2 to 5 percent.

Typical pedon of Kirvin fine sandy loam, 2 to 5 percent slopes; from the intersection of U.S. Highway 175 and Farm Road 315 in Poynor, 6 miles north on Farm Road 315 and 75 feet east in pasture:

Ap—0 to 8 inches; dark brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; common fine roots; about 10 percent ironstone pebbles; medium acid; clear wavy boundary.

A2—8 to 11 inches; brown (7.5YR 5/4) fine sandy loam; massive; slightly hard, very friable; common fine roots; about 10 percent ironstone pebbles; strongly acid; clear wavy boundary.

B21t—11 to 26 inches; red (2.5YR 4/6) clay; common fine distinct strong brown mottles; moderate fine and medium subangular blocky structure; extremely hard, firm; common very fine roots; continuous clay films along surfaces of peds; about 2 percent ironstone pebbles; very strongly acid; gradual wavy boundary.

B22t—26 to 34 inches; red (2.5YR 4/8) clay; many fine and medium distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; extremely hard, firm; few very fine roots; patchy clay films along surfaces of peds; about 10 percent ironstone pebbles; very strongly acid; gradual wavy boundary.

B23t—34 to 55 inches; red (2.5YR 4/8) and yellowish red (5YR 5/8) sandy clay loam; weak fine subangular blocky structure; very hard, firm; about 10 percent ironstone pebbles; very strongly acid; gradual wavy boundary.

C—55 to 70 inches; mottled red (2.5YR 4/8) and strong brown (7.5YR 5/8) sandy clay loam; massive; few thin strata of gray (l0YR 6/1) shaley material; very strongly acid.

The solum ranges from 41 to 55 inches thick.

The A horizon ranges from 9 to 13 inches thick. It is dark brown, brown, or strong brown. Reaction ranges from slightly acid through strongly acid. Ironstone gravel content ranges from 5 to 25 percent.

The B2t horizon is red or yellowish red. Texture is clay in the upper part and clay, clay loam, or sandy clay loam in the lower part. The B2t horizon is mottled with strong brown, red, light brownish gray, brownish yellow, yellowish brown, reddish yellow, very pale brown, and yellowish red in some pedons. Reaction ranges from strongly acid through extremely acid. Ironstone gravel content ranges from 0 to 10 percent.

The C horizon has colors of red, yellowish red, strong brown, light gray, light brownish gray, brownish yellow, and pale brown. Texture is sandy loam or sandy clay loam or is stratified partially weathered sandstone and shale.

Larue series

The Larue series consists of deep, sandy soils on uplands. These soils formed in unconsolidated sandy and loamy sediments. Native vegetation consists of pine and hardwood trees and mid and tall grasses. Slope ranges from 1 to 8 percent.

Typical pedon of Larue loamy fine sand, 1 to 8 percent slopes; from the intersection of U.S. Highway 175 and Farm Road 315 in Poynor, 1.7 miles southeast on U.S. Highway 175, 1.1 miles north on county road, 1.6 miles east-southeast on county road, 0.7 mile north on private road, and then 100 feet east of road in lovegrass pasture:

Ap—0 to 7 inches; brown (7.5YR 4/4) loamy fine sand; weak fine and medium subangular blocky structure; loose, very friable; many fine roots; strongly acid; abrupt boundary.

A2—7 to 34 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose, very friable; few fine roots; medium acid; clear smooth boundary.

B21t—34 to 48 inches; red (2.5YR 4/6) sandy clay loam; moderate fine and medium subangular blocky structure; hard, firm; common fine roots; slightly acid; gradual wavy boundary.

B22t—48 to 63 inches; red (2.5YR 4/6) sandy clay loam; few fine distinct strong brown mottles; weak coarse subangular blocky structure; hard, firm; few fine roots; common ironstone pebbles mostly in lower part; slightly acid.

The solum is more than 60 inches thick.

The A horizon ranges from 20 to 40 inches thick. The Ap or A1 horizon is brown or pale brown. The A2 horizon is brown or light yellowish brown. Reaction of the A horizon is strongly acid or medium acid.

The B21t horizon is red or yellowish red. The lower Bt horizon has the same colors as the B21t horizon and also is reddish yellow or strong brown. It is mottled in shades of red and yellow in some pedons. Reaction of the B horizon ranges from strongly acid through slightly acid.

Leagueville series

The Leagueville series consists of deep, sandy soils on uplands. These soils formed in sandy and loamy sediments. Native vegetation consists of hardwood trees and mid and tall grasses. Slope ranges from 1 to 5 percent.

Typical pedon of Leagueville fine sand, in an area of Leagueville-Henco complex, 1 to 5 percent slopes; from northeast corner of square in Athens, 3.4 miles northeast on Texas Highway 31, 4.5 miles east on Farm Road 317, 0.9 mile north on county road, and 50 feet east in pasture:

A11—0 to 3 inches; very dark gray (10YR 3/1) fine sand; weak fine and medium subangular blocky structure; soft, very friable; many fine and medium roots; strongly acid; clear wavy boundary.

A12—3 to 13 inches; dark grayish brown (10YR 4/2) fine sand; weak coarse subangular blocky structure; soft, very friable; common fine and medium roots; few fine brownish stains along root channels; medium acid; clear wavy boundary.

A2—13 to 29 inches; very pale brown (10YR 7/3) fine sand; common fine distinct yellowish mottles; single grained; soft, very friable; common fine and medium roots; medium acid; clear wavy boundary.

B2tg—29 to 51 inches; gray (10YR 5/1) sandy clay loam; many medium and coarse distinct yellowish brown (10YR 5/6) and brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; hard, friable; common fine and medium roots; extremely acid; diffuse wavy boundary.

A&B—51 to 80 inches; light gray (10YR 6/1), 7/1) uncoated fine sand; vertically oriented pockets and streaks of strong brown (7.5YR 5/6), gray (10YR 6/1), yellowish brown (10YR 5/6), and light yellowish brown (2.5Y 6/4) sandy clay loam and sandy loam; weak coarse subangular blocky structure; slightly hard, friable; few fine roots; very strongly acid.

The solum is 60 to more than 80 inches thick. Reaction ranges from very strongly acid through slightly acid in the A horizon and from extremely acid through strong-

ly acid in the B2t horizon. Base saturation at 72 inches ranges from 20 to 35 percent.

The A horizon is 20 to 40 inches thick. The Al horizon has colors of very dark gray, very dark grayish brown, dark gray, dark grayish brown, gray, grayish brown, brown, or pale brown. When value is less than 3.5, the horizon is less than l0 inches thick. The A2 horizon has colors of light gray, light brownish gray, pale brown, or very pale brown.

The B2tg horizon is sandy clay loam or fine sandy loam. It is gray, light gray, or light brownish gray. There are common to many fine, medium, and coarse mottles in shades of brown, yellow, and red. In some pedons the B2tg horizon has pockets and streaks of gray uncoated sand.

The A&B horizon is fine sand or loamy fine sand and sandy clay loam or fine sandy loam. The A soil material makes up 30 to 80 percent and is gray, light gray, or light brownish gray. The B soil material is strong brown, yellowish brown, brownish yellow, yellowish red, or gray. The horizon is typically mottled in these colors.

Lufkin series

The Lufkin series consists of deep, loamy soils on uplands. These soils formed in alkaline clayey sediments. Native vegetation consists of hardwood trees and mid and tall grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Lufkin loam, in an area of Lufkin-Raino complex; from the intersection of Farm Road 316 and U.S. Highway 175 in Eustace, 4.5 miles northwest on U.S. Highway 175, 0.5 mile north on private road, and 50 feet east in bermudagrass pasture:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam; weak fine subangular blocky structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

A2—6 to 10 inches; light brownish gray (10YR 6/2) loam; massive; hard, friable; common fine roots; strongly acid; abrupt wavy boundary.

B21tg—10 to 30 inches; grayish brown (10YR 5/2) clay; few fine distinct very dark grayish brown mottles; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots; very strongly acid; gradual wavy boundary.

B22tg—30 to 44 inches; dark gray (10YR 4/1) clay; few fine distinct pale yellow mottles; moderate medium subangular blocky structure; extremely hard, very firm; few fine black concretions; very strongly acid; gradual wavy boundary.

B23tg—44 to 60 inches; light brownish gray (2.5Y 6/2), grayish brown (10YR 5/2), and brownish yellow (10YR 6/8) clay; weak coarse subangular blocky structure; extremely hard, very firm; few white masses of neutral salts; moderately alkaline.

The solum ranges from 50 to 68 inches thick.

The A1 or Ap horizon is dark grayish brown or grayish brown. The A2 horizon is grayish brown or light brownish gray. Mottles in colors of brown and yellow range from none to common. Reaction of the A horizon ranges from strongly acid through neutral.

The Btg horizon is dark gray, gray, dark grayish brown, grayish brown, or light brownish gray. It is mottled in brown and yellow in most pedons. Reaction is very strongly acid in the upper part and ranges through mildly alkaline in the lower part.

The C horizon, when present, is gray, light brownish gray, grayish brown, or light gray and is mottled in brown and yellow. Texture is clay, clay loam, or sandy clay loam. In most pedons the C horizon contains soft white neutral salts and soft black concretions.

Nahatche series

The Nahatche series consists of deep, loamy soils on bottom lands. These soils formed in loamy alluvial sediments. Native vegetation consists mainly of hardwood trees. Slope ranges from 0 to 1 percent.

Typical pedon of Nahatche loam, frequently flooded; from the intersection of Texas Highway 31 and U.S. Highway 175 in Athens; 8.5 miles northwest on U.S. Highway 175 and 1,000 feet west in creek bottom near crossfence:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam; common fine distinct yellowish brown and few fine distinct light brownish gray mottles; weak coarse subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable; many fine and very fine roots; strongly acid; clear smooth boundary.

A1—5 to 13 inches; brown (10YR 4/3) fine sandy loam; common fine and medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; few grayish brown (10YR 5/2) clay flows along root channels and along some ped surfaces; many fine and medium roots; medium acid; clear wavy boundary.

C1g—13 to 30 inches; grayish brown (10YR 5/2) clay loam; many fine and medium distinct yellowish red (5YR 4/6, 4/8) mottles; moderate coarse subangular blocky structure; hard, firm; few light brownish gray silt flows along the surface of some peds; dark gray coatings on surfaces of peds; common fine and medium roots; slightly acid; gradual wavy boundary.

C2g—30 to 75 inches; dark gray (10YR 4/1) clay loam; weak coarse blocky structure; very hard, firm; few fine roots; common vertical sand and silt flows; few fine black masses; neutral.

The A horizon is dark grayish brown, dark brown, brown, grayish brown, or very dark grayish brown. In some pedons it has few to common mottles in shades of brown, gray, and red. It is fine sandy loam, loam, sandy clay loam, or clay loam. Reaction ranges from strongly acid through neutral.

The Cg horizon is loam, sandy loam, sandy clay loam, silty clay loam, or clay loam. It is strongly acid through mildly alkaline. The matrix is grayish brown, dark grayish brown, gray, dark gray, and light brownish gray. In most places the Cg horizon has few to many mottles of the above colors and other shades of red, brown, yellow, and gray. A few soft black masses are in the Cg horizon of some pedons.

Normangee series

The Normangee series consists of moderately deep to deep loamy soils on old terraces and uplands. These soils formed in alkaline clay sediments and shale. Native vegetation consists of mid and tall grasses. Slope ranges from 2 to 5 percent.

Typical pedon of Normangee clay loam, 2 to 5 percent slopes, eroded; from the intersection of Farm Road 85 and Farm Road 90 in Gun Barrel City; 1.8 miles north on Farm Road 90; 0.75 mile west on private road to break into creek bottom:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) clay loam; weak fine and medium subangular blocky structure; very hard, firm; common fine roots; slightly acid; clear smooth boundary.

B21t—3 to 10 inches; brown (10YR 4/3) clay; moderate medium subangular blocky structure; extremely hard, very firm; common fine roots; very dark grayish brown coatings on surface of peds; slightly acid; gradual wavy boundary.

B22t—10 to 19 inches; brown (10YR 4/3) clay; few fine faint olive mottles; moderate coarse subangular blocky structure; extremely hard, very firm; common fine calcium carbonate concretions; moderately alkaline; gradual wavy boundary.

B23t—19 to 39 inches; light olive brown (2.5Y 5/4) clay; weak coarse subangular blocky structure; extremely hard, very firm; patchy coatings of dark grayish brown on surface of some peds; few fine calcium carbonate concretions; moderately alkaline; gradual wavy boundary.

C—39 to 72 inches; stratified light olive brown (2.5Y 5/4), yellowish brown (10YR 5/8), and dark gray (10YR 4/1) shale and clay; massive; extremely hard, very firm; few calcium carbonate concretions; moderately alkaline.

The solum ranges from 30 to 51 inches thick. Calcium carbonate concretions are in the lower part in most pedons.

The A horizon ranges from 2 to 5 inches thick. The A horizon is very dark grayish brown, dark brown, dark grayish brown, or brown. Reaction ranges from medium acid through neutral.

The upper part of the B2t horizon is dark brown, brown, or dark yellowish brown. It ranges from medium acid through neutral. The lower part of the B2t horizon is brown, olive brown, or light olive brown. In some pedons it is mottled with gray, grayish brown, yellowish brown, and brownish yellow. Reaction ranges from neutral through moderately alkaline.

The C horizon is stratified shale and clay in shades of olive brown, dark gray, yellowish brown, and brown. Reaction is moderately alkaline.

The Normangee soils in this survey area are considered taxadjuncts to the Normangee series because they have a slightly thinner solum than is typical for the series. This difference, however, does not affect the use and behavior of the soils.

Pickton series

The Pickton series consists of deep, sandy soils on uplands. These soils formed in unconsolidated, acid, sandy and loamy sediments. Native vegetation consists mainly of hardwood and pine trees and mid and tall grasses. Slope ranges from 1 to 15 percent.

Typical pedon of Pickton loamy fine sand, 1 to 8 percent slopes; from the intersection of Texas Highway 31 and Farm Road 2495 on the eastern edge of Athens, 0.7 mile northeast on Texas Highway 31, 2.3 miles north on Farm Road 1616, and 400 feet east in idle cropland field:

Ap—0 to 8 inches; brown (10YR 5/3) loamy fine sand; weak fine subangular blocky structure; loose, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

A2—8 to 50 inches; light yellowish brown (10YR 6/4) loamy fine sand; single grained; loose, very friable; many fine roots; slightly acid; abrupt irregular boundary.

B21t—50 to 76 inches; strong brown (7.5YR 5/8) sandy clay loam; common medium and coarse distinct yellowish red (5YR 4/6) mottles and common medium and coarse prominent red (2.5YR 4/6) mottles; weak medium and coarse subangular blocky structure; very hard, firm; few fine roots; patchy clay films; medium acid; diffuse irregular boundary.

B22t—76 to 80 inches; strong brown (7.5YR 5/8) sandy clay loam; common coarse distinct yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; very hard, firm; patchy clay films; common light gray vertical uncoated sand streaks up to 1 1/2 inches wide and pockets up to 6 inches across; medium acid.

The solum is more than 80 inches thick. The thickness of the A horizon ranges from 40 to 72 inches.

The A1 or Ap horizon is brown, yellowish brown, or pale brown. The A2 horizon is light yellowish brown, yellowish brown, or very pale brown. Reaction of the A horizon is medium acid or slightly acid.

The B2t horizon is strong brown, reddish brown, yellowish red, or light yellowish brown. Mottles of red, yellowish red, strong brown, brownish yellow, gray, light brownish gray, and very pale brown range from few in the upper part of the B2t horizon to many in the lower part. The B2t horizon is sandy clay loam and ranges from very strongly acid through medium acid. The B3 horizon, when present, is strong brown mottled in shades of gray, red, and yellow. It is sandy clay loam, clay loam, or fine sandy loam and ranges from very strongly acid through medium acid.

Rader series

The Rader series consists of deep, loamy soils on terraces. These soils formed in clayey sediments interbedded with sandy material. Native vegetation consists of hardwood trees and mid and tall grasses. Slopes range from 0 to 1 percent.

Typical pedon of Rader fine sandy loam, in an area of Derly-Rader complex; from the intersection of Farm Road 85 and Farm Road 90 in Gun Barrel City, 3.4 miles south on Farm Road 90, 0.5 mile south on county road, and 50 feet west in woods on a mound:

A1—0 to 6 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; slightly hard, very friable; common fine and medium roots; medium acid; clear wavy boundary.

A2—6 to 28 inches; yellowish brown (10YR 5/4) fine sandy loam; weak coarse subangular blocky structure; slightly hard, very friable; common fine and medium roots; common fine pores; strongly acid; gradual wavy boundary.

B&A—28 to 44 inches; bodies of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) sandy clay loam, most of which are surrounded by light brownish gray (10YR 6/2) sandy material; moderate fine and medium subangular blocky structure; hard, friable; common fine and medium roots; common fine pores; very strongly acid; clear wavy boundary.

B21t—44 to 65 inches; grayish brown (10YR 5/2) clay; many fine and medium prominent red (2.5YR 4/6) and common fine distinct yellowish red mottles; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; very strongly acid; gradual wavy boundary.

B22t—65 to 72 inches; mottled grayish brown (10YR 5/2), red (2.5YR 4/6), and yellowish red (5YR 5/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; strongly acid.

The solum is more than 60 inches thick.

The A1 horizon is dark grayish brown or brown. Reaction is medium acid or slightly acid. The A2 horizon is light brownish gray, pale brown, or yellowish brown. It is fine sandy loam or loam and ranges from very strongly acid through slightly acid.

The B&A horizon is yellowish brown, brownish yellow, brown, or strong brown. In most pedons it has grayish and reddish mottles within the peds. The A2 material is light brownish gray or light gray fine sandy loam. This horizon is very strongly acid or strongly acid.

The B2t horizon is gray, grayish brown, or light brownish gray. It has common to many mottles of red, yellowish brown, or yellowish red or, in some places, the matrix is mottled in these colors. Reaction ranges from very strongly acid through mildly alkaline.

Raino series

The Raino series consists of deep, loamy soils on uplands. These soils formed in clayey sediments. Native vegetation consists mainly of hardwood trees and mid and tall grasses. Slope is less than 1 percent.

Typical pedon of Raino loam, in an area of Lufkin-Raino complex; from the intersection of Farm Road 316 and U.S. Highway 175 in Eustace, 4.5 miles northwest on U.S. Highway 175, 0.5 mile north on private road to bermudagrass pasture:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam; weak fine subangular blocky structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.

A1—5 to 10 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; slightly hard, friable; common fine roots; few fine black concretions; medium acid; diffuse boundary.

B1—10 to 29 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; slightly hard, friable; common fine roots; common very fine pores; few fine black concretions; few pockets of uncoated sand and silt up to 1/8 inch across; very strongly acid; clear smooth boundary.

A'2&Bt—29 to 35 inches; mottled light brownish gray (10YR 6/2) loam and yellowish brown (10YR 5/6) sandy clay loam; weak fine subangular blocky structure; slightly hard, friable; common fine roots; 15 to 25 percent isolated bodies of Bt material surrounded by A'2 material; common pockets and streaks of uncoated sand and silt; very strongly acid; abrupt irregular boundary.

B21t&A'2—35 to 44 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish brown (10YR 5/6) and common medium prominent red (2.5YR 4/6) mottles; moderate fine and medium blocky structure; extremely hard, very firm; few fine

roots; tongues of uncoated sand and silt penetrate 1/8 to 1/4 inch deep and are 1/16 to 1/2 inch wide and make up 5 to 10 percent of the upper B21t; a few pockets of uncoated sand in lower B21t; very strongly acid; gradual wavy boundary.

B22t—44 to 64 inches; mottled grayish brown (10YR 5/2), gray (10YR 5/1), and yellowish brown (10YR 5/6) clay; moderate fine and medium blocky structure; extremely hard, very firm; few fine roots; common black concretions; few neutral salt masses; very strongly acid; gradual wavy boundary.

B3—64 to 72 inches; mottled gray (10YR 6/1), grayish brown (10YR 5/2), red (2.5YR 5/6), and yellowish brown (10YR 5/6) clay loam; weak medium blocky structure; hard, firm; few fine roots; many black concretions; few neutral salts; very strongly acid.

The solum is more than 60 inches thick.

The A horizon is dark grayish brown or brown. Reaction ranges from strongly acid through slightly acid.

The B1 horizon is dark yellowish brown, yellowish brown, light yellowish brown, or brown. Texture is loam or fine sandy loam. Reaction ranges from very strongly acid through medium acid.

The A'2&Bt horizon is grayish brown, light brownish gray, or light gray loam or fine sandy loam and is 15 to 25 percent isolated bodies of yellowish brown, brownish yellow, light yellowish brown, and pale brown sandy clay loam. Reaction is very strongly acid or strongly acid.

The B21t&A'2 horizon is reddish yellow, grayish brown, or red or is mottled in shades of yellow, brown, or red. Streaks or pockets of uncoated sand and silt make up 5 to 10 percent of this horizon. Texture is clay or clay loam. Reaction is very strongly acid or strongly acid.

The lower part of the Bt horizon is in shades of gray with or without mottles of yellow and brown or is mottled in these colors. Texture is clay or clay loam. Reaction is very strongly acid or strongly acid. The B3 horizon has the same colors as the Bt horizon. Texture is clay or clay loam. Reaction ranges from very strongly acid through neutral.

Silawa series

The Silawa series consists of deep, loamy soils on terraces. These soils formed in sandy or loamy sediments. Native vegetation consists mainly of mid and tall grasses. Slope ranges from 1 to 12 percent.

Typical pedon of Silawa fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 274 and Farm Road 85 in Seven Points, 2.0 miles west on Farm Road 85, 4.7 miles south on county road, and 1,350 feet west in pasture:

Ap—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; medium acid; clear wavy boundary.

A1—3 to 10 inches; brown (10YR 5/3) fine sandy loam; common fine faint dark brown mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; common fine roots; slightly acid; clear wavy boundary.

A2—10 to 15 inches; brown (7.5YR 5/4) fine sandy loam; massive; slightly hard, very friable; common fine roots; slightly acid; clear wavy boundary.

B21t—15 to 29 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; very hard, firm; common fine roots; patchy clay films; medium acid; gradual wavy boundary.

B22t—29 to 37 inches; red (2.5YR 4/8) sandy clay loam; common fine distinct brownish yellow mottles; moderate medium and coarse subangular blocky structure; very hard, firm; few fine roots; patchy clay films; strongly acid; gradual wavy boundary.

B3—37 to 64 inches; yellowish red (5YR 5/6) sandy clay loam; weak coarse subangular blocky structure; hard, friable; few fine roots; patchy red clay films on surface of peds and common very pale brown sand coatings on surface of peds; medium acid; gradual wavy boundary.

C—64 to 80 inches; yellowish red (5YR 5/8) fine sandy loam; massive; hard, friable; medium acid.

The solum ranges from 36 to 64 inches thick. The thickness of the A horizon ranges from 4 to 15 inches.

The A1 or Ap horizon is dark grayish brown, brown, or dark yellowish brown. The A2 horizon is brown or yellowish brown. Reaction of the A horizon ranges from strongly acid through slightly acid.

The B2t horizon is red, yellowish red, strong brown, or reddish yellow. Reaction of the B2t horizon ranges from very strongly acid through slightly acid.

The B3 horizon, when present, is strong brown, reddish yellow, or yellowish red. Texture is fine sandy loam or sandy clay loam. Reaction ranges from very strongly acid through medium acid.

The C horizon is strong brown, yellowish brown, brownish yellow, very pale brown, or yellowish red. Texture is fine sandy loam or loamy fine sand. Reaction is strongly acid or medium acid.

Styx series

The Styx series consists of deep, sandy soils on terraces. These soils formed in sandy and loamy sediments. Native vegetation consists mainly of mid and tall grasses. Slope ranges from 1 to 5 percent.

Typical pedon of Styx loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 31 and Farm Road 90 in Malakoff, 3.1 miles south on Farm Road 90, 0.7 mile west on county road, and 600 feet north in pasture:

A11—0 to 3 inches; brown (10YR 4/3) loamy fine sand; weak fine subangular blocky structure; loose, very friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—3 to 10 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak medium subangular blocky structure; loose, very friable; common fine roots; slightly acid; clear smooth boundary.

A2—10 to 22 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose, very friable; few fine roots; slightly acid; clear wavy boundary.

B21t—22 to 31 inches; brownish yellow (10YR 6/6) sandy clay loam; common fine distinct light yellowish brown and few fine distinct strong brown mottles; weak medium subangular blocky structure; hard, firm; few fine roots; very strongly acid; clear wavy boundary.

B22t—31 to 45 inches; mottled light yellowish brown (10YR 6/4), light brownish gray (10YR 6/2), and red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; hard, firm; few fine roots; very strongly acid; clear wavy boundary.

B23t—45 to 67 inches; mottled light brownish gray (10YR 6/2), red (2.5YR 4/8), and light yellowish brown (10YR 6/4) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; very strongly acid; gradual wavy boundary.

B3—67 to 80 inches; light brownish gray (10YR 6/2) sandy clay loam; common coarse prominent red (2.5YR 4/8) and few fine distinct light yellowish brown mottles; weak coarse subangular blocky structure; very hard, firm; about 5 percent light gray uncoated sand in vertical streaks, very strongly acid.

The solum is more than 60 inches thick.

The A horizon ranges from 20 to 40 inches thick. The A1 or Ap horizon is brown or dark yellowish brown. The A2 horizon is yellowish brown or light yellowish brown. Reaction ranges from medium acid through neutral.

The B21t horizon is brownish yellow, yellowish brown, or strong brown. Mottles of strong brown or very pale brown are in most pedons. The lower part of the B2t horizon is mottled light yellowish brown, light brownish gray, red, gray, or strong brown. Texture is sandy clay loam or clay loam. Reaction ranges from very strongly acid through slightly acid. The B3 horizon is gray or light brownish gray and mottled in shades of red and brown. Texture is sandy clay or clay loam. Uncoated sand grains as coatings on peds and as small pockets range from 5 to 15 percent.

Tonkawa series

The Tonkawa series consists of deep, sandy soils on uplands. These soils formed in thick sandy deposits. Native vegetation consists mainly of short grasses and sparse hardwood trees. Slope ranges from 1 to 12 percent.

Typical pedon of Tonkawa fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 31 and Texas Highway 19 in Athens, 3.6 miles north on Texas Highway 19, 3.3 miles west on county road, and 300 feet east in vertical ditch bank:

A1—0 to 7 inches; brown (10YR 5/3) fine sand; weak fine subangular blocky structure; loose, very friable; common fine roots; slightly acid; clear wavy boundary.

C1—7 to 56 inches; brown (10YR 4/3) fine sand; single grained; loose; few fine roots; slightly acid; gradual wavy boundary.

C2—56 to 80 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; slightly acid.

The solum thickness exceeds 72 inches. Reaction ranges from strongly acid through slightly acid. Lamellae that are not thick enough for an argillic horizon are in the lower part of some pedons.

The A horizon is brown or yellowish brown.

The C horizon is brown, pale brown, yellowish brown, dark yellowish brown, light yellowish brown, brownish yellow, yellow, strong brown, or very pale brown.

Trawick series

The Trawick series consists of deep, loamy soils on uplands. These soils formed in geologic formations rich in glauconite or green sand marl. Native vegetation consists mainly of pine and hardwood trees. Slope ranges from 12 to 20 percent.

Typical pedon of Trawick gravelly fine sandy loam, 12 to 20 percent slopes; from the intersection of U.S. Highway 175 and Farm Road 315 in Poynor, 2.25 miles north on Farm Road 315 and 250 feet east in woods:

A1—0 to 7 inches; dark reddish brown (5YR 3/3) gravelly fine sandy loam; weak fine granular structure; slightly hard, very friable; many very fine through coarse roots; about 30 percent ironstone gravel; slightly acid; clear wavy boundary.

B2t—7 to 27 inches; red (10R 4/6) clay; moderate fine subangular blocky structure; extremely hard, firm; common very fine through coarse roots; continuous clay films along surface of peds; few very fine soft black masses; medium acid; gradual wavy boundary.

B3—27 to 40 inches; red (2.5YR 4/6) clay; common fine distinct strong brown mottles; weak fine and medium subangular blocky structure; very hard, firm; few very fine and fine roots; patchy clay films along surface of peds; very strongly acid; gradual wavy boundary.

C—40 to 72 inches; red (2.5YR 4/6, 4/8), clay and strong brown (7.5YR 5/8) and yellowish brown

(10YR 5/6) partially weathered glauconite; platy to massive; very hard; very strongly acid.

The solum ranges from 40 to 55 inches thick.

The A horizon ranges from medium acid through neutral. The A horizon is 15 to 30 percent ironstone pebbles.

The Bt and B3 horizons are clay in the upper part and clay or sandy clay in the lower part. They have mottles of yellow and strong brown in most pedons. Reaction ranges from very strongly acid through medium acid.

The C horizon has colors of red, strong brown, yellowish brown, light brownish gray, and yellow. It is clay loam or clay that has partially weathered glauconite and intermittent layers of ironstone. Reaction is very strongly acid or strongly acid.

Trinity series

The Trinity series consists of deep, clayey soils on bottom lands. These soils formed in calcareous clayey alluvium. Native vegetation consists mainly of hardwood trees. Slope ranges from 0 to 1 percent.

Typical pedon of Trinity clay, frequently flooded; from the intersection of Texas Highway 31 and Texas Highway 274 in Trinidad, 3.0 miles north on Texas Highway 274, 2.1 miles west on county road, 0.2 mile south on county road, 0.7 mile west on pasture road, and 50 feet north in river bottom:

A11—0 to 6 inches; very dark gray (5Y 3/1) clay; moderate fine and medium granular structure; very hard, very firm, sticky and plastic; many very fine to medium roots; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 17 inches; very dark gray (5Y 3/1) clay; few fine faint yellowish mottles; moderate fine and medium subangular and angular blocky structure; extremely hard, very firm, sticky and plastic; common very fine and fine roots; many shiny faces on peds; calcareous; moderately alkaline; clear wavy boundary.

A13—17 to 60 inches; very dark gray (10YR 3/1) clay; common fine distinct light olive brown mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, very firm, sticky and plastic; common very fine and fine roots; common worm casts in cracks; many grooved intersecting slickensides 3 to 15 inches wide and tilted 40 to 60 degrees; calcareous; moderately alkaline; gradual wavy boundary.

C—60 to 80 inches; dark gray (5Y 4/1) clay; many fine distinct olive mottles; massive; extremely hard, very firm, sticky and plastic; few very fine roots; few intersecting slickensides; common calcium carbonate concretions up to 1/4 inch across; calcareous; moderately alkaline.

Thickness of the solum is more than 60 inches. The clay content of the control section ranges from 60 to 70 percent. Intersecting slickensides begin at a depth of about 20 inches. When dry, there are cracks 0.5 inch to 2.0 inches wide and 20 inches or more deep. In Gilgai microrelief in undisturbed areas, the microknolls are only slightly higher than the microdepressions.

The A horizon is black or very dark gray. In most pedons it has brownish or olive mottles. It is mildly alkaline or moderately alkaline.

The C horizon is very dark gray, dark gray, or olive gray. In most pedons it has brownish or yellowish mottles and calcium carbonate concretions are common. It is mildly alkaline or moderately alkaline.

Wilson series

The Wilson series consists of deep, loamy soils on terraces. These soils formed in alkaline clayey sediments. Native vegetation consists mainly of mid and tall grasses. Slope ranges from 0 to 1 percent.

Typical pedon of Wilson loam, 0 to 1 percent slopes; from the intersection of Farm Road 85 and Farm Road 90 in Gun Barrel City, 2.6 miles south on Farm Road 90, 0.65 mile east on county road, 300 feet north of road:

A1—0 to 6 inches; grayish brown (10YR 5/2) loam; weak fine and medium subangular blocky structure; hard, friable; common fine and medium roots; few worm casts; medium acid; abrupt wavy boundary.

B21tg—6 to 40 inches; very dark gray (10YR 3/1) clay; moderate medium subangular blocky structure; extremely hard, very firm; common fine through coarse roots; vertical cracks filled with material from A1 horizon; common pressure faces; medium acid; clear wavy boundary.

B22tg—40 to 47 inches; dark grayish brown (10YR 4/2) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; common gypsum crystals; few fine black concretions; neutral; clear wavy boundary.

B23tg—47 to 71 inches; light brownish gray (10YR 6/2) clay; common fine distinct yellowish brown and brownish yellow mottles; weak coarse subangular blocky structure; extremely hard, very firm; common gypsum crystals; few fine soft black masses; neutral.

The solum ranges from 55 to 74 inches in thickness. Calcium carbonate concretions and gypsum crystals are in the lower part of most pedons.

The A horizon is 3 to 7 inches thick. It is dark grayish brown, grayish brown, very dark grayish brown, very dark gray, or dark gray. Reaction ranges from medium acid through neutral.

The B21tg is very dark gray or black. It ranges from medium acid through neutral. The lower part of the Btg horizon is dark gray, dark grayish brown, grayish brown,

or light brownish gray. In some pedons it is mottled in these colors and also in shades of yellow, brown, red, and olive. It ranges from neutral through moderately alkaline.

Wolfpen series

The Wolfpen series consists of deep, sandy soils on uplands. These soils formed in loamy or sandy unconsolidated sediments. Native vegetation consists of pine and hardwood trees and mid and tall grasses. Slope ranges from 1 to 12 percent.

Typical pedon of Wolfpen loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 31 and Farm Road 2495 in Athens, 0.7 mile northeast on Texas Highway 31, 1.4 miles north on Farm Road 1616, 0.4 mile north on dirt lane to a cattleguard, and 1,800 feet north in pasture:

Ap—0 to 7 inches; brown (10YR 5/3) loamy fine sand; weak fine subangular blocky structure; loose, very friable; many fine and medium roots; neutral; clear smooth boundary.

A2—7 to 28 inches; pale brown (10YR 6/3) loamy fine sand; single grained; loose, very friable; common fine and medium roots; neutral; clear wavy boundary.

B21t—28 to 43 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium prominent red (2.5YR 4/6) mottles; weak medium and coarse subangular blocky structure; very hard, firm; few fine roots; many very fine pores; patchy clay films; common light gray sand coatings on surface of some peds; medium acid; gradual wavy boundary.

B22t—43 to 65 inches; mottled gray (10YR 6/1), yellowish brown (10YR 5/6), and red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; few fine roots; patchy clay films; strongly acid; gradual wavy boundary.

B3—65 to 80 inches; gray (10YR 6/1) sandy clay loam; common fine and medium prominent red (2.5YR 4/6) and common fine and medium distinct brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; very hard, firm; few very fine roots; patchy clay films; very strongly acid.

The solum is more than 70 inches thick.

The A horizon is 20 to 40 inches thick. The Al or Ap horizon is brown, dark yellowish brown, or dark grayish brown. The A2 horizon is pale brown, light yellowish brown, very pale brown, or yellowish brown. Reaction of the A horizon ranges from strongly acid through neutral.

The B2t horizon is yellowish brown or strong brown. It has mottles of red, yellowish red, brownish yellow, dark gray, gray, grayish brown, and light brownish gray. Mottles range from few to common in the upper part to a mottled matrix in the lower part. The B2t horizon is sandy clay loam, clay loam, or loam and ranges from very strongly acid through slightly acid. The B3 horizon is gray or is mottled in the same colors as the B2t horizon. It is sandy clay loam, clay loam, or loam and ranges from very strongly acid through slightly acid.

Woodtell series

The Woodtell series consists of deep, loamy soils on uplands. These soils formed in acid, unconsolidated, stratified loamy, clayey, or shaley deposits. Native vegetation consists of hardwood trees and mid and tall grasses. Slope ranges from 1 to 15 percent.

Typical pedon of Woodtell loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 175 and Texas Highway 31 in Athens, 3.6 miles west on Texas Highway 31, 0.3 mile south on county road, and 600 feet east in pasture:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; slightly hard, friable; many very fine to medium roots; common worm casts; medium acid; clear smooth boundary.

A2—5 to 8 inches; brown (10YR 4/3) loam; massive; slightly hard, friable; common very fine to medium roots; common worm casts; slightly acid; abrupt wavy boundary.

B21t—8 to 20 inches; red (2.5YR 4/8) clay; common medium distinct brownish yellow (10YR 6/6) mottles; moderate fine and medium subangular blocky structure; extremely hard, firm; common very fine to coarse roots; continuous clay films on surface of peds; common pressure faces; very strongly acid; clear wavy boundary.

B22t—20 to 31 inches; mottled red (2.5YR 4/8), brownish yellow (10YR 6/6), light brownish gray (10YR 6/2), and pale brown (10YR 6/3) clay loam; moderate fine and medium subangular blocky structure; very hard, firm; common very fine to medium roots; continuous clay films on surface of peds; very strongly acid; gradual wavy boundary.

B23t—31 to 54 inches; light brownish gray (10YR 6/2) sandy clay loam; common medium distinct red (2.5YR 4/6) and brownish yellow (10YR 6/6) mottles; moderate coarse prismatic structure parting to fine and medium subangular blocky; very hard, firm; common fine and medium roots along surface of peds; patchy clay films; less than 5 percent uncoated sand grains along surface of some peds; very strongly acid; gradual wavy boundary.

C—54 to 80 inches; alternating layers of yellowish red (5YR 5/6), pale brown (10YR 6/3), and brownish yellow (10YR 6/8) sandy clay loam and sandy loam; massive; few very fine roots; common fine masses of white neutral salts; strongly acid.

The solum ranges from 40 to 60 inches in thickness. The A1 horizon is 3 to 12 inches thick. It is very dark grayish brown, dark grayish brown, dark brown, brown, and dark yellowish brown. The A2 horizon, when present, is one or two units of color value higher. Reaction of the A horizon ranges from strongly acid through slightly acid.

The B21 horizon is red or yellowish red. In some pedons it is mottled in shades of brown, yellow, and gray. Reaction is strongly acid or very strongly acid. The lower part of the B2t horizon is mottled with the same colors as the B21t horizon or the matrix is dark yellowish brown, dark grayish brown, light brownish gray, gray, or light gray. It is clay, clay loam, or sandy clay loam and ranges from very strongly acid through medium acid.

The C horizon is sandy loam or sandy clay loam or stratified shale and soft sandstone. It ranges from strongly acid through slightly acid.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*5*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Ultisol.

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

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

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is clayey, mixed, thermic, Typic Hapludults.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is the Cuthbert series, a member of the clayey, mixed, thermic family of Typic Hapludults.

Formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

Factors of soil formation

The characteristics of the soil at any given point are determined by the physical and mineral composition of the parent material; the climate under which the parent material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. All five of these factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor

may dominate the formation of a soil, and in another area a different factor may be more important.

The interrelationship among these five factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient to discuss each factor separately however, and to indicate the probable effects of each.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the chemical and mineral composition of the soil. In Henderson County the parent material consists of unconsolidated sediment of Paleocene, Eocene, Pleistocene, and Recent age.

The soils formed from the Eocene formations cover most of the survey area. These soils are mainly sandy or loamy. For example, the Tonkawa soils formed in thick beds of sand. These soils consist of highly resistant quartz sand and lack clay-enriched horizons. Bernaldo and Gallime soils developed in loamy deposits. These soils have clay-enriched horizons that contain concentrations of iron oxide.

The soils formed from the Fluviatile terraces of Pleistocene age are along the sides of the bottom lands of the Trinity River and Cedar Creek. They consist of sandy and loamy sediments. Dutek and Silawa soils are the main examples.

Soils that formed in recent alluvium are on bottom lands along streams throughout the county. These soils are loamy or clayey. Nahatche, Trinity, and Kaufman soils are the main soils of this group.

Climate

The climate of Henderson County is warm and humid. Its dominant influence on soil development in the county has been through the amount and distribution of rainfall. The moderate amount of rainfall has promoted rapid soil development. Climate is uniform throughout the area, although its effect on the formation of soils is modified locally by runoff. Therefore, the differences in the soils of the survey area are probably not due to climate.

Plant and animal life

In Henderson County, plants, animals, micro-organisms, earthworms, and other forms of living organisms have contributed to the development of the soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are some of the changes caused by plant and animal life.

Vegetation, dominantly trees, has affected soil formation in the survey area more than animals. Soils that form under trees are generally low in organic-matter content.

Relief

Relief or topography affects soil formation through its effect on drainage, erosion, plant cover, and soil temperature.

In Henderson County the degree of profile development or horizonation, depends mainly on slope. The nearly level soils, such as Deport and Derly soils in the western part of the county, receive excess water and have developed gleyed characteristics. Because the soils are somewhat poorly drained and have wet characteristics, horizons show little development. Soils in more sloping areas, such as Wolfpen, Pickton, and Bernaldo soils, exhibit characteristics of better drained soils, which have distinct horizonation throughout. Soils that have steep slopes, in the eastern part of the county, such as Cuthbert soils, have very distinct horizonation.

Plant cover is thinner than normal in many of the more sloping areas. This increases the risk of erosion, and the soils are not developed to as great a depth as in other less sloping areas.

Time

The length of time that the soil-forming factors have acted on the parent material determines, to a large degree, the characteristics of the soil. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of soil horizons. Young soils have very little horizon development, and old soils have well-expressed horizons. In Henderson County, Trinity and Kaufman soils are examples of young soils. These soils retain most of the characteristics of their clayey parent material. Cuthbert soils are an example of older soils that have well developed horizons. The Cuthbert soils have distinct A and Bt horizons that bear little resemblance to the original parent material.

Processes of soil horizon differentiation

Several processes were involved in the formation of horizons in the soils of Henderson County: accumulation of organic matter, leaching of calcium carbonates and bases, and formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the upper part of the profile helps to form an A1 horizon. The soils in the survey area range from low to medium in organic matter.

Leaching of carbonates and bases occurred in most of the soils. The amount of rainfall has been great enough to cause this leaching, and this condition contributes to the formation of horizons. Once this leaching has occurred, the soils tend to become acid.

In many soils of the survey area, such as Axtell, Woodtell, Kirvin, and Cuthbert soils, the downward translocation of clay minerals has contributed to horizon de-

velopment. The Bt horizon contains appreciably more silicate clay than the A horizon.

Prior to the downward movement of silicate clays, the parent materials were leached of some carbonates and soluble salts. The leaching and movement of the materials are among the more important processes responsible for the development of horizons in the soils of the survey area.

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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.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

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 coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated

compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

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 running water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant 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.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Gypsum. Hydrous calcium sulphate.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:
O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.
A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.
A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06

inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential, soil. The expected suitability of a soil for specific uses.

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

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

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

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

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

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 that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water. *Water table, apparent.* A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data were recorded in the period 1954-75 at Athens, Texas]

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[1]	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	58.6	36.8	47.7	82	12	63	2.53	1.23	3.59	5	.4
February	62.9	39.6	51.3	84	17	124	3.01	1.68	4.09	5	.3
March	69.5	45.8	57.7	88	23	277	2.65	1.27	3.77	5	.0
April	78.5	55.8	67.2	90	33	516	4.49	1.98	6.53	6	.0
May	84.6	62.5	73.6	94	46	732	5.15	2.59	7.23	5	.0
June	91.0	68.5	79.8	99	53	894	3.18	1.04	4.89	5	.0
July	96.1	71.6	83.9	106	61	1,051	1.52	.59	2.28	3	.0
August	95.8	70.7	83.3	105	59	1,032	2.47	.70	3.90	3	.0
September	88.8	66.0	77.4	101	48	822	4.54	2.36	6.41	5	.0
October	80.4	55.9	68.2	93	36	564	4.42	1.17	7.02	4	.0
November	69.5	45.9	57.7	86	24	263	3.38	1.47	4.93	4	.0
December	61.7	39.3	50.5	81	16	117	3.17	1.31	4.67	5	.1
Yearly:											
Average	78.1	54.9	66.5	---	---	---	---	---	---	---	---
Extreme	---	---	---	106	10	---	---	---	---	---	---
Total	---	---	---	---	---	6,455	40.51	33.27	47.50	55	.8

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1954-75 at Athens, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 14	March 22	April 5
2 years in 10 later than--	March 6	March 16	March 30
5 years in 10 later than--	February 18	March 5	March 19
First freezing temperature in fall:			
1 year in 10 earlier than--	November 20	November 10	October 29
2 years in 10 earlier than--	November 29	November 19	November 5
5 years in 10 earlier than--	December 17	December 5	November 19

TABLE 3.--GROWING SEASON LENGTH

[Data were recorded in the period 1954-75 at Athens, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	266	245	215
8 years in 10	278	255	225
5 years in 10	301	275	244
2 years in 10	323	294	263
1 year in 10	335	304	273

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Axtell loam, 1 to 5 percent slopes	29,090	4.8
2	Axtell loam, 5 to 12 percent slopes	22,720	3.8
3	Bernaldo fine sandy loam, 1 to 4 percent slopes	23,060	3.8
4	Bernaldo-Urban land complex, 1 to 4 percent slopes	200	*
5	Burleson clay, 0 to 1 percent slopes	1,770	0.3
6	Crockett loam, 1 to 3 percent slopes	3,910	0.6
7	Cuthbert fine sandy loam, 8 to 20 percent slopes	44,820	7.4
8	Cuthbert very gravelly fine sandy loam, 12 to 30 percent slopes	8,170	1.4
9	Deport clay, 0 to 1 percent slopes	3,330	0.6
10	Derly-Rader complex	19,900	3.3
11	Dutek loamy fine sand, 1 to 5 percent slopes	3,320	0.5
12	Dutek loamy fine sand, 5 to 12 percent slopes	1,710	0.2
13	Elrose fine sandy loam, 1 to 5 percent slopes	5,250	0.9
14	Eufaula fine sand, 1 to 8 percent slopes	3,440	0.6
15	Ferris clay, 4 to 8 percent slopes	1,040	0.2
16	Freestone fine sandy loam, 1 to 3 percent slopes	27,810	4.6
17	Gallime fine sandy loam, 1 to 5 percent slopes	4,890	0.8
18	Gladewater clay, frequently flooded	4,900	0.8
19	Kaufman clay, rarely flooded	7,370	1.2
20	Kaufman clay, frequently flooded	2,210	0.4
21	Kirvin fine sandy loam, 2 to 5 percent slopes	6,780	1.1
22	Kirvin-Urban land complex, 2 to 5 percent slopes	370	0.1
23	Kirvin soils, graded	840	0.1
24	Larue loamy fine sand, 1 to 8 percent slopes	5,550	0.9
25	Leagueville-Henco complex, 1 to 5 percent slopes	11,060	1.8
26	Lufkin-Raino complex	6,850	1.1
27	Nahatche loam, frequently flooded	52,850	8.7
28	Normangee clay loam, 2 to 5 percent slopes, eroded	1,710	0.3
29	Pickton loamy fine sand, 1 to 8 percent slopes	72,210	11.9
30	Pickton loamy fine sand, 8 to 15 percent slopes	32,190	5.3
31	Pickton-Urban land complex, 1 to 8 percent slopes	1,090	0.2
32	Pits	860	0.1
33	Silawa fine sandy loam, 1 to 5 percent slopes	2,770	0.5
34	Silawa fine sandy loam, 5 to 12 percent slopes	3,130	0.5
35	Styx loamy fine sand, 1 to 5 percent slopes	8,840	1.5
36	Tonkawa fine sand, 1 to 5 percent slopes	13,140	2.2
37	Tonkawa fine sand, 5 to 12 percent slopes	3,920	0.7
38	Tonkawa-Urban land complex, 1 to 5 percent slopes	560	0.1
39	Trawick gravelly fine sandy loam, 12 to 20 percent slopes	4,410	0.7
40	Trinity clay, rarely flooded	2,810	0.5
41	Trinity clay, frequently flooded	18,710	3.1
42	Wilson loam, 0 to 1 percent slopes	2,210	0.4
43	Wolfpen loamy fine sand, 1 to 5 percent slopes	48,340	8.0
44	Wolfpen loamy fine sand, 5 to 12 percent slopes	10,690	1.8
45	Woodtell loam, 1 to 5 percent slopes	11,980	2.0
46	Woodtell loam, 5 to 15 percent slopes	19,010	3.1
	Water	43,010	7.1
	Total	604,800	100.0

* Less than 0.1 percent.

TABLE 5.--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	Corn	Grain sorghum	Peanuts	Dry peas	Improved bermudagrass
	Bu	Bu	Lb	Lb	AUM*
1---------- Axtell	35	40	---	---	7.0
2---------- Axtell	---	---	---	---	5.0
3---------- Bernaldo	65	50	1,800	1,000	8.0
4---------- Bernaldo-Urban land	---	---	---	---	---
5---------- Burleson	65	85	---	---	8.0
6---------- Crockett	40	54	---	---	7.5
7---------- Cuthbert	---	---	---	---	7.0
8---------- Cuthbert	---	---	---	---	5.0
9---------- Deport	50	70	---	---	6.5
10---------- Derly-Rader	---	---	---	---	6.0
11---------- Dutek	40	---	---	---	5.0
12---------- Dutek	25	---	---	---	4.5
13---------- Elrose	55	---	1,500	900	8.0
14---------- Eufaula	---	---	---	---	3.5
15---------- Ferris	---	---	---	---	4.5
16---------- Freestone	60	---	---	---	9.0
17---------- Gallime	75	---	2,000	1,100	8.0
18---------- Gladewater	---	---	---	---	7.0
19---------- Kaufman	75	105	---	---	9.0
20---------- Kaufman	---	---	---	---	8.5
21---------- Kirvin	45	---	1,300	---	9.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Grain sorghum	Peanuts	Dry peas	Improved bermudagrass
	Bu	Bu	Lb	Lb	AUM*
22--Kirvin-Urban land	---	---	---	---	---
23--Kirvin	---	---	---	---	6.0
24--Larue	55	---	1,200	800	6.0
25--Leagueville-Henco	---	---	---	---	5.3
26--Lufkin-Raino	46	56	---	---	6.3
27--Nahatche	---	---	---	---	9.0
28--Normangee	---	---	---	---	6.0
29--Pickton	50	---	1,300	700	6.5
30--Pickton	35	---	1,100	600	6.5
31--Pickton-Urban land	---	---	---	---	---
32**. Pits					
33--Silawa	50	45	---	---	6.0
34--Silawa	---	---	---	---	4.0
35--Styx	30	---	1,100	---	7.0
36--Tonkawa	---	---	1,200	600	5.0
37--Tonkawa	---	---	---	---	4.5
38--Tonkawa-Urban land	---	---	---	---	---
39--Trawick	---	---	---	---	6.0
40--Trinity	60	100	---	---	8.0
41--Trinity	---	---	---	---	8.0
42--Wilson	45	55	---	---	6.0
43--Wolfpen	70	---	1,400	800	7.0
44--Wolfpen	55	---	---	---	7.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Grain sorghum	Peanuts	Dry peas	Improved bermudagrass
	Bu	Bu	Lb	Lb	AUM*
45---------- Woodtell	45	55	---	---	7.5
46---------- Woodtell	---	---	---	---	6.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	67,710	55,760	4,580	7,370	---
III	231,159	77,775	21,322	132,062	---
IV	66,770	53,350	---	13,420	---
V	89,730	---	89,730	---	---
VI	96,280	96,280	---	---	---
VII	8,170	8,170	---	---	---
VIII	---	---	---	---	---

TABLE 7.--NATIVE GRAZING LAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support native vegetation suitable for grazing are listed]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
1, 2----------	Favorable	5,000	Little bluestem----------	25
Axtell*	Normal	3,500	Indiangrass----------	10
	Unfavorable	2,500	Beaked panicum----------	5
			Purpletop----------	5
			Florida paspalum----------	5
			Tall dropseed----------	5
3----------	Favorable	2,500	Pinehill bluestem----------	20
Bernaldo*	Normal	2,000	Beaked panicum----------	20
	Unfavorable	1,500	Longleaf uniola----------	20
			Panicum----------	10
			Purpletop----------	5
5----------	Favorable	7,000	Little bluestem----------	40
Burleson	Normal	5,500	Indiangrass----------	15
	Unfavorable	4,000	Big bluestem----------	15
			Texas needlegrass----------	5
			Silver bluestem----------	5
			Tall dropseed----------	5
6----------	Favorable	6,000	Little bluestem----------	10
Crockett	Normal	5,000	Indiangrass----------	10
	Unfavorable	3,000	Virginia wildrye----------	10
			Florida paspalum----------	10
			Texas needlegrass----------	10
			Silver bluestem----------	10
			Paspalum----------	10
			Big bluestem----------	5
			Post oak----------	5
7, 8----------	Favorable	2,500	Pinehill bluestem----------	20
Cuthbert*	Normal	2,000	Beaked panicum----------	20
	Unfavorable	1,250	Longleaf uniola----------	10
			Panicum----------	10
			Big bluestem----------	5
			Purpletop----------	5
			Indiangrass----------	5
9----------	Favorable	5,000	Sedge----------	15
Deport	Normal	4,000	Panicum----------	15
	Unfavorable	2,500	Paspalum----------	15
			Little bluestem----------	10
			Virginia wildrye----------	10
			Indiangrass----------	5
			Purpletop----------	5
			Big bluestem----------	5
10**:				
Derly*----------	Favorable	6,500	Virginia wildrye----------	15
	Normal	4,500	Florida paspalum----------	15
	Unfavorable	3,000	Little bluestem----------	10
			Beaked panicum----------	10
			Switchcane----------	10
			Redtop panicum----------	10
Rader----------	Favorable	6,000	Little bluestem----------	40
	Normal	4,500	Post oak----------	10
	Unfavorable	3,500	Indiangrass----------	5
			Switchgrass----------	5
			Eastern gamagrass----------	5
			Paspalum----------	5
			Purpletop----------	5
			Beaked panicum----------	5
			Sedge----------	5
			Longleaf uniola----------	5

See footnote at end of table.

TABLE 7.--NATIVE GRAZING LAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
11, 12---------- Dutek	Favorable	4,500	Little bluestem----------	35
	Normal	4,000	Indiangrass----------	10
	Unfavorable	2,000	Post oak----------	10
			Blackjack oak----------	10
			Switchgrass----------	5
			Purpletop----------	5
			Silver bluestem----------	5
			Greenbrier----------	5
13---------- Elrose*	Favorable	4,000	Longleaf----------	15
	Normal	2,500	Indiangrass----------	10
	Unfavorable	1,500	Little bluestem----------	10
			Big bluestem----------	10
			Panicum----------	10
14---------- Eufaula	Favorable	4,000	Little bluestem----------	25
	Normal	2,800	Big bluestem----------	10
	Unfavorable	2,000	Sand bluestem----------	10
			Post oak----------	10
			Indiangrass----------	5
			Switchgrass----------	5
			Purpletop----------	5
			Arrowfeather threeawn----------	5
			Scribner panicum----------	5
			Lespedeza----------	5
15---------- Ferris	Favorable	7,000	Little bluestem----------	30
	Normal	5,500	Indiangrass----------	15
	Unfavorable	4,000	Big bluestem----------	15
			Switchgrass----------	5
			Florida paspalum----------	5
			Eastern gamagrass----------	5
			Virginia wildrye----------	5
			Texas needlegrass----------	5
			Meadow dropseed----------	5
16---------- Freestone*	Favorable	2,500	Little bluestem----------	15
	Normal	1,750	Beaked panicum----------	15
	Unfavorable	1,000	Longleaf uniola----------	15
			Purpletop----------	10
			Panicum----------	10
17---------- Gallime*	Favorable	3,000	Pinehill bluestem----------	20
	Normal	2,500	Beaked panicum----------	20
	Unfavorable	2,000	Longleaf uniola----------	20
			Purpletop----------	5
			Panicum----------	5
			American beautyberry----------	5
			Sassafras----------	5
			Greenbrier----------	5
18---------- Gladewater*	Favorable	8,000	Virginia wildrye----------	10
	Normal	6,000	Beaked panicum----------	10
	Unfavorable	4,000	Sedge----------	10
			Panicum----------	10
			Eastern gamagrass----------	10
			Switchgrass----------	10
			Vine-mesquite----------	10
			Purpletop----------	5
			Giant cane----------	5
			Paspalum----------	5

See footnote at end of table.

TABLE 7.--NATIVE GRAZING LAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
19, 20----------	Favorable	7,500	Virginia wildrye----------	15
Kaufman*	Normal	6,000	Sedge----------	10
	Unfavorable	4,000	Beaked panicum----------	10
			Eastern gamagrass----------	10
			Panicum----------	10
			Rustyseed paspalum----------	5
			Switchgrass----------	5
			Hackberry----------	5
21----------	Favorable	2,500	Longleaf uniola----------	15
Kirvin*	Normal	1,750	Pinehill bluestem----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Purpletop----------	10
			Giant cane----------	10
			Brownseed paspalum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
23**----------	Favorable	2,500	Longleaf uniola----------	15
Kirvin	Normal	1,750	Pinehill bluestem----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Purpletop----------	10
			Giant cane----------	10
			Brownseed paspalum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
24----------	Favorable	5,000	Pinehill bluestem----------	20
Larue*	Normal	3,500	Indiangrass----------	10
	Unfavorable	2,500	Longleaf uniola----------	10
			Switchgrass----------	10
			Purpletop----------	5
25**:				
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
Henco*----------	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
26**:				
Lufkin*----------	Favorable	5,000	Little bluestem----------	40
	Normal	4,000	Indiangrass----------	10
	Unfavorable	2,500	Brownseed paspalum----------	10
			Purpletop----------	5
			Post oak----------	5
			Blackjack oak----------	5

See footnote at end of table.

TABLE 7.--NATIVE GRAZING LAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
26**:				
Raino*	Favorable	2,500	Little bluestem	15
	Normal	1,750	Beaked panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			Panicum	10
27	Favorable	5,500	Hairy wildrye	20
Nahatche*	Normal	4,500	Rustyseed paspalum	15
	Unfavorable	3,000	Hairy panicum	10
			Panicum	5
			Bentawn plumegrass	5
			Switchcane	5
28	Favorable	5,500	Little bluestem	45
Normangee	Normal	4,000	Indiangrass	15
	Unfavorable	3,000	Big bluestem	10
			Switchgrass	10
			Florida paspalum	5
29, 30	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
33, 34	Favorable	5,500	Little bluestem	50
Silawa	Normal	4,500	Indiangrass	10
	Unfavorable	2,500	Switchgrass	5
			Purpletop	5
			Fall witchgrass	5
35	Favorable	5,500	Little bluestem	30
Styx	Normal	4,500	Indiangrass	10
	Unfavorable	3,000	Switchgrass	10
			Post oak	10
			Sand lovegrass	5
			Purpletop	5
			Beaked panicum	5
			Brownseed paspalum	5
			Panicum	5
			Paspalum	5
36, 37	Favorable	3,000	Broomsedge bluestem	20
Tonkawa*	Normal	2,000	Pinehill bluestem	20
	Unfavorable	1,200	Arrowfeather threeawn	15
			Panicum	10
			Indiangrass	10
39	Favorable	3,200	Longleaf uniola	20
Trawick*	Normal	2,000	Indiangrass	15
	Unfavorable	1,200	Panicum	10
			Pinehill bluestem	10
			Sedge	10

See footnote at end of table.

TABLE 7.--NATIVE GRAZING LAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
40, 41---------- Trinity*	Favorable	6,500	Virginia wildrye----------	15
	Normal	4,000	Sedge----------	15
	Unfavorable	3,000	Eastern gamagrass----------	10
			Switchgrass----------	10
			Indiangrass----------	10
			Giant cane----------	5
			Beaked panicum----------	5
			Panicum----------	5
42---------- Wilson	Favorable	6,000	Little bluestem----------	45
	Normal	4,500	Indiangrass----------	10
	Unfavorable	3,000	Big bluestem----------	10
			Virginia wildrye----------	5
			Vine-mesquite----------	5
			Florida paspalum----------	5
			Texas needlegrass----------	5
			Silver bluestem----------	5
43, 44---------- 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
45, 46---------- Woodtell*	Favorable	3,500	Pinehill bluestem----------	20
	Normal	2,500	Panicum----------	10
	Unfavorable	2,000	Sedge----------	10
			Brownseed paspalum----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Purpletop----------	5
			Carolina jointtail----------	5
			Knotroot bristlegrass----------	5
			Splitbeard bluestem----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.
** This soil is capable of producing commercial timber; the plants listed under characteristic vegetation are understory vegetation.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

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	
1, 2---------- Axtell	4c	Slight	Slight	Severe	Moderate	Post oak----------	50	Loblolly pine.
						Eastern redcedar----	35	
						Loblolly pine-------	70	
3---------- Bernaldo	2o	Slight	Slight	Slight	Slight	Loblolly pine-------	90	Loblolly pine, slash pine, sweetgum.
						Shortleaf pine------	80	
						Sweetgum----------	---	
						Southern red oak----	---	
7---------- Cuthbert	4c	Moderate	Slight	Slight	Slight	Loblolly pine-------	70	Loblolly pine, shortleaf pine.
						Shortleaf pine------	60	
8---------- Cuthbert	4r	Moderate	Moderate	Slight	Moderate	Loblolly pine-------	70	Loblolly pine, shortleaf pine.
						Shortleaf pine------	60	
10*:								
Derly----------	4w	Slight	Severe	Moderate	Severe	Water oak----------	70	Water oak, sweetgum, willow oak.
						Willow oak----------	70	
Rader.								
13---------- Elrose	2o	Slight	Slight	Slight	Slight	Loblolly pine-------	89	Loblolly pine, shortleaf pine.
						Shortleaf pine------	85	
						Sweetgum----------	90	
						Southern red oak----	---	
16---------- Freestone	3w	Slight	Moderate	Slight	Moderate	Loblolly pine-------	80	Loblolly pine, slash pine, shortleaf pine.
						Shortleaf pine------	70	
						Sweetgum----------	80	
17---------- Gallime	2o	Slight	Slight	Slight	Slight	Loblolly pine-------	90	Loblolly pine, slash pine.
						Shortleaf pine------	80	
						Sweetgum----------	---	
						Southern red oak----	---	
18---------- Gladewater	2w	Slight	Severe	Moderate	Severe	Water oak----------	90	Water oak, sweetgum.
						Willow oak----------	90	
						Green ash----------	---	
19, 20---------- Kaufman	1w	Slight	Moderate	Moderate	Severe	Eastern cottonwood--	110	Eastern cottonwood, green ash, pecan, sweetgum.
						Sweetgum----------	100	
						Water oak----------	---	
						Green ash----------	---	
21---------- Kirvin	3o	Slight	Slight	Slight	Slight	Loblolly pine-------	80	Loblolly pine, slash pine.
						Shortleaf pine------	70	
23*---------- Kirvin	4c	Moderate	Moderate	Moderate	Slight	Loblolly pine-------	70	Loblolly pine.
						Shortleaf pine------	60	
24---------- Larue	3s	Slight	Moderate	Moderate	Moderate	Loblolly pine-------	80	Loblolly pine, shortleaf pine.
						Shortleaf pine------	70	
						Longleaf pine-------	70	
						Southern red oak----	---	
						Sweetgum----------	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
25*:								
Leagueville	3w	Slight	Severe	Severe	Severe	Loblolly pine	80	Loblolly pine, slash pine, sweetgum, southern red oak.
						Sweetgum	80	
						Water oak	80	
						Southern red oak	70	
Henco	3w	Slight	Severe	Severe	Severe	Water oak	80	Loblolly pine, slash pine, sweetgum, southern red oak.
						Sweetgum	80	
						Southern red oak	70	
26*:								
Lufkin	5w	Slight	Moderate	Severe	Slight	Loblolly pine	60	Loblolly pine.
						Shortleaf pine	50	
Raino	3w	Slight	Moderate	Slight	Moderate	Loblolly pine	80	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	
27 Nahatche	1w	Slight	Severe	Moderate	Slight	Water oak	100	Eastern cottonwood, water oak.
						Willow oak	100	
						Eastern cottonwood	100	
						Loblolly pine	100	
29, 30 Pickton	4s	Slight	Slight	Moderate	Moderate	Loblolly pine	70	Loblolly pine, slash pine, southern red oak.
						Shortleaf pine	60	
						Southern red oak	60	
36, 37 Tonkawa	5s	Slight	Moderate	Severe	Slight	Shortleaf pine	55	Loblolly pine, slash pine.
						Loblolly pine	---	
						Longleaf pine	---	
39 Trawick	4r	Moderate	Moderate	Slight	Slight	Loblolly pine	70	Loblolly pine.
						Shortleaf pine	60	
						Southern red oak	60	
40 Trinity	1w	Slight	Severe	Moderate	Severe	Eastern cottonwood	106	Eastern cottonwood, green ash.
						Pin oak	---	
						Green ash	---	
43, 44 Wolfpen	3s	Slight	Slight	Moderate	Moderate	Loblolly pine	80	Loblolly pine, slash pine, shortleaf pine.
						Shortleaf pine	70	
45 Woodtell	4c	Slight	Moderate	Moderate	Moderate	Loblolly pine	70	Slash pine, loblolly pine.
						Shortleaf pine	60	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Axtell	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
2 Axtell	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
3 Bernaldo	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
4*: Bernaldo	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
Urban land.					
5 Burleson	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
6 Crockett	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
7 Cuthbert	Severe: too clayey.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Severe: low strength.
8 Cuthbert	Severe: too clayey, slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: low strength, slope.
9 Deport	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
10*: Derly	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, corrosive, shrink-swell.	Severe: wetness, low strength, shrink-swell.
Rader	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Moderate: low strength, wetness.
11 Dutek	Moderate: cutbanks cave.	Slight	Slight	Slight	Slight.
12 Dutek	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
13 Elrose	Slight	Slight	Slight	Slight	Severe: low strength.
14 Eufaula	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
15--- Ferris	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
16--- Freestone	Severe: wetness, too clayey.	Moderate: shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness.	Severe: low strength, shrink-swell.
17--- Gallime	Moderate: wetness, too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, wetness, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength.
18--- Gladewater	Severe: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
19--- Kaufman	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: shrink-swell, low strength, wetness.
20. Kaufman					
21--- Kirvin	Moderate: too clayey, depth to rock.	Moderate: low strength, shrink-swell.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
22*: Kirvin---	Moderate: too clayey, depth to rock.	Moderate: low strength, shrink-swell.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
Urban land.					
23*--- Kirvin	Moderate: too clayey, slope, depth to rock.	Moderate: slope, low strength, shrink-swell.	Moderate: low strength, slope, shrink-swell.	Severe: slope.	Severe: low strength.
24--- Larue	Slight---	Slight---	Slight---	Moderate: slope.	Slight.
25*: Leagueville---	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
Henco---	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
26*: Lufkin---	Severe: wetness, too clayey.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
Raino---	Severe: wetness, too clayey.	Moderate: shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness.	Severe: low strength.
27--- Nahatche	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
28---------- Normangee	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
29---------- Pickton	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Moderate: slope.	Slight.
30---------- Pickton	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.
31*: Pickton----------	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Moderate: slope.	Slight.
Urban land.					
32*. Pits					
33---------- Silawa	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
34---------- Silawa	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
35---------- Styx	Moderate: wetness.	Slight----------	Moderate: wetness.	Moderate: wetness.	Slight.
36---------- Tonkawa	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
37---------- Tonkawa	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
38*: Tonkawa----------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
Urban land.					
39---------- Trawick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
40---------- Trinity	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: shrink-swell, low strength.
41---------- Trinity	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, low strength.
42---------- Wilson	Severe: wetness, too clayey.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.
43---------- Wolfpen	Moderate: wetness.	Slight----------	Moderate: wetness.	Slight----------	Slight.
44---------- Wolfpen	Moderate: wetness.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
45---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
46---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: low strength, shrink-swell, slope.	Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Axtell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
2 Axtell	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
3 Bernaldo	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Good.
4*: Bernaldo	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Good.
Urban land.					
5 Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
6 Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
7 Cuthbert	Severe: percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
8 Cuthbert	Severe: percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer.
9 Deport	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
10*: Derly	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, thin layer.
Rader	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Moderate: wetness.	Poor: thin layer.
11 Dutek	Slight	Moderate: seepage, slope.	Severe: too sandy, seepage.	Slight	Fair: too sandy.
12 Dutek	Slight	Severe: slope.	Severe: too sandy, seepage.	Slight	Fair: too sandy.
13 Elrose	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
14 Eufaula	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
15 Ferris	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 10.--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
16--Freestone	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
17--Gallime	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Good.
18--Gladewater	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, wetness.
19--Kaufman	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
20--Kaufman	Severe: percs slowly, floods, wetness.	Slight	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
21--Kirvin	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
22*: Kirvin	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, depth to rock.	Slight	Fair: too clayey.
Urban land.					
23*--Kirvin	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, depth to rock.	Moderate: slope.	Fair: too clayey.
24--Larue	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: too sandy.
25*: Leagueville	Severe: wetness.	Severe: wetness, seepage, floods.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, wetness.
Henco	Severe: wetness.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, wetness.
26*: Lufkin	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
Raino	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Severe: wetness.	Fair: thin layer.
27--Nahatche	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
28--Normangee	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 10.--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
29--Pickton	Moderate: wetness.	Severe: seepage.	Severe: wetness, too sandy, seepage.	Severe: seepage.	Fair: too sandy.
30--Pickton	Moderate: slope, wetness.	Severe: slope, seepage.	Severe: wetness, too sandy, seepage.	Severe: seepage.	Fair: too sandy, slope.
31*: Pickton	Moderate: wetness.	Severe: seepage.	Severe: wetness, too sandy, seepage.	Severe: seepage.	Fair: too sandy.
Urban land.					
32*. Pits					
33, 34--Silawa	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
35--Styx	Moderate: wetness.	Moderate: seepage, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too sandy.
36--Tonkawa	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
37--Tonkawa	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
38*: Tonkawa	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
Urban land.					
39--Trawick	Severe: percs slowly.	Severe: slope.	Moderate: depth to rock.	Severe: slope.	Poor: thin layer.
40--Trinity	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: too clayey, wetness.
41--Trinity	Severe: wetness, floods, percs slowly.	Slight	Severe: floods, too clayey, wetness.	Severe: wetness, floods.	Poor: too clayey, wetness.
42--Wilson	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer, wetness.
43--Wolfpen	Moderate: wetness, percs slowly.	Severe: seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: too sandy.
44--Wolfpen	Moderate: slope, wetness, percs slowly.	Severe: slope, seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: too sandy, slope.

See footnote at end of table.

TABLE 10.--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
45---------- Woodtell	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
46---------- Woodtell	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2---------- Axtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
3---------- Bernaldo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4*: Bernaldo----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Urban land.				
5---------- Burleson	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
6---------- Crockett	Poor: shrink-swell, low strength.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer.
7---------- Cuthbert	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
8---------- Cuthbert	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, slope.
9---------- Deport	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
10*: Derly----------	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
Rader----------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11, 12---------- Dutek	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
13---------- Elrose	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
14---------- Eufaula	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
15---------- Ferris	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
16---------- Freestone	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
17---------- Gallime	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
18---------- Gladewater	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
19, 20---------- Kaufman	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
21---------- Kirvin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
22*: Kirvin----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land.				
23*---------- Kirvin	Poor: low strength.	Unsuited: excess fines.	Poor: thin layer.	Poor: small stones.
24---------- Larue	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
25*: Leagueville----------	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, wetness.
Henco----------	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, wetness.
26*: Lufkin----------	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness.
Raino----------	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
27---------- Nahatche	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
28---------- Normangee	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
29---------- Pickton	Good----------	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
30---------- Pickton	Good----------	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
31*: Pickton----------	Good----------	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Urban land.				
32*. Pits				
33, 34---------- Silawa	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
35---------- Styx	Good----------	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
36, 37---------- Tonkawa	Good----------	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
38*: Tonkawa----------	Good----------	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land.				
39---------- Trawick	Good----------	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
40, 41---------- Trinity	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
42---------- Wilson	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, wetness.
43, 44---------- Wolfpen	Good----------	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
45, 46---------- Woodtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
1, 2---------- Axtell	Slight---------	Moderate: hard to pack.	Severe: no water.	Not needed-----	Percs slowly, erodes easily.	Percs slowly, erodes easily.
3---------- Bernaldo	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Not needed-----	Complex slope	Favorable.
4*: Bernaldo---------	Moderate: seepage.	Moderate: piping.	Severe: deep to water.	Not needed-----	Complex slope	Favorable.
Urban land.						
5---------- Burleson	Slight---------	Moderate: hard to pack.	Severe: no water.	Not needed-----	Percs slowly---	Percs slowly.
6---------- Crockett	Slight---------	Moderate: hard to pack.	Severe: no water.	Not needed-----	Percs slowly, erodes easily.	Percs slowly, erodes easily, slope.
7, 8---------- Cuthbert	Moderate: seepage, depth to rock.	Moderate: low strength, compressible.	Severe: no water.	Slope----------	Slope, erodes easily.	Slope, erodes easily.
9---------- Deport	Slight---------	Moderate: unstable fill, compressible.	Severe: no water.	Percs slowly---	Slope, wetness, slow intake.	Percs slowly.
10*: Derly----------	Slight---------	Moderate: low strength, compressible.	Severe: deep to water.	Wetness, percs slowly.	Not needed-----	Not needed.
Rader----------	Slight---------	Moderate: wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Percs slowly.
11, 12---------- Dutek	Moderate: seepage.	Moderate: piping.	Severe: no water.	Not needed-----	Too sandy, erodes easily.	Erodes easily.
13---------- Elrose	Moderate: seepage.	Slight---------	Severe: no water.	Favorable------	Favorable------	Favorable.
14---------- Eufaula	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Not needed-----	Too sandy, soil blowing, slope.	Slope, droughty.
15---------- Ferris	Slight---------	Moderate: hard to pack.	Severe: no water.	Not needed-----	Percs slowly, slope.	Percs slowly, slope.
16---------- Freestone	Slight---------	Moderate: unstable fill.	Severe: no water.	Percs slowly---	Percs slowly---	Percs slowly.
17---------- Gallime	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Not needed-----	Complex slope	Favorable.
18---------- Gladewater	Slight---------	Moderate: low strength.	Severe: deep to water.	Floods, percs slowly, wetness.	Percs slowly---	Percs slowly.
19, 20---------- Kaufman	Slight---------	Severe: wetness.	Severe: no water.	Floods, percs slowly.	Not needed-----	Percs slowly, wetness.
21---------- Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed-----	Complex slope, erodes easily.	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
22*: Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed	Complex slope, erodes easily.	Favorable.
Urban land.						
23* Kirvin	Moderate: seepage.	Moderate: unstable fill, low strength.	Severe: no water.	Not needed	Complex slope, erodes easily.	Favorable.
24 Larue	Moderate: seepage.	Slight	Severe: no water.	Not needed	Too sandy	Slope, droughty.
25*: Leagueville	Severe: seepage.	Severe: piping, wetness.	Slight	Favorable	Wetness, too sandy.	Wetness.
Henco	Severe: seepage.	Severe: piping, wetness.	Slight	Favorable	Wetness, too sandy.	Wetness.
26*: Lufkin	Slight	Severe: wetness.	Severe: no water.	Percs slowly	Wetness, percs slowly, erodes easily.	Percs slowly, erodes easily, wetness.
Raino	Slight	Moderate: unstable fill.	Severe: no water.	Percs slowly, complex slope.	Percs slowly, complex slope.	Not needed.
27 Nahatche	Moderate: seepage.	Severe: wetness.	Severe: no water.	Floods	Not needed	Wetness.
28 Normangee	Slight	Moderate: hard to pack.	Severe: no water.	Not needed	Percs slowly	Percs slowly.
29, 30 Pickton	Severe: seepage.	Severe: piping.	Severe: no water.	Not needed	Too sandy, slope.	Droughty, slope.
31*: Pickton	Severe: seepage.	Severe: piping.	Severe: no water.	Not needed	Too sandy, slope.	Droughty, slope.
Urban land.						
32*. Pits						
33, 34 Silawa	Severe: seepage.	Moderate: piping, erodes easily.	Severe: deep to water.	Not needed	Erodes easily	Erodes easily.
35 Styx	Moderate: seepage.	Moderate: piping.	Severe: no water.	Not needed	Not needed	Droughty, erodes easily.
36, 37 Tonkawa	Severe: seepage.	Severe: seepage, unstable fill, piping.	Severe: no water.	Not needed	Slope, too sandy.	Slope, droughty.
38*: Tonkawa	Severe: seepage.	Severe: seepage, unstable fill, piping.	Severe: no water.	Not needed	Slope, too sandy.	Slope, droughty.
Urban land.						

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
39---------- Trawick	Moderate: seepage.	Moderate: low strength, unstable fill, thin layer.	Severe: no water.	Not needed-----	Erodes easily	Erodes easily.
40---------- Trinity	Slight---------	Moderate: hard to pack.	Severe: slow refill.	Percs slowly---	Not needed-----	Wetness, percs slowly.
41---------- Trinity	Slight---------	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, floods.	Not needed-----	Wetness, percs slowly.
42---------- Wilson	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly, wetness.	Percs slowly, wetness, erodes easily.	Percs slowly, wetness, erodes easily.
43, 44---------- Wolfpen	Severe: seepage.	Moderate: thin layer.	Severe: deep to water.	Not needed-----	Too sandy, slope.	Slope.
45, 46---------- Woodtell	Slight---------	Moderate: unstable fill, compressible, hard to pack.	Severe: slow refill.	Percs slowly, slope.	Slope, erodes easily, wetness.	Percs slowly, slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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
1 Axtell	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
2 Axtell	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
3 Bernaldo	Slight	Slight	Moderate: slope.	Slight.
4*: Bernaldo	Slight	Slight	Moderate: slope.	Slight.
Urban land.				
5 Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.
6 Crockett	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
7 Cuthbert	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
8 Cuthbert	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
9 Deport	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
10*: Derly	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
Rader	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Slight.
11 Dutek	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
12 Dutek	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, slope.	Severe: too sandy.
13 Elrose	Slight	Slight	Moderate: slope.	Slight.
14 Eufaula	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
15 Ferris	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
16 Freestone	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17--- Gallime	Slight	Slight	Moderate: slope.	Slight.
18--- Gladewater	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
19--- Kaufman	Severe: too clayey, floods, percs slowly.	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness.
20--- Kaufman	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey, wetness.
21--- Kirvin	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
22*: Kirvin	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Urban land.				
23* Kirvin	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
24--- Larue	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
25*: Leagueville	Severe: wetness, floods, too sandy.	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy.
Henco	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Moderate: wetness, too sandy.
26*: Lufkin	Severe: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.
Raino	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
27--- Nahatche	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
28--- Normangee	Moderate: percs slowly.	Slight	Moderate: too clayey, percs slowly, slope.	Slight.
29--- Pickton	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
30--- Pickton	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31*: Pickton	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
Urban land.				
32*. Pits				
33, 34 Silawa	Slight	Slight	Moderate: slope.	Slight.
35 Styx	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
36 Tonkawa	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
37 Tonkawa	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
38*: Tonkawa	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Urban land.				
39 Trawick	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
40 Trinity	Severe: wetness, percs slowly, floods.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
41 Trinity	Severe: wetness, floods, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, floods, too clayey.	Severe: wetness, too clayey.
42 Wilson	Severe: percs slowly, wetness.	Severe: wetness, percs slowly.	Severe: percs slowly, wetness.	Severe: wetness.
43 Wolfpen	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
44 Wolfpen	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
45 Woodtell	Severe: slope, percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight.
46 Woodtell	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1---------- Axtell	Fair	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.
2---------- Axtell	Poor	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.
3---------- Bernaldo	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
4*. Bernaldo Urban land											
5---------- Burleson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.
6---------- Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor.
7---------- Cuthbert	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
8---------- Cuthbert	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
9---------- Deport	Fair	Fair	Poor	---	---	Fair	Poor	Fair	Fair	---	Poor.
10*:											
Derly----------	Fair	Fair	Good	Fair	Fair	---	Good	Good	Fair	Fair	Good.
Rader----------	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor.
11, 12---------- Dutek	Poor	Fair	Good	Fair	---	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
13---------- Elrose	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
14---------- Eufaula	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.
15---------- Ferris	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.
16---------- Freestone	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
17---------- Gallime	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
18---------- Gladewater	Poor	Fair	Fair	Fair	---	---	Poor	Good	Fair	Fair	Fair.
19---------- Kaufman	Good	Good	Poor	Good	---	Fair	Poor	Good	Fair	Good	Fair.
20---------- Kaufman	Poor	Poor	Fair	Good	---	Fair	Poor	Good	Poor	Good	Fair.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
21---------- Kirvin	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
22*. Kirvin Urban land											
23*---------- Kirvin	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.
24---------- Larue	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.
25*: Leagueville-------	Poor	Fair	Fair	Fair	Fair	---	Fair	Poor	Fair	Fair	Fair.
Henco----------	Poor	Fair	Fair	Fair	Fair	---	Fair	Poor	Fair	Fair	Fair.
26*: Lufkin----------	Fair	Good	Fair	Good	Good	---	Fair	Fair	Fair	Good	Fair.
Raino----------	Fair	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
27---------- Nahatche	Very poor.	Poor	Fair	Good	Good	---	Fair	Fair	Poor	Fair	Fair.
28---------- Normangee	Fair	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor.
29, 30---------- Pickton	Poor	Fair	Good	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.
31*. Pickton Urban land											
32*. Pits											
33, 34---------- Silawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.
35---------- Styx	Fair	Fair	Good	Fair	---	Good	Poor	Very poor.	Fair	---	Very poor.
36, 37---------- Tonkawa	Poor	Poor	Fair	Poor	---	---	Very poor.	Very poor.	Poor	Poor	Very poor.
38*. Tonkawa Urban land											
39---------- Trawick	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
40---------- Trinity	Fair	Good	Fair	Good	---	---	Poor	Fair	Fair	Good	Poor.
41---------- Trinity	Poor	Fair	Fair	Good	---	---	Poor	Fair	Fair	Fair	Poor.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
42---------- Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair.
43, 44---------- Wolfpen	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.
45---------- Woodtell	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Poor.
46---------- Woodtell	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[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		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Axtell	0-6	Loam----------	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-95	28-60	<31	NP-7
	6-28	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	28-48	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	48-80	Sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7-6	0-2	85-100	75-100	75-99	36-98	35-60	15-45
2---------- Axtell	0-9	Loam----------	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-95	28-60	<31	NP-7
	9-20	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	20-50	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	41-60	25-40
	50-80	Sandy clay loam, clay loam, clay.	CL, CH, SC	A-6, A-7-6	0-2	85-100	75-100	75-95	36-98	35-60	15-45
3---------- Bernaldo	0-16	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-65	<25	NP-5
	16-45	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	95	90-100	51-75	28-40	12-22
	45-80	Fine sandy loam, loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	95-100	90-100	45-65	25-40	8-23
4*: Bernaldo----------	0-16	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-65	<25	NP-5
	16-45	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	100	90-100	51-75	28-40	12-22
	45-80	Fine sandy loam, loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	95-100	90-100	45-65	25-40	8-22
Urban land.											
5---------- Burleson	0-80	Clay----------	CH	A-7-6	0-2	83-100	80-100	80-100	80-95	51-90	27-55
6---------- Crockett	0-9	Loam----------	SM, ML, CL, SC	A-4, A-6	0-2	95-100	95-100	90-100	35-98	15-35	3-15
	9-14	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-98	36-60	22-45
	14-43	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	51-90	30-56	11-40
	43-80	Clay loam, sandy clay loam, loam.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-56	11-40
7---------- Cuthbert	0-8	Fine sandy loam	SM, SM-SC, ML	A-4	0-1	75-100	75-100	65-100	36-60	<30	NP-7
	8-30	Clay----------	CH, MH, CL, ML	A-7	0	90-100	85-100	85-100	51-98	45-60	20-40
	30-65	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8---------- Cuthbert	0-4	Very gravelly fine sandy loam.	GM, SM	A-1, A-2	2-5	35-60	27-50	15-45	10-30	<25	NP-4
	4-24	Clay----------	CH, MH, CL, ML	A-7	0	90-100	85-100	85-100	51-98	45-60	20-40
	24-62	Weathered bedrock.	---	---	---	---	---	---	---	---	---
9---------- Deport	0-70	Clay----------	CH	A-7-6	0	95-100	95-100	95-100	85-99	51-75	30-50
10*:											
Derly----------	0-11	Loam----------	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<25	NP-8
	11-21	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	70-95	44-60	23-36
	21-43	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
	43-65	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
Rader----------	0-28	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	30-70	18-28	3-10
	28-44	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	44-72	Sandy clay, clay, clay loam.	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-40
11---------- Dutek	0-34	Loamy fine sand	SM, SP-SM	A-2	0	95-100	95-100	90-100	10-25	<22	NP-3
	34-55	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4, A-6	0	98-100	95-100	90-100	30-55	24-40	6-20
	55-80	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0	95-100	95-100	90-100	22-55	20-40	4-20
12---------- Dutek	0-21	Loamy fine sand	SM, SP-SM	A-2	0	95-100	95-100	90-100	10-25	<22	NP-3
	21-45	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4, A-6	0	98-100	95-100	90-100	30-55	24-40	6-20
	45-80	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0	95-100	95-100	90-100	22-55	20-40	4-20
13---------- Elrose	0-9	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	85-95	70-85	30-45	<25	NP-7
	9-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	85-95	80-90	36-55	20-38	8-20
14---------- Eufaula	0-80	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
15---------- Ferris	0-65	Clay----------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
16---------- Freestone	0-14	Fine sandy loam	SM, SC, CL, ML	A-4	0	95-100	95-100	90-100	36-60	20-30	2-10
	14-34	Sandy clay loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	0	95-100	95-100	90-100	55-85	24-46	7-23
	34-59	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44
	59-80	Clay----------	CL, CH	A-7	0	99-100	98-100	95-100	80-99	48-74	25-48

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17---------- Gallime	0-28	Fine sandy loam	SM, SC, CL, ML	A-4	0	95-100	95-100	90-100	45-65	15-28	NP-10
	28-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6, A-4	0	95-100	95-100	90-100	45-80	25-40	10-24
18---------- Gladewater	0-6	Clay----------	CH, CL	A-7	0	100	100	90-100	80-95	48-75	25-50
	6-67	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	51-75	30-50
19---------- Kaufman	0-11	Clay----------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
	11-80	Clay----------	CH	A-7	0	100	100	95-100	85-100	65-96	45-70
20---------- Kaufman	0-10	Clay----------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
	10-68	Clay----------	CH	A-7	0	100	100	95-100	85-100	65-96	45-70
21---------- Kirvin	0-11	Fine sandy loam	SM, SM-SC	A-4	0-2	75-100	75-95	65-90	36-50	<25	NP-4
	11-34	Clay, sandy clay, clay loam.	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	34-55	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	55-70	Weathered bedrock.	---	---	---	---	---	---	---	---	---
22*: Kirvin----------	0-11	Fine sandy loam	SM, SM-SC	A-4	0-2	75-100	75-95	65-90	36-50	<25	NP-4
	11-34	Clay, sandy clay, clay loam.	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	34-55	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	55-70	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
23*---------- Kirvin	0-3	Gravelly fine sandy loam.	GM, SM, GM-GC, SM-SC	A-1, A-2	0-5	55-75	40-75	40-65	20-35	<25	NP-4
	3-10	Clay, sandy clay, clay loam.	CH, MH, CL, ML	A-7	0	95-100	85-100	85-99	51-75	41-60	15-30
	10-32	Sandy clay loam, clay loam, sandy loam.	CL, SC, SM, ML	A-4, A-6	0	95-100	85-100	85-99	36-65	20-40	4-20
	32-54	Weathered bedrock.	---	---	---	---	---	---	---	---	---
24---------- Larue	0-34	Loamy fine sand	SM	A-2-4	0	100	98-100	50-75	15-30	---	NP
	34-63	Sandy clay loam	SC, SM-SC	A-2-4, A-4, A-6	0	100	95-100	80-90	30-45	20-35	5-12
25*: Leagueville-------	0-29	Fine sand-------	SM	A-2	0	100	100	85-100	15-30	<20	NP-4
	29-51	Sandy clay loam, fine sandy loam, sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	100	95-100	85-100	36-60	20-35	5-15
	51-80	Fine sand, sandy clay loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4	0	100	95-100	85-100	15-50	<30	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
25*:											
Henco	0-44	Loamy fine sand	SM	A-2	0	100	100	85-100	15-30	<20	NP-4
	44-62	Sandy clay loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	95-100	85-100	30-50	15-30	2-14
	62-72	Loamy fine sand, fine sand.	SM	A-2	0	100	95-100	85-100	15-30	<20	NP-4
26*:											
Lufkin	0-10	Loam	SM, CL, CL-ML, SM-SC	A-4	0-5	90-100	80-100	80-100	40-85	<30	NP-10
	10-44	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	90-100	90-100	90-100	70-95	45-67	30-45
	44-60	Clay, clay loam, sandy clay loam.	CH, CL, SC	A-7	0	70-100	70-100	55-100	44-90	45-86	25-55
Raino	0-29	Loam	ML, CL, SM, SC	A-4	0	95-100	95-100	80-100	40-80	<30	NP-10
	29-35	Loam, sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-70	20-40	5-20
	35-72	Clay, sandy clay, silty clay.	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
27 Nahatche	0-13	Loam	CL	A-6, A-7, A-4	0	100	100	90-100	51-80	25-45	9-25
	13-75	Loam, clay loam, silty clay loam.	CL	A-6, A-4	0	100	100	85-100	60-95	28-40	8-25
28	0-3	Clay loam	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
Normangee	3-39	Clay	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
	39-72	Stratified shaly clay.	CL, CH	A-7	0	95-100	90-100	90-100	70-90	41-60	20-35
29	0-50	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<25	NP-7
Pickton	50-80	Sandy clay loam, clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-6, A-2-6	0	100	95-100	85-100	25-75	23-35	5-14
30	0-42	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<25	NP-7
Pickton	42-72	Sandy clay loam, clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-6, A-2-6	0	100	95-100	85-100	25-75	23-35	5-14
31*:											
Pickton	0-50	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<25	NP-7
	50-80	Sandy clay loam, clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-6, A-2-6	0	100	95-100	85-100	25-75	23-35	5-14
Urban land.											
32*. Pits											

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
33---------- Silawa	0-15	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	80-100	80-100	70-100	40-60	<26	NP-7
	15-37	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	80-100	80-100	80-100	35-60	25-40	8-18
	37-64	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-2	45-100	45-100	38-100	18-60	21-34	4-14
	64-80	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	45-100	45-100	38-100	12-40	<26	NP-7
34---------- Silawa	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	80-100	80-100	70-100	40-60	<26	NP-7
	8-38	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	80-100	80-100	80-100	35-60	25-40	8-18
	38-55	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-2	45-100	45-100	38-100	18-60	21-34	4-14
	55-70	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	45-100	45-100	38-100	12-40	<26	NP-7
35---------- Styx	0-22	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	100	100	70-100	15-40	<25	NP-4
	22-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	80-100	40-70	20-40	8-20
36, 37---------- Tonkawa	0-80	Fine sand-------	SP-SM, SP	A-3, A-2	0	100	97-100	90-100	2-12	<30	NP-5
38*: Tonkawa----------	0-80	Fine sand-------	SP-SM, SP	A-3, A-2	0	100	97-100	90-100	2-12	<30	NP-5
Urban land.											
39---------- Trawick	0-7	Gravelly fine sandy loam.	SM, SM-SC	A-2-4, A-4	1-5	70-80	65-80	60-70	20-40	20-30	2-7
	7-40	Clay, clay loam	CL, CH, MH	A-7	0	90-100	75-98	70-85	51-75	41-60	18-30
	40-72	Weathered bedrock.	---	---	---	---	---	---	---	---	---
40---------- Trinity	0-72	Clay----------	CH	A-7	0	100	98-100	85-100	80-100	55-90	30-60
41---------- Trinity	0-80	Clay----------	CH	A-7	0	100	98-100	85-100	80-100	55-90	30-60
42---------- Wilson	0-6	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	6-71	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	38-55	21-35
43---------- Wolfpen	0-28	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-35	<25	NP-7
	28-80	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-4, A-7	0	100	95-100	85-100	36-85	25-45	8-27

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44---------- Wolfpen	0-24	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-35	<25	NP-7
	24-60	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-4, A-7	0	100	95-100	85-100	36-85	25-45	8-27
45---------- Woodtell	0-8	Loam----------	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-100	30-60	<25	NP-7
	8-20	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	20-54	Clay loam, clay, sandy clay loam.	CL, SC, CH	A-6, A-7-6	0	100	80-100	75-100	36-98	35-65	15-45
	54-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
46---------- Woodtell	0-4	Loam----------	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-100	30-60	<25	NP-7
	4-42	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	42-71	Weathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF 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 <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
1----------	0-6	7-18	0.6-2.0	0.11-0.15	5.1-6.5	Low----------	0.43	5	0.5-1
Axtell	6-28	40-55	<0.06	0.13-0.18	4.5-5.5	High----------	0.37		
	28-48	40-55	<0.06	0.13-0.15	5.1-7.1	High----------	0.37		
	48-80	25-50	<02-0.6	0.13-0.18	5.6-8.4	High----------	0.37		
2----------	0-9	7-18	0.6-2.0	0.11-0.15	5.1-6.5	Low----------	0.43	5	.5-1
Axtell	9-20	40-55	<0.06	0.13-0.18	4.5-5.5	High----------	0.37		
	20-50	40-55	<0.06	0.13-0.15	5.1-7.1	High----------	0.37		
	50-80	25-50	<02-0.6	0.13-0.18	5.6-8.4	High----------	0.37		
3----------	0-16	5-15	2.0-6.0	0.11-0.15	5.1-6.5	Low----------	0.32	5	<1
Bernaldo	16-45	18-30	0.6-2.0	0.15-0.20	4.5-6.5	Moderate-------	0.32		
	45-80	10-30	0.6-2.0	0.15-0.20	4.5-6.5	Low----------	0.32		
4*:									
Bernaldo--------	0-16	5-15	2.0-6.0	0.11-0.15	5.1-6.5	Low----------	0.32	5	<1
	16-45	18-30	0.6-2.0	0.15-0.20	4.5-6.5	Moderate-------	0.32		
	45-80	10-30	0.6-2.0	0.15-0.20	4.5-6.5	Low----------	0.32		
Urban land.									
5----------	0-80	35-60	<0.06	0.12-0.18	5.6-8.4	High----------	0.32	5	---
Burleson									
6----------	0-9	5-20	0.6-2.0	0.11-0.20	5.6-7.3	Low----------	0.43	5	.5-2
Crockett	9-14	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	14-43	40-60	<0.06	0.14-0.18	5.6-7.3	High----------	0.32		
	43-80	15-45	0.06-0.2	0.15-0.20	7.4-8.4	Moderate-------	0.32		
7----------	0-8	5-20	2.0-6.0	0.11-0.15	4.5-6.5	Low----------	0.32	3	<1
Cuthbert	8-30	40-60	0.2-0.6	0.00-0.18	3.6-5.5	Moderate-------	0.32		
	30-65	---	---	---	---	----------	----		
8----------	0-4	5-20	2.0-6.0	0.08-0.12	4.5-6.5	Low----------	0.20	3	<1
Cuthbert	4-24	40-60	0.2-0.6	0.00-0.18	3.6-5.5	Moderate-------	0.32		
	24-62	---	---	---	---	----------	----		
9----------	0-70	45-60	<0.06	0.12-0.18	5.6-8.4	High----------	0.32	4	1-3
Deport									
10*:									
Derly----------	0-11	8-20	0.6-2.0	0.13-0.24	4.5-6.0	Low----------	0.37	5	.5-2
	11-21	30-45	0.06-0.2	0.15-0.22	4.5-5.5	Very high------	0.37		
	21-43	40-60	<0.06	0.12-0.18	4.5-6.0	Very high------	0.32		
	43-65	40-60	<0.06	0.12-0.18	5.6-7.3	Very high------	0.32		
Rader----------	0-28	5-20	2.0-6.0	0.10-0.15	4.5-6.5	Low----------	0.32	5	.5-2
	28-44	18-30	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-------	0.32		
	44-72	35-50	<0.06	0.12-0.18	4.5-6.5	High----------	0.32		
11----------	0-34	3-12	6.0-20	0.05-0.10	5.6-7.3	Very low-------	0.20	5	---
Dutek	34-55	18-35	0.6-2.0	0.12-0.17	5.1-6.0	Low----------	0.24		
	55-80	10-30	0.6-6.0	0.10-0.16	4.5-6.0	Low----------	0.24		
12----------	0-21	3-12	6.0-20	0.05-0.10	5.6-7.3	Very low-------	0.20	5	---
Dutek	21-45	18-35	0.6-2.0	0.12-0.17	5.1-6.0	Low----------	0.24		
	45-80	10-30	0.6-6.0	0.10-0.16	4.5-6.0	Low----------	0.24		
13----------	0-9	10-20	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.24	5	.5-2
Elrose	9-80	22-35	0.6-2.0	0.13-0.18	4.5-6.5	Low----------	0.32		
14----------	0-80	---	6.0-20.0	0.05-0.11	5.1-7.3	Low----------	0.17	5	---
Eufaula									

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
15----------	0-65	40-60	<0.06	0.15-0.18	7.9-8.4	Very high------	0.32	4	0.5-2
Ferris									
16----------	0-14	5-15	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.32	5	.5-2
Freestone	14-34	20-35	0.2-0.6	0.12-0.17	4.5-6.5	Moderate-------	0.32		
	34-59	30-50	0.06-0.2	0.12-0.18	4.5-6.5	High----------	0.32		
	59-80	40-55	0.06-0.2	0.12-0.18	5.6-7.8	High----------	0.32		
17----------	0-28	10-20	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.32	5	<1
Gallime	28-80	18-35	0.6-2.0	0.12-0.17	4.5-6.5	Moderate-------	0.43		
18----------	0-6	30-60	0.06-0.2	0.15-0.20	5.6-7.3	High----------	0.32	5	1-3
Gladewater	6-67	40-60	<0.06	0.15-0.18	4.5-7.3	High----------	0.32		
19----------	0-11	40-80	0.06-0.2	0.15-0.20	5.6-8,4	High----------	0.32	5	1-4
Kaufman	11-80	60-80	<0.06	0.15-0.18	5.6-8.4	Very high------	0.32		
20----------	0-10	40-80	0.06-0.2	0.15-0.20	5.6-8.4	High----------	0.32	5	1-4
Kaufman	10-68	60-80	<0.06	0.15-0.18	5.6-8.4	Very high------	0.32		
21----------	0-11	10-20	2.0-6.0	0.10-0.15	5.1-7.3	Low----------	0.37	4	.5-2
Kirvin	11-34	35-60	0.2-0.6	0.12-0.18	3.6-5.5	Moderate-------	0.32		
	34-55	15-35	0.6-2.0	0.12-0.17	3.6-5.5	Moderate-------	0.32		
	55-70	---	---	---	---	----------	----		
22*:									
Kirvin----------	0-11	10-20	2.0-6.0	0.10-0.15	5.1-7.3	Low----------	0.37	4	.5-2
	11-34	35-60	0.2-0.6	0.12-0.18	3.6-5.5	Moderate-------	0.32		
	34-55	15-35	0.6-2.0	0.12-0.17	3.6-5.5	Moderate-------	0.32		
	55-70	---	---	---	---	----------	----		
Urban land.									
23*----------	0-3	5-15	2.0-6.0	0.06-0.08	5.1-7.3	Low----------	0.28	4	---
Kirvin	3-10	35-60	0.2-0.6	0.12-0.18	3.6-5.5	Moderate-------	0.32		
	10-32	15-35	0.6-2.0	0.12-0.17	3.6-5.5	Moderate-------	0.32		
	32-54	---	---	---	---	----------	----		
24----------	0-34	3-15	6.0-20	0.05-0.10	5.6-6.5	Low----------	0.17	5	.5-2
Larue	34-63	20-30	0.6-2.0	0.10-0.15	5.1-6.5	Low----------	0.24		
25*:									
Leagueville-----	0-29	2-10	6.0-20	0.07-0.11	4.5-6.5	Low----------	0.17	5	.5-2
	29-51	10-25	0.6-2.0	0.12-0.17	4.5-5.5	Low----------	0.20		
	51-80	5-25	2.0-6.0	0.07-0.15	4.5-5.5	Low----------	0.20		
Henco----------	0-44	2-10	6.0-20	0.07-0.11	4.5-6.5	Low----------	0.17	5	.5-2
	44-62	10-25	0.6-2.0	0.11-0.15	4.5-5.5	Low----------	0.17		
	62-72	5-12	6.0-20	0.07-0.11	4.5-5.5	Low----------	0.17		
26*:									
Lufkin----------	0-10	15-25	0.6-2.0	0.11-0.18	5.1-6.5	Low----------	0.43	5	.5-2
	10-44	35-50	<0.06	0.12-0.18	5.1-7.8	Very high------	0.32		
	44-60	35-50	<0.06	0.10-0.14	6.1-8.4	High----------	0.37		
Raino----------	0-29	10-20	0.6-2.0	0.11-0.20	4.5-6.5	Low----------	0.43	5	.5-2
	29-35	18-30	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-------	0.43		
	35-72	40-60	<0.06	0.12-0.18	4.5-6.5	High----------	0.32		
27----------	0-13	18-35	0.6-2.0	0.10-0.15	5.1-7.8	Moderate-------	0.28	5	1-3
Nahatche	13-75	18-35	0.6-2.0	0.10-0.15	5.1-7.8	Moderate-------	0.28		
28----------	0-3	25-35	0.06-0.2	0.15-0.20	5.6-7.3	Moderate-------	0.32	4	.5-2
Normangee	3-39	40-55	<0.06	0.12-0.18	5.6-8.4	High----------	0.32		
	39-72	40-55	<0.06	0.12-0.18	6.1-8.4	High----------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
29----------	0-50	3-12	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5	0.5-2
Pickton	50-80	18-30	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
30----------	0-42	3-12	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5	.5-2
Pickton	42-72	18-30	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
31*:									
Pickton---------	0-50	3-12	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5	.5-2
	50-80	18-30	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
Urban land.									
32*.									
Pits									
33----------	0-15	10-20	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.24	5	.5-2
Silawa	15-37	18-35	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.32		
	37-64	12-30	2.0-6.0	0.08-0.15	4.5-6.0	Low----------	0.32		
	64-80	2-15	6.0-20	0.05-0.11	4.5-6.0	Very low-------	0.20		
34----------	0-8	10-20	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.24	5	.5-2
Silawa	8-38	18-35	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.32		
	38-55	12-30	2.0-6.0	0.08-0.15	4.5-6.0	Low----------	0.32		
	55-70	2-15	6.0-20	0.05-0.11	4.5-6.0	Very low-------	0.20		
35----------	0-22	3-15	2.0-6.0	0.05-0.11	5.1-7.3	Low----------	0.17	5	.5-2
Styx	22-80	25-35	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
36, 37----------	0-80	2-8	6.0-20	0.04-0.08	4.5-6.5	Low----------	0.15	5	<1
Tonkawa									
38*:									
Tonkawa---------	0-80	2-8	6.0-20	0.04-0.08	4.5-6.5	Low----------	0.15	5	<1
Urban land.									
39----------	0-7	15-35	0.6-2.0	0.08-0.12	5.6-7.3	Low----------	0.37	4	---
Trawick	7-40	35-50	0.2-0.6	0.12-0.18	4.5-6.0	Moderate-------	0.32		
	40-72	---	---	---	---	----------	----		
40----------	0-72	60-80	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32	5	1-4
Trinity									
41----------	0-80	60-80	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32	5	1-4
Trinity									
42----------	0-6	20-27	0.2-0.6	0.15-0.20	5.6-7.3	Low----------	0.43	5	.5-2
Wilson	6-71	35-50	<0.06	0.14-0.20	5.6-8.4	High----------	0.37		
43----------	0-28	3-12	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5	.5-2
Wolfpen	28-80	20-30	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
44----------	0-24	3-12	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5	.5-2
Wolfpen	24-60	20-30	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
45----------	0-8	5-20	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	.5-1
Woodtell	8-20	40-60	<0.06	0.12-0.18	3.6-5.5	High----------	0.32		
	20-54	15-45	0.06-0.2	0.15-0.20	4.5-6.0	High----------	0.32		
	54-80	---	---	---	---	----------	----		
46----------	0-4	5-20	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	.5-1
Woodtell	4-42	40-60	<0.06	0.12-0.18	3.6-5.5	High----------	0.32		
	42-71	---	---	---	---	----------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1, 2--Axtell	D	None	---	---	>6.0	---	---	>60	---	High	Moderate.
3--Bernaldo	B	None	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---	Moderate	Moderate.
4*:											
Bernaldo	B	None	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---	Moderate	Moderate.
Urban land.											
5--Burleson	D	None	---	---	>6.0	---	---	>60	---	High	Low.
6--Crockett	D	None	---	---	>6.0	---	---	>60	---	High	Low.
7, 8--Cuthbert	C	None	---	---	>6.0	---	---	20-40	Ripable	High	High.
9--Deport	D	None	---	---	0-2.0	Apparent	Dec-May	>60	---	High	Low.
10*:											
Derly	D	None	---	---	0-1.5	Perched	Oct-May	>60	---	High	High.
Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
11, 12--Dutek	A	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
13--Elrose	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
14--Eufaula	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
15--Ferris	D	None	---	---	>6.0	---	---	>60	---	High	Low.
16--Freestone	C	None	---	---	1.0-3.0	Apparent	Dec-May	>60	---	High	Moderate.
17--Gallime	B	None	---	---	4.0-6.0	Apparent	Dec-Mar	>60	---	Moderate	Moderate.
18--Gladewater	D	Frequent	Brief to long.	Nov-May	0-3.5	Apparent	Nov-May	>60	---	High	Moderate.
19--Kaufman	D	Rare	Brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
20--Kaufman	D	Frequent	Brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
21--Kirvin	C	None	---	---	>6.0	---	---	40-60	Ripable	High	High.
22*:											
Kirvin	C	None	---	---	>6.0	---	---	40-60	Ripable	High	High.
Urban land.											
23*--Kirvin	C	None	---	---	>6.0	---	---	40-60	Ripable	High	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
24---------- Larue	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
25*:											
Leagueville------	B/D	Rare--------	Brief-----	---	0.5-1.5	Apparent	Nov-May	>60	---	High-----	High.
Henco----------	B/D	Rare--------	Brief-----	---	0.5-2.0	Apparent	Nov-May	>60	---	High-----	High.
26*:											
Lufkin----------	D	None--------	---	---	0-1.0	Perched	Oct-Mar	>60	---	High-----	Moderate.
Raino----------	D	None--------	---	---	2.0-5.0	Apparent	Dec-Mar	>60	---	High-----	Moderate.
27---------- Nahatche	C	Frequent----	Brief to long.	Nov-May	0-1.5	Apparent	Nov-May	>60	---	High-----	Moderate.
28---------- Normangee	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
29, 30---------- Pickton	A	None--------	---	---	4.0-6.0	Apparent	Jan-Mar	>60	---	Moderate	High.
31*:											
Pickton----------	A	None--------	---	---	4.0-6.0	Apparent	Jan-Mar	>60	---	Moderate	High.
Urban land.											
32*. Pits											
33, 34---------- Silawa	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
35---------- Styx	B	None--------	---	---	3.5-4.5	Apparent	Dec-May	>60	---	Moderate	Moderate.
36, 37---------- Tonkawa	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
38*:											
Tonkawa----------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Urban land.											
39---------- Trawick	B	None--------	---	---	>6.0	---	---	40-60	Rippable	High-----	High.
40---------- Trinity	D	Rare--------	Brief-----	Nov-May	0-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
41---------- Trinity	D	Frequent----	Brief-----	Nov-May	0-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
42---------- Wilson	D	None--------	---	---	0-1.0	Perched	Nov-Mar	>60	---	High-----	High.
43, 44---------- Wolfpen	A	None--------	---	---	4.0-6.0	Apparent	Dec-May	>60	---	Moderate	High.
45, 46---------- Woodtell	D	None--------	---	---	1.5-4.0	Apparent	Dec-Feb	>60	---	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density[1]	Shrinkage		
			Percentage passing sieve							Percentage smaller than--						Limit	Linear	Ratio
	AASHTO	Unified	7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm						
													Pct		G/cc	Pct	Pct	Pct
Axtell loam:[3] (S75TX-213-007)																		
A1------- 0 to 3	A-4 (00)	SM	100	100	99	98	98	94	50	--	9	8	20	3	2.65	17.0	2.1	1.7
B21t----- 6 to 13	A-7-6(16)	CL	100	100	100	100	100	98	71	--	43	40	41	25	2.68	12.0	13.8	1.9
C--------48 to 80	A-7-6(45)	CH	100	100	100	100	100	99	98	--	56	44	60	42	2.71	13.0	19.4	1.9
Bernaldo fine sandy loam:[4] (S75TX-213-003)																		
A2------- 8 to 16	A-4 (00)	ML	100	100	100	100	100	99	51	--	9	7	18	3	2.62	16.0	1.5	1.8
B21t-----16 to 45	A-6 (05)	CL	100	100	100	100	99	98	57	--	26	23	29	15	2.66	16.0	7.3	1.8
B23t&A'2-57 to 80	A-6 (08)	CL	100	100	100	100	100	99	53	--	36	35	37	23	2.69	16.0	10.5	1.8
Cuthbert fine sandy loam:[5] (S75TX-213-005)																		
A1------- 0 to 6	A-4 (00)	SM	100	100	100	100	99	98	42	--	8	6	20	3	2.63	18.0	1.3	1.7
B2t------ 6 to 16	A-7-6(20)	CL	100	100	100	100	100	100	74	--	50	48	46	28	2.67	15.0	14.3	1.8
B3&C-----16 to 33	A-6 (02)	SC	100	100	100	99	97	94	38	--	25	25	29	15	2.67	16.0	6.7	1.8
Freestone fine sandy loam:[6] (S75TX-213-002)																		
A1------- 5 to 14	A-4 (00)	ML	100	100	100	100	98	96	53	--	14	8	20	3	2.64	18.0	1.6	1.7
B21t-----14 to 23	A-4 (02)	CL-ML	100	100	100	100	98	97	59	--	18	15	24	7	2.64	17.0	4.2	1.8
B23t-----34 to 45	A-7-6(31)	CH	100	100	100	100	99	98	77	--	49	47	57	40	2.68	11.0	19.5	1.9
Gallime fine sandy loam:[7] (S75TX-213-004)																		
A2-------10 to 28	A-4 (00)	ML	100	100	100	100	100	100	63	--	6	3	20	3	2.66	17.0	1.7	1.7
B21t-----28 to 47	A-6 (05)	CL	100	98	97	96	96	96	66	--	21	19	28	11	2.66	18.0	5.3	1.7
B23t&A'2-62 to 80	A-6 (04)	SC	100	100	100	100	100	100	49	--	27	25	35	16	2.65	22.0	6.4	1.6

See footnotes at end of table.

TABLE 18.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density	Shrinkage		
			Percentage passing sieve--							Percentage smaller than--								
	AASHTO	Unified	7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
													Pct		G/cc	Pct	Pct	Pct
Kaufman clay:[8] (S75TX-213-006)																		
A11------ 0 to 11	A-7-6(43)	CH	100	100	100	100	100	100	91	--	68	62	65	42	2.67	10.0	22.2	2.0
A13------33 to 69	A-7-6(47)	CH	100	100	100	100	100	99	89	--	62	58	68	49	2.71	10.0	23.0	2.0
Nahatche loam:[9] (S75TX-213-010)																		
Ap------- 0 to 5	A-4 (02)	CL	100	100	100	100	100	100	54	--	19	13	29	9	2.61	20.0	4.7	1.7
C1g------13 to 30	A-6 (20)	CL	100	100	100	100	100	100	90	--	43	32	39	23	2.64	16.0	11.3	1.8
C2g------30 to 75	A-6 (19)	CL	100	100	100	100	100	100	84	--	43	34	38	24	2.65	15.0	11.4	1.8
Pickton loamy fine sand:[10] (S75TX-213-012)																		
A2------- 8 to 50	A-2-4(00)	SM	100	100	100	100	100	99	16	--	3	2	19	2	2.66	15.0	0.0	1.8
B21t-----50 to 76	A-2-6(00)	SC	100	100	100	100	100	99	28	--	22	21	28	12	2.70	20.0	4.3	1.7
Trinity clay:[11] (S75TX-213-008)																		
A12------ 6 to 17	A-7-6(51)	CH	100	100	100	100	100	100	99	--	72	62	66	46	2.70	12.0	21.7	2.0
A13------17 to 60	A-7-6(58)	CH	100	100	100	100	100	100	100	--	85	73	74	50	2.72	12.0	23.5	1.9
Wolfpen loamy fine sand:[12] (S75TX-213-011)																		
A2------- 7 to 28	A-2-4(00)	SM	100	100	100	100	99	98	24	--	6	3	17	2	2.65	15.0	0.0	1.8
B21t-----28 to 43	A-6 (04)	SC	100	100	100	100	100	99	45	--	29	27	32	18	2.69	16.0	8.3	1.8
B3-------65 to 90	A-7-6(22)	CL	100	100	100	100	100	100	83	--	45	39	42	27	2.66	14.0	12.7	1.9

See footnotes at end of table.

TABLE 18.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density	Shrinkage		
			Percentage passing sieve--							Percentage smaller than--								
	AASHTO	Unified	7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
													Pct		G/cc	Pct	Pct	Pct
Woodtell loam:[13] (S75TX-213-001)																		
A1------- 0 to 5	A-4 (00)	SM-SC	100	100	100	100	99	99	43	--	8	6	23	4	2.61	20.0	1.6	1.6
B21t----- 8 to 20	A-7-6(23)	CH	100	100	100	100	100	100	73	--	51	50	52	33	2.70	13.0	16.9	1.9
B23t-----31 to 54	A-6 (14)	CL	100	100	100	100	100	100	67	--	36	33	40	25	2.69	14.0	12.4	1.8

[1]For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2]Liquid limit and plastic index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3]Axtell loam:
7.2 miles north of Malakoff on Farm Road 90, 0.35 mile south on county road, 250 feet west in pasture.

[4]Bernaldo fine sandy loam:
5.6 miles north of Athens on Texas Highway 19, 3.8 miles northeast on county road, 0.6 mile east on county road, 650 feet east in pasture.

[5]Cuthbert fine sandy loam:
5.6 miles north of Athens on Texas Highway 19, 4.2 miles northeast on county road, 0.8 mile east to end of road, 1,000 feet southeast in pasture.

[6]Freestone fine sandy loam:
5.3 miles west of Athens on Texas Highway 31, 300 feet south in pasture.

[7]Gallime fine sandy loam:
5.6 miles east of Murchison on Texas Highway 31, 0.3 mile south on county road, 1,000 feet east in cropland field.

[8]Kaufman clay:
2.6 miles southwest of Cross Roads, Texas on county road, 0.7 mile west, 0.1 mile north, 0.8 mile west on pasture road, 200 feet north in field.

[9]Nahatche loam:
8.5 miles northwest of Athens on U.S. Highway 175, 1,000 feet west in creek bottom.

[10]Pickton loamy fine sand:
0.7 mile northeast of Athens on Texas Highway 31, 2.3 miles north on Farm Road 1616, 400 feet east in idle cropland field.

[11]Trinity clay:
3.0 miles north of Trinidad on Texas Highway 274, 2.1 miles west on county road, 0.2 mile south on county road, 0.7 mile west on pasture road.

[12]Wolfpen loamy fine sand:
0.7 mile northeast of Athens on Texas Highway 31, 1.4 miles north on Farm Road 1616, 0.4 mile north on dirt road, 1,800 feet north in pasture.

[13]Woodtell loam:
3.6 miles west of Athens on Texas Highway 31, 0.3 mile south on county road, 600 feet east in pasture.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Axtell	Fine, montmorillonitic, thermic Udertic Paleustalfs
Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
*Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Cuthbert	Clayey, mixed, thermic Typic Hapludults
Deport	Fine, montmorillonitic, thermic Udorthentic Pellusterts
Derly	Fine, montmorillonitic, thermic Typic Glossaqualfs
Dutek	Loamy, siliceous, thermic Arenic Haplustalfs
Elrose	Fine-loamy, siliceous, thermic Typic Paleudalfs
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Freestone	Fine-loamy, siliceous, thermic Glossaquic Paleudalfs
Gallime	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Gladewater	Fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Henco	Loamy, siliceous, thermic Grossarenic Paleaquults
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Kirvin	Clayey, mixed, thermic Typic Hapludults
Larue	Loamy, siliceous, thermic Arenic Paleudalfs
Leagueville	Loamy, siliceous, thermic Arenic Paleaquults
Lufkin	Fine, montmorillonitic, thermic Vertic Albaqualfs
Nahatche	Fine-loamy, mixed, nonacid, thermic Aeric Fluvaquents
*Normangee	Fine, montmorillonitic, thermic Vertic Haplustalfs
Pickton	Loamy, siliceous, thermic Grossarenic Paleudalfs
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Raino	Fine-loamy over clayey, siliceous, thermic Aquic Glossudalfs
Silawa	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Styx	Loamy, siliceous, thermic Arenic Paleustalfs
Tonkawa	Thermic, coated Typic Quartzipsamments
Trawick	Fine, kaolinitic, thermic Mollic Hapludalfs
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Wolfpen	Loamy, siliceous, thermic Arenic Paleudalfs
Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs

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