United States Department of Agriculture

Soil Conservation Service

In cooperation with Texas Agricultural Experiment Station

Soil Survey of Stephens County, Texas

How To Use This Soil Survey

General Soil Map

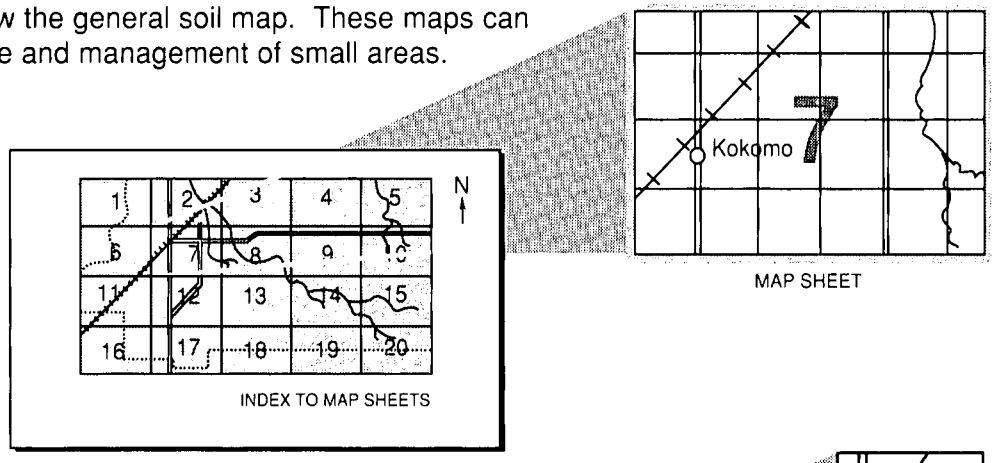
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

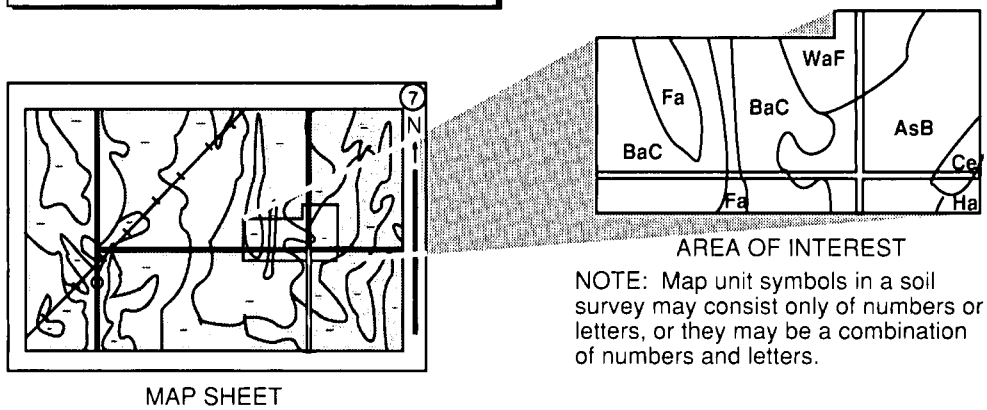
Detailed Soil Maps

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

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



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



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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This soil 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 Lower Clear Fork of the Brazos Soil and Water Conservation District.

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

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

Cover: A pond in an area of Bonti-Exray-Truce complex, hilly, very stony.

Contents

Issued May 1994

Index to Map Units

Summary of Tables

Foreword

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

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

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

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

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Soil Survey of Stephens County, Texas

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Fieldwork by Thomas E. Cyprian and Steven S. Park, Soil Conservation Service

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

STEPHENS COUNTY is located in north-central Texas (fig. 1). The county has an area of 589,817 acres. It is bordered by Throckmorton and Young Counties on the north, Shackelford County on the west, Palo Pinto County on the east, and Eastland County on the south. Elevation ranges from about 1,000 to 1,600 feet.

Stephens County was created in 1858 and organized in 1861. Breckenridge, which is located in the central part of the county, is the county seat. In 1980, the population of Breckenridge was 6,900 and the total population of Stephens County was 9,926.

Land use in the county has not changed significantly since the early 1940's. About 495,000 acres, or 90 percent of the total agricultural land, is used as range. The production of beef cattle is the main agricultural enterprise. A few sheep, goats, and hogs also are raised. The acreage used as cropland has declined from about 65,000 acres in 1959 to about 46,800 acres in 1985. The main crops are drilled small grain crops, which are grown primarily for grazing but also may be harvested for grain. Drilled forage sorghum is used for grazing and hay. About 10,700 acres is used as pasture and is planted with kleingrass and coastal bermudagrass. About 350 acres is irrigated.

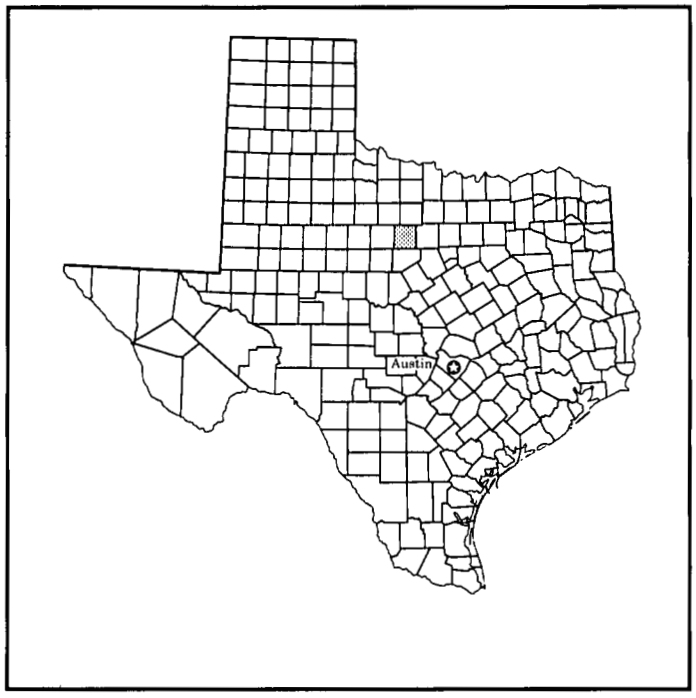

Figure 1.—Location of Stephens County in Texas.

General Nature of the County

This section provides general information about Stephens County. It describes the history, natural resources, and climate of the area.

History

Mrs. Betty Hanna, chairperson, Stephens County Historical Committee, prepared this section.

Before the Texas Rebellion against Mexico in 1835, the area that is now Stephens County was included in

the Viesta District for administrative purposes. At that time this area had no known settlers. Wandering bands of Comanches traveled through the area, and one of their war trails crossed the southeast corner of the county. In the 1840's, a man named Peters was given the right to colonize the north-central part of Texas, which included Stephens County. When he failed to fulfill the agreement, the land reverted to the government. The Texas Land Emigration Company later issued patents on unclaimed land in the same area. Since many of the settlers had filed previously for extra land, conflicts over land ownership took place for many years afterward.

The first settlers moved to the area in about 1850. They settled on land along the creeks and became ranchers. Picketville, the first settlement, was established in the late 1850's. The community consisted of several houses, a school, a store, and a saloon. Caddo, in the eastern part of the county, began as a trading post soon afterward.

The Texas Legislative Act of 1858 designated the boundaries of Stephens County, originally named Buchanan County for President James Buchanan. Breckinridge, the county seat, was named for John C. Breckinridge, who was Buchanan's Vice President and later a Confederate major general. The county held its first election in the early 1860's. With the secession of Texas and the onset of the Civil War, sentiments in the county demanded a name change; thus, the county was renamed Stephens County, for Alexander H. Stephens, the Vice President of the Confederacy. The Civil War disrupted civilian government, and as a result the county was linked administratively to Palo Pinto County until the 1870's.

The major period of settlement was in the late 1870's and 1880's. Most of the early settlers came from the South, but some families came to the area from foreign countries, such as Sweden and Ireland.

Stephens County was officially reorganized in 1876, and the city of Breckinridge was again named the county seat. A three-story, native sandstone courthouse was built in 1883. About this time, the name Breckinridge was misspelled as Breckenridge, its present spelling.

By the turn of the century, Breckenridge had developed into a thriving community. Other communities in the county were Crystal Falls, Eliasville, Cotton Plant (later known as Necessity), Eolian, Gunsight, and Caddo. Many churches and one- or two-room schools were established throughout the county.

The first successful oil well was drilled in 1916 near Caddo. It was a small well but produced enough oil to spur further drilling. When the big gushers were hit in 1918, the oil boom was on. Within one year the population of Breckenridge increased from 1,590 to over 20,000. By 1920, there were 13 banks in the county. Railroads were extended to Breckenridge in 1920. Many oil companies built camps to provide workers with housing close to their leases. The biggest and most elaborate was Parks Camp, which was southeast of Breckenridge.

By the early 1920's, the boom was starting to decline as the pressure in the oil field reservoirs fell and oil prices dropped. By the mid 1920's, all but one of the county's banks had closed. The depression of the 1930's further eroded the economy. During World War II many of the communities in the county were depopulated as people moved to be near military bases or war production plants.

Severe droughts occurred in 1886, the 1930's, and the 1950's. Possum Kingdom Lake was begun in the late 1930's and completed in 1941. The city of Breckenridge had built Lake Daniel in the 1950's for a steady supply of water. Hubbard Creek Reservoir, with about 17,000 surface acres, was completed in 1962. A major flood occurred in the county in 1981.

The area now has an economic base of ranching and oil and a variety of manufacturing and service firms. Products made locally are mobile homes and aircraft parts.

Natural Resources

The soil is the most important natural resource in the county. Most of the residents earn their living by producing forage for livestock or food and fiber for market.

Oil and gas are produced from numerous wells in the county. They provide a major source of income for some landowners and provide a tax base from which public services are funded.

Water is another very important resource. Lake Daniel and Hubbard Creek Reservoir furnish water for the city of Breckenridge. Possum Kingdom Lake, on the Brazos River in the northeastern part of the county, and numerous other lakes and ponds throughout the county provide water for livestock and recreation. The Clear Fork of the Brazos River flows through the northern part of the county and provides water for livestock, wildlife, and recreation. A rural water system furnishes water for many areas of the county.

Deer, turkey, quail, and other wildlife species are plentiful. Hunting provides opportunities for recreation and income. Revenue from hunting leases is an important source of income for many farmers and ranchers in the county.

Other natural resources are gravel and limestone. They are used mainly for the construction of roads.

Climate

Stephens 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 but reaches a slight peak in spring. Snowfall is infrequent. Annual total precipitation is normally adequate for the crops grown.

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

In winter, the average temperature is 46 degrees F and the average daily minimum temperature is 32 degrees. The lowest temperature on record, which occurred at Breckenridge on January 12, 1973, is -6 degrees. In summer, the average temperature is 84 degrees and the average daily maximum temperature is 96 degrees. The highest recorded temperature, which occurred at Breckenridge on June 29, 1980, is 111 degrees.

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

The total annual precipitation is about 26 inches. Of this, 16 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 15.7 inches at Breckenridge on October 13, 1981. Thunderstorms occur on about 44 days each year. Tornadoes and severe thunderstorms occur occasionally. They are local in extent and of short duration. The pattern of damage is variable.

The average seasonal snowfall is about 3 inches. The greatest snow depth at any one time during the period of record was 3 inches.

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

How This Survey Was Made

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

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

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

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

compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

1. Bonti-Truce-Bluegrove

Moderately deep and deep, gently sloping to hilly, loamy soils, most of which are flaggy or stony and underlain by sandstone or shale; on uplands

This map unit consists of the moderately deep, gently sloping to hilly Bonti soils on ridges and hills and the deep, gently sloping to hilly Truce and moderately deep, gently sloping Bluegrove soils on foot slopes, ridges, and plains.

This map unit makes up about 29 percent of the county. It is about 25 percent Bonti and similar soils, 13 percent Truce soils, 12 percent Bluegrove soils, and 50 percent soils of minor extent and rock outcrop (fig. 2).

Typically, the surface layer of the Bonti soils is brown stony fine sandy loam about 4 inches thick. The subsurface layer, to a depth of about 8 inches, is light yellowish brown stony fine sandy loam. The subsoil is red or reddish brown clay about 16 inches thick. Strongly cemented sandstone is at a depth of about 24 inches.

Typically, the surface layer of the Truce soils is yellowish brown fine sandy loam about 10 inches thick. The subsoil, to a depth of about 44 inches, is reddish brown and strong brown clay. The underlying material is reddish brown shale that has a clayey texture.

Typically, the surface layer of the Bluegrove soils is brown flaggy loam about 4 inches thick. The subsoil, to a depth of about 21 inches, is clay. It is reddish brown in the upper part and yellowish red in the lower part. The underlying material is interbedded sandstone and shale.

Of minor extent in this map unit are Exray, Frio, Gageby, Harpersville, Hensley, Leeray, Lindy, Owens, Palopinto, Rowden, Set, Throck, and Thurber soils. The very shallow to moderately deep, gently sloping to steep Exray, Hensley, Lindy, Palopinto, Rowden, and Set soils are on hilltops, hillsides, and ridges in the uplands. The deep, nearly level to gently sloping Frio and Gageby soils are on flood plains along the larger streams. The moderately deep and deep, gently sloping to steep Owens, Throck, and Harpersville soils are on hillsides. Small areas of rock outcrop are also included. They occur as exposures of limestone and sandstone bedrock about 10 to 20 feet wide on scarps and rounded hills. The exposures follow the contour of the slope, and in hilly and steep areas they occur as ledges, cliffs, or bluffs. Small areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used mainly as rangeland or wildlife habitat. They are not suited to crops and pasture because of the slope, the surface stoniness, and the depth to bedrock.

Deer, turkeys, quail, and furbearing animals are the main kinds of wildlife. Most areas are managed by ranchers for hunting. Nesting areas for songbirds are plentiful.

There are many scenic areas in this map unit that are desirable as homesites. The main limitations on sites for dwellings, yards, and roads are the depth to bedrock, the clayey texture of the subsoil, the slope, the large stones, and the risk of corrosion to uncoated steel. Special precautions are needed during construction in order to preserve buildings and roads. Excavation is difficult because of the hard bedrock. Allowances should be made for the rapid runoff that

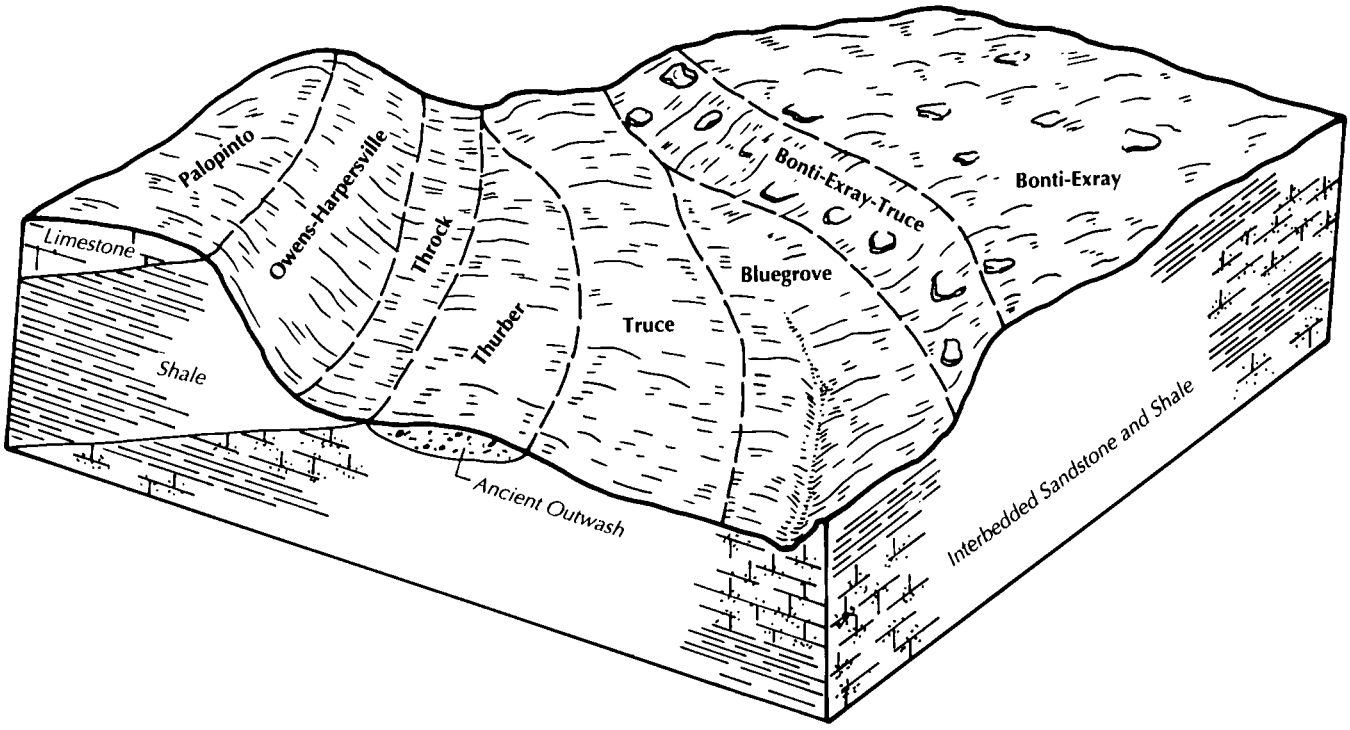

Figure 2.—Typical pattern of soils and parent material in the Bonti-Truce-Bluegrove general soil map unit.

follows high-intensity rains. Underground steel corrodes rapidly unless it is protected.

Limestone is quarried for road-building material in a few places.

2. Bluegrove-Thurber-Leeray

Moderately deep and very deep, nearly level and very gently sloping, loamy and clayey soils underlain by sandstone, shale, or ancient outwash; on uplands

This map unit consists of the very deep, nearly level Thurber and Leeray soils on plains and valley floors and the moderately deep, very gently sloping Bluegrove soils on ridges.

This map unit makes up about 28 percent of the county. It is about 25 percent Bluegrove soils, 22 percent Thurber soils, 21 percent Leeray soils, and 32 percent soils of minor extent (fig. 3).

Typically, the surface layer of the Bluegrove soils is reddish brown loam about 5 inches thick. The subsoil, to a depth of about 27 inches, is reddish brown clay loam and clay. The underlying material is interbedded sandstone and shale.

Typically, the surface layer of the Thurber soils is grayish brown clay loam about 4 inches thick. The subsoil is clay to a depth of 62 inches or more. In sequence downward, it is dark grayish brown, dark brown, brown, and reddish brown.

Typically, the surface layer of the Leeray soils is dark grayish brown clay about 54 inches thick. The subsoil is brown clay to a depth of about 74 inches. The underlying material to a depth of 80 inches or more is olive gray, weathered shale that has a clayey texture.

Of minor extent in this map unit are Bonti, Exray, Frio, Gageby, Harpersville, Hensley, Lindy, Owens, Throck, and Truce soils. The shallow and moderately deep, gently sloping Bonti, Exray, and Hensley soils are on ridges in the uplands. The gently sloping to steep Harpersville and Owens soils are on shaly ridges and hillsides. The nearly level Frio and Gageby soils are on flood plains. The moderately deep Lindy soils are on upland plains. The deep and moderately deep, gently sloping Throck soils are on uplands. The deep, gently sloping Truce soils are on gently undulating plains. Small areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used as cropland, rangeland, pasture, or wildlife habitat. The main crops are wheat, forage sorghum, and grain sorghum. Improved pasture grasses are mainly King Ranch bluestem and kleingrass.

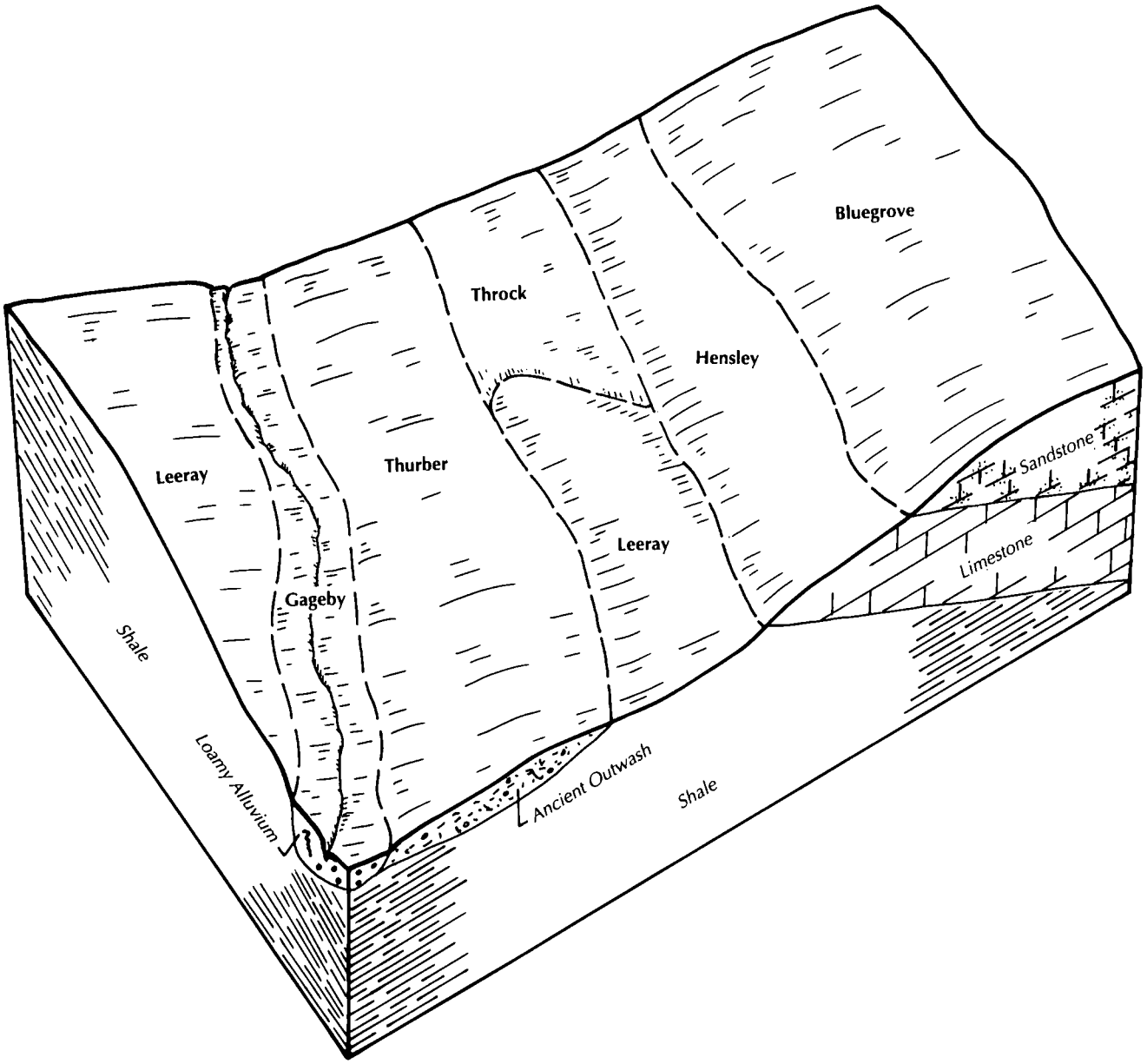

Figure 3.—Typical pattern of soils and parent material in the Bluegrove-Thurber-Leeray general soil map unit.

Deer, turkeys, quail, doves, and squirrels are the main kinds of wildlife. Some areas are managed by ranchers for hunting and fishing. Nesting areas for doves, turkeys, and songbirds are plentiful.

The main limitations on sites for dwellings, roads, and other structures are the depth to bedrock and the risk of corrosion to uncoated steel. The Leeray and Thurber soils are susceptible to shrinking and swelling. Foundations for buildings and roads should be designed and constructed to withstand the high shrink-swell potential. The foundations can be built on solid bedrock; however, excavating the bedrock is difficult. Steel utility lines corrode rapidly unless they are protected. Septic systems must be specially designed in order to function properly in the clayey subsoil. The effluent can pass through the bedrock and pollute ground water. Landscaping and gardening are difficult because of the surface stoniness in some areas and the clayey texture of the subsoil.

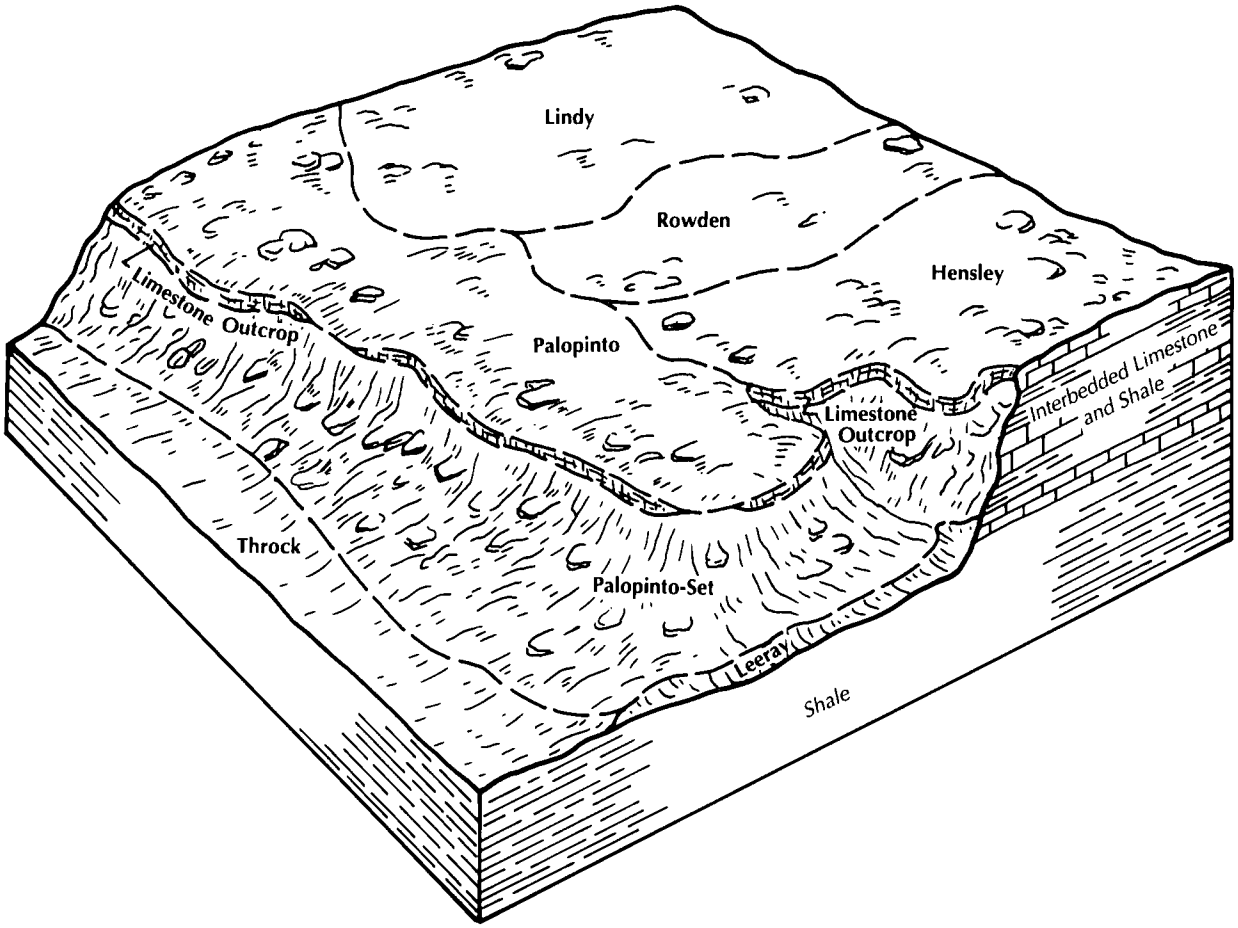

Figure 4.—Typical pattern of soils and parent material in the Palopinto-Lindy-Hensley general soil map unit.

3. Palopinto-Lindy-Hensley

Very shallow to moderately deep, nearly level to moderately steep, loamy soils, most of which are flaggy, stony, or bouldery and underlain by limestone; on uplands

This map unit consists of the very shallow or shallow Palopinto and Hensley soils on ridges and the upper side slopes and the moderately deep Lindy soils on ridgetops.

This map unit makes up about 26 percent of the county. It is about 24 percent Palopinto soils, 18 percent Lindy soils, 16 percent Hensley soils, and 42 percent soils of minor extent (fig. 4).

Typically, the surface layer of the Palopinto soils is dark brown very flaggy loam about 5 inches thick. The next layer is dark brown extremely flaggy clay loam about 6 inches thick. Hard, thinly bedded limestone bedrock is at a depth of about 11 inches.

Typically, the surface layer of the Lindy soils is brown and reddish brown silt loam about 5 inches thick. The subsoil is reddish brown clay about 20 inches thick. Hard limestone bedrock is at a depth of about 25 inches.

Typically, the surface layer of the Hensley soils is reddish brown loam about 4 inches thick. Stones and boulders are on the surface. The subsoil is reddish brown and red clay loam about 11 inches thick. Indurated limestone bedrock is at a depth of about 15 inches.

Of minor extent in this map unit are areas of rock outcrop and Bluegrove, Bonti, Bosque, Chaney, Cho, Exray, Frio, Gageby, Harpersville, Leeray, Owens, Rowden, Set, Throck, Thurber, and Truce soils. The moderately deep Bluegrove and Bonti soils and the shallow Exray soils are on ridges underlain by sandstone. The shallow, gently sloping Cho soils are on upland hilltops and ridges. The deep Frio and Gageby

soils are on flood plains. The gently sloping to steep Harpersville and Owens soils are on shaly ridges and hillsides. The deep, nearly level to gently sloping Leeray and Throck soils are on upland plains and valley side slopes. The rock outcrop occurs as exposures of limestone bedrock 10 to 20 feet wide. The exposures follow the contour of the slope. In some areas they occur as ledges, cliffs, or bluffs. The deep Set soils are on valley side slopes. The moderately deep Rowden soils are on nearly level to gently sloping plains underlain by limestone. The deep Thurber and Truce soils are on nearly level to gently sloping plains. Small areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used as rangeland, pasture, or wildlife habitat. Some areas are used as cropland. The main crops are wheat, forage sorghum, and grain sorghum. Improved pasture grasses on the Lindy soils are mainly a mixture of King Ranch bluestem and kleingrass. Because of the surface stoniness, the Palopinto soils are not suited to use as cropland or improved pasture. Some of the Hensley soils also have boulders on the surface.

Deer, turkeys, quail, and furbearing animals are the main kinds of wildlife. Most areas are managed by ranchers for hunting. Nesting areas for songbirds are plentiful.

The main limitations on sites for dwellings, yards, and roads are the depth to bedrock, the slope, and the surface stoniness. Special precautions are needed during construction in order to preserve buildings and roads. Excavation is difficult because of the hard limestone bedrock. Allowances should be made for the rapid runoff rate and water seeping from the limestone after rains. Septic systems must be specially designed in order to function properly. The effluent may seep to the surface downslope or through the bedrock into the ground water. Underground steel corrodes rapidly unless it is protected.

Limestone is quarried for road-building material in some areas.

4. Gageby-Thurber-Frio

Very deep, nearly level and very gently sloping, loamy and clayey soils underlain by alluvial sediments or ancient outwash; on flood plains and stream terraces

This map unit consists of Gageby and Frio soils on flood plains and Thurber soils on low stream terraces and foot slopes and in broad valleys.

This map unit makes up about 6 percent of the county. It is about 42 percent Gageby soils, 33 percent Thurber soils, 11 percent Frio soils, and 14 percent soils of minor extent (fig. 5).

Typically, the surface layer of the Gageby soils is moderately alkaline, dark brown clay loam about 22 inches thick. The subsoil, to a depth of about 42 inches, is moderately alkaline, yellowish brown clay loam. The underlying material is light brown sandy clay loam to a depth of about 52 inches and yellowish brown clay loam to a depth of 60 inches or more.

Typically, the surface layer of the Thurber soils is grayish brown clay loam about 4 inches thick. The subsoil is clay to a depth of 62 inches or more. In sequence downward, it is dark grayish brown, dark brown, brown, and reddish brown.

Typically, the surface layer of the Frio soils is dark grayish brown and dark brown silty clay about 25 inches thick. The subsoil, to a depth of about 52 inches, is brown silty clay. The underlying material to a depth of 74 inches or more is brown silty clay.

Of minor extent in this map unit are Bonti, Bosque, Exray, Truce, and Wichita soils and areas of oil-waste land. The moderately deep Bonti and shallow Exray soils are on low ridges. The deep, nearly level to gently sloping Bosque soils are on flood plains along the major streams. The deep, nearly level to gently sloping Wichita soils are on stream terraces along the major streams. The deep, nearly level to gently sloping Truce soils are on adjacent upland plains. The areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used as cropland, rangeland, or pasture or for recreational or urban development. The Gageby and Frio soils are flooded once every 1 to 10 years, and they remain under water from 2 to 48 hours. There is a swift current during periods of flooding. Thurber soils are used as cropland and pasture. A few of the nearly level areas are occasionally flooded for a few hours. The main crops are wheat, forage sorghum, and grain sorghum. Improved pasture grasses are mainly bermudagrass and kleingrass.

Deer, turkeys, quail, doves, and squirrels are the main kinds of wildlife. Many areas do not have adequate cover for deer, but the deer can graze the oats and wheat at night. Nesting areas are available for turkeys, doves, and songbirds.

The main limitations on sites for dwellings, roads, and other structures are the flooding, low strength, a high shrink-swell potential, and the risk of corrosion to uncoated steel. Foundations for buildings and roads should be designed and constructed to withstand the high shrink-swell potential and the low strength. The hazard of flooding on the Gageby and Frio soils should be considered in the design and construction of playgrounds, camp areas, houses, and roads. Steel utility lines corrode rapidly unless they are protected. Septic systems must be specially designed in order to function properly in the clayey subsoil. The effluent can

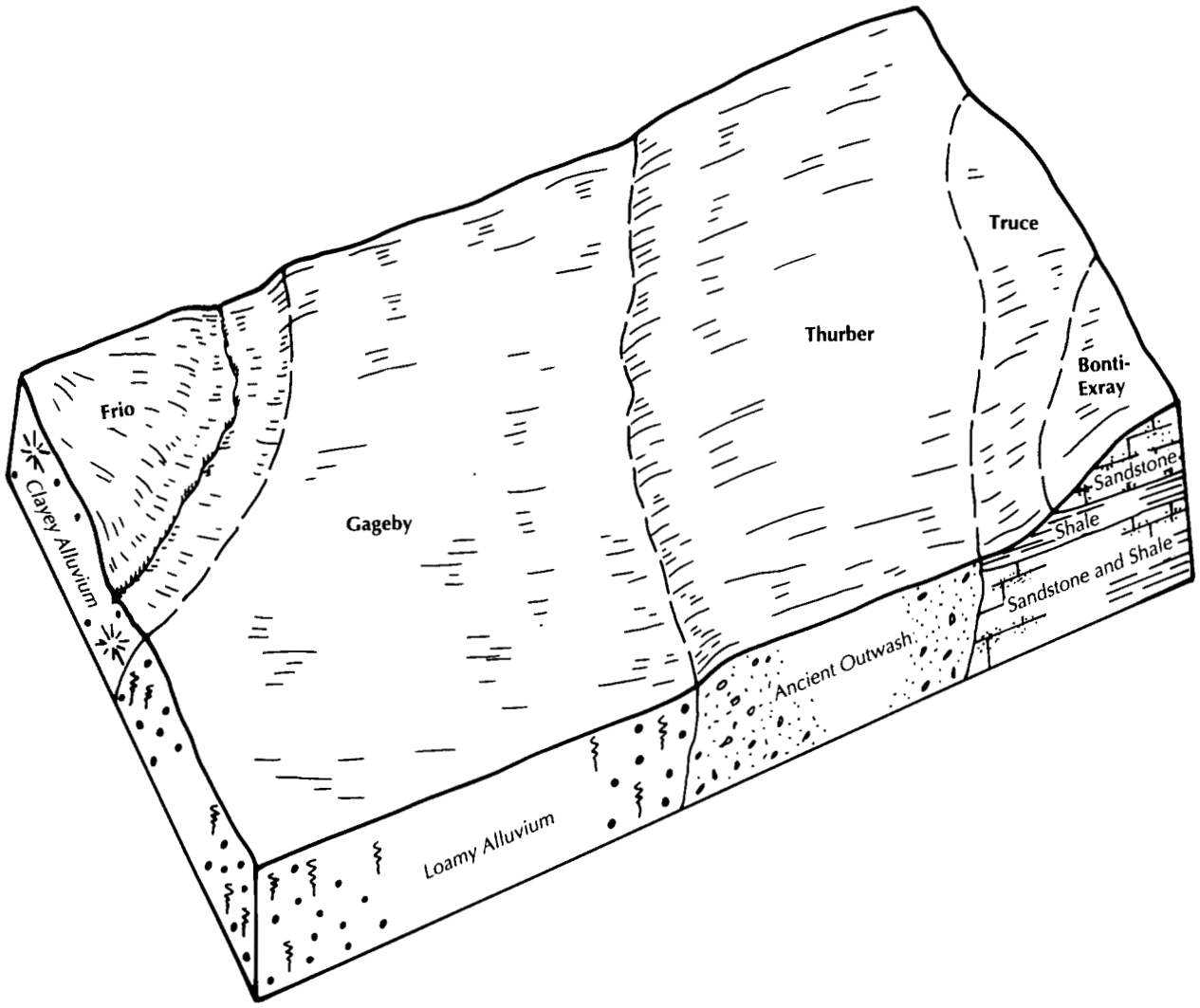

Figure 5.—Typical pattern of soils and parent material in the Gageby-Thurber-Frio general soil map unit.

pass through the substratum and pollute ground water. Unprotected areas are muddy after rains.

5. Bonti-Chaney-Truce

Moderately deep to very deep, nearly level to hilly, loamy and sandy soils underlain by sandstone or shale; on uplands

This map unit consists of the moderately deep Bonti, the very deep Chaney, and the deep Truce soils on broad upland hilltops and slightly raised ridges.

This map unit makes up about 5 percent of the county. It is about 33 percent Bonti soils, 29 percent Chaney soils, 14 percent Truce soils, and 24 percent soils of minor extent.

Typically, the surface layer of the Bonti soils is dark brown fine sandy loam about 4 inches thick. The subsurface layer, to a depth of about 10 inches, is light brown fine sandy loam. The subsoil is reddish brown clay to a depth of 18 inches and yellowish red clay to a depth of 27 inches. The underlying material is yellowish brown sandstone.

Typically, the surface layer of the Chaney soils is brown loamy fine sand about 9 inches thick. The subsoil extends to a depth of about 52 inches. It is mottled. The upper part is reddish yellow sandy clay, the next part is brownish yellow sandy clay, and the lower part is very pale brown sandy clay loam. The underlying material to a depth of 66 inches or more is mottled, reddish yellow sandy clay loam.

Typically, the surface layer of the Truce soils is yellowish brown fine sandy loam about 10 inches thick.

The subsoil extends to a depth of about 44 inches. It is reddish brown and strong brown clay. The underlying material is reddish brown, weathered shale that has a clayey texture.

Of minor extent in this map unit are Bluegrove, Exray, Heaton, Nimrod, and Patilo soils. The moderately deep, undulating Bluegrove soils and the shallow, strongly sloping Exray soils are on ridges in the uplands. The deep, nearly level to gently sloping Heaton, Nimrod, and Patilo soils are on high, gently undulating plains. Small areas of oil-waste land are in some of the oil fields.

The soils in this unit are used as rangeland, cropland, pasture, or wildlife habitat. They originally supported oak timber and were cleared for use as cropland. Some of the cultivated areas have eroded, and many areas have been converted to pasture or rangeland. The main crops are peanuts, cotton, wheat, and forage sorghum. Bermudagrass is the dominant pasture grass.

Deer, turkeys, quail, doves, and squirrels are the main kinds of wildlife. Some areas are managed by landowners for hunting. Nesting areas for doves and songbirds are plentiful.

The main limitations on sites for dwellings, roads, and other structures are the depth to bedrock, low strength, and the risk of corrosion to uncoated steel. Foundations for buildings and roads should be designed and constructed to compensate for the low strength. The foundations can be built on solid bedrock; however, excavating the bedrock is difficult. Steel utility lines corrode rapidly unless they are protected. Septic systems must be specially designed in order to function properly. The effluent can pass through the bedrock and pollute ground water. Landscaping and gardening are difficult because of the clayey subsoil and the depth to bedrock. Cover crops should be planted to protect the soils from wind erosion.

6. Bastrop-Minwells

Very deep, nearly level and very gently sloping, loamy soils underlain by loamy and gravelly alluvial sediments; on stream terraces

This map unit consists of Minwells and Bastrop soils on high terraces along the Clear Fork of the Brazos River and other major tributaries throughout the county.

This map unit makes up about 4 percent of the county. It is about 36 percent Bastrop soils, 26 percent Minwells soils, and 38 percent soils of minor extent (fig. 6).

Typically, the surface layer of the Bastrop soils is reddish brown fine sandy loam about 5 inches thick. The subsoil is reddish brown sandy clay loam to a depth of about 11 inches and red sandy clay loam to a depth of about 66 inches. The underlying material is red loam.

Typically, the surface layer of the Minwells soils is brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. In sequence downward, it is reddish brown clay, red clay, yellowish red clay, and reddish yellow sandy clay loam. The underlying material is reddish yellow very gravelly sandy loam.

Of minor extent in this map unit are Bluegrove, Bonti, Clairemont, Clearfork, Exray, Lusk, Truce, and Wichita soils and areas of oil-waste land. The gently sloping Bluegrove soils are on ridges in the uplands. The moderately deep Bonti soils and the shallow Exray soils are on upland plains underlain by sandstone. The deep Clairemont and Clearfork soils are on flood plains along streams. The moderately deep Lusk soils are on stream terraces. The deep Truce soils are on upland plains. The deep Wichita soils are in the uplands. The areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used as cropland, rangeland, pasture, or wildlife habitat. The main crops are wheat, forage sorghum, and grain sorghum. Improved pasture grasses are mainly bermudagrass and kleingrass.

Deer, turkeys, quail, doves, and squirrels are the main kinds of wildlife. Many areas do not have adequate cover for deer, but the deer can graze the wheat at night. Nesting areas are available for doves and songbirds.

The main limitations on sites for dwellings, roads, and other structures are the shrink-swell potential and the risk of corrosion to uncoated steel. Foundations for buildings and roads should be designed and constructed to withstand the high shrink-swell potential. Steel utility lines corrode rapidly unless they are protected. Septic systems must be carefully designed and installed in order to function properly. The effluent can pass through the soils and pollute ground water.

Some areas of this map unit are quarried for gravel.

7. Clearfork-Clairemont

Very deep, nearly level and very gently sloping, loamy soils underlain by clayey and loamy alluvial sediments; on flood plains

This map unit consists of Clearfork and Clairemont soils on the flood plains along the Clear Fork of the Brazos River. Slopes range mainly from 0 to 2 percent.

This map unit makes up about 2 percent of the county. It is about 45 percent Clearfork soils, 37 percent Clairemont soils, and 18 percent soils of minor extent (fig. 7).

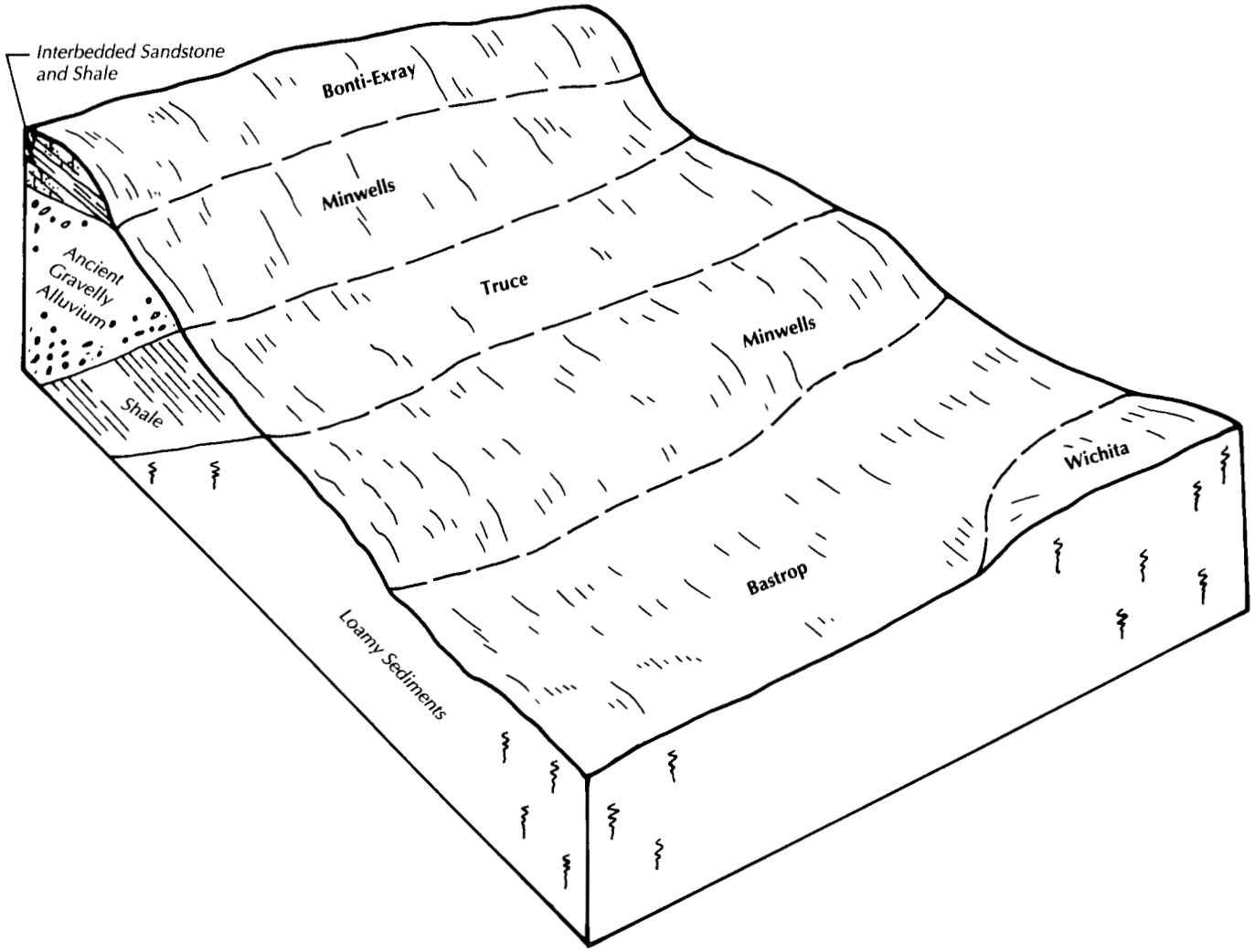

Figure 6.—Typical pattern of soils and parent material in the Bastrop-Minwells general soil map unit.

Typically, the surface layer of the Clearfork soils is silty clay loam about 28 inches thick. It is reddish brown in the upper part and dark reddish gray in the lower part. The subsoil to a depth of 83 inches or more is reddish brown silty clay loam.

Typically, the surface layer of the Clairemont soils is reddish brown silty clay loam about 11 inches thick. The underlying material is moderately alkaline, reddish brown silty clay loam that grades to light reddish brown silt loam.

Of minor extent in this map unit are Bluegrove, Frio, and Gageby soils. The deep, nearly level to gently sloping Frio and Gageby soils are on flood plains along the major streams. The moderately deep, gently sloping Bluegrove soils are on adjacent upland ridges. Areas of oil-waste land are in some of the oil fields.

The soils in this map unit are used as cropland, rangeland, or pasture or for recreational or urban development. The soils are flooded once every 1 to 10 years, and they remain under water from 2 to 48 hours. There is a swift current during periods of flooding. The main crops are wheat, cotton, forage sorghum, and grain sorghum. Improved pasture grasses are mainly bermudagrass and kleingrass. A few fields are irrigated.

Deer, turkeys, quail, doves, and squirrels are the main kinds of wildlife. Some areas are managed by ranchers for hunting.

The Clear Fork of the Brazos River and its surrounding areas provide scenic areas for fishing, swimming, boating, hiking, and other related activities. The hazard of flooding should be considered in the design and construction of playgrounds, camp areas,

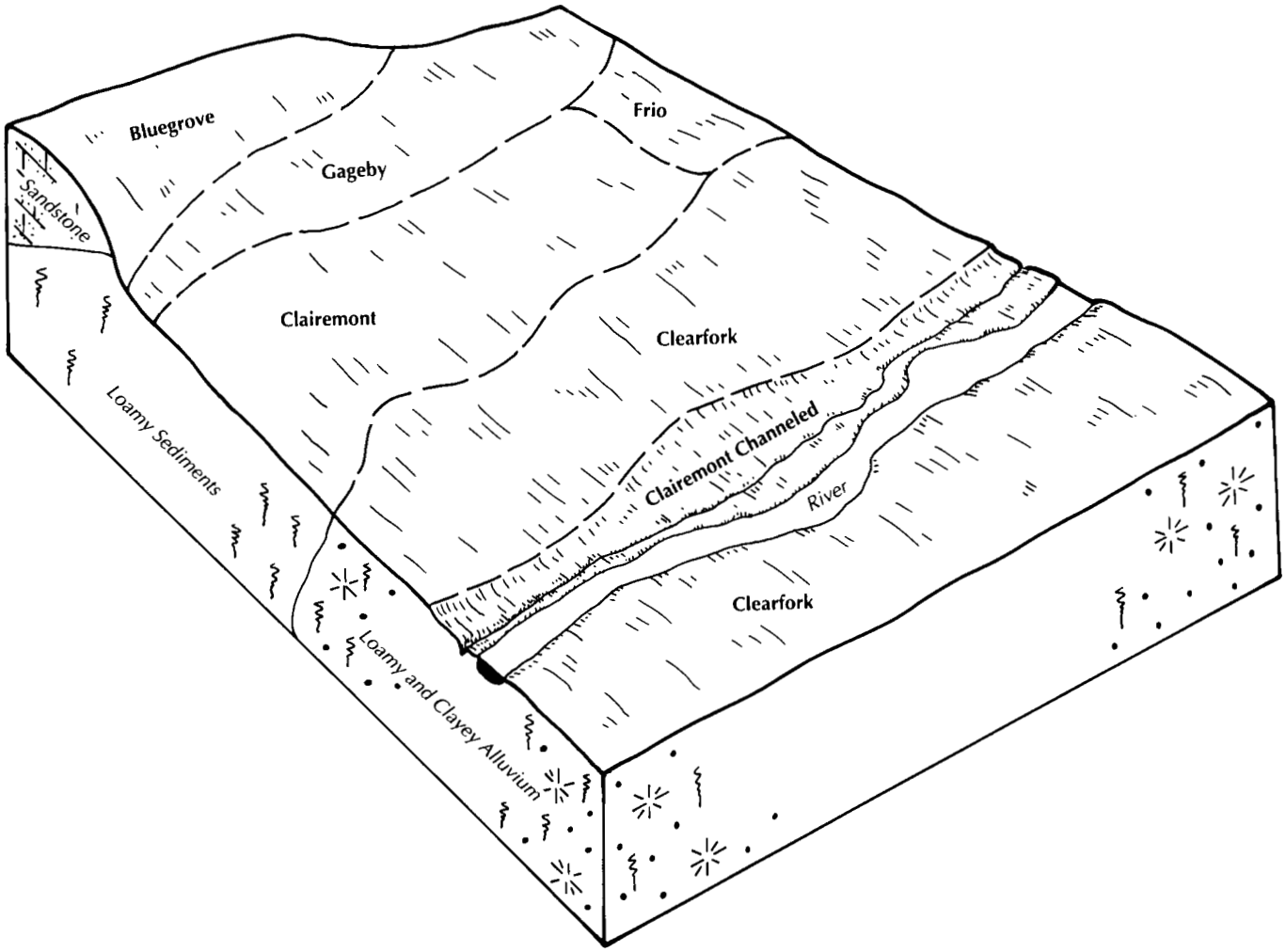

Figure 7.—Typical pattern of soils and parent material in the Clearfork-Clairemont general soil map unit.

houses, and roads. Additional limitations on sites for dwellings, roads, and other structures include low strength and the risk of corrosion to uncoated steel. Foundations for small buildings and roads can be designed and constructed to compensate for the low strength. Steel utility lines corrode rapidly unless they are protected. Septic systems must be specially designed in order to function properly. The effluent can pass through the substratum and pollute ground water.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bastrop loamy fine sand, 1 to 5 percent slopes, is a phase of the Bastrop series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bonti-Exray complex, gently undulating, is an example.

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

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

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

BaC—Bastrop loamy fine sand, 1 to 5 percent slopes. This very deep, well drained, gently sloping soil is on terraces of the Brazos River. The mapped areas are oblong or irregularly shaped. They range from about 15 to more than 100 acres in size. A few areas, less than 3 acres in size, are eroded.

Typically, the surface layer is mildly alkaline, pale brown loamy fine sand about 6 inches thick. The subsurface layer, to a depth of about 18 inches, is neutral, reddish yellow loamy fine sand. The subsoil extends to a depth of about 64 inches. It is yellowish red, sandy clay loam. It is slightly acid to a depth of about 56 inches and is neutral below that depth. The underlying material to a depth of 80 inches or more is moderately alkaline, yellowish red clay loam.

Runoff is medium. Permeability and the available water capacity are moderate. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are small areas of Bonti, Clairemont, Exray, Heaton, Minwells, and Truce soils; a few nearly level areas; and some areas of soils that have a surface layer of fine sandy loam. Included areas range from 1 to 5 acres in size and make up less than 15 percent of the map unit.

The Bastrop soil is used mainly as cropland or rangeland. Grain sorghum and wheat are the main crops.

This soil is suited to crops. Leaving crop residue on the surface conserves moisture and helps to control wind erosion.

This soil is well suited to native range plants, mainly mid and tall grasses. Most areas of range support hooded windmillgrass, sand dropseed, Arizona cottontop, tumble lovegrass, and threeawn and live oak, mesquite, and other woody plants. The potential as habitat for quail, doves, and songbirds is good.

This soil is well suited to most urban and recreational uses. The low strength of the soil and seepage in sewage lagoon areas are the major limitations. Proper design and careful installation can help to overcome these limitations. The slope restricts some playground uses.

This soil is in capability subclass IIIe. It is in the Loamy Sand range site.

BfA—Bastrop fine sandy loam, 0 to 1 percent slopes. This very deep, well drained, nearly level soil is on terraces. The mapped areas are oblong or irregularly shaped. They range from 10 to 50 acres in size.

Typically, the surface layer is neutral, light reddish brown fine sandy loam about 4 inches thick. The upper part of the subsoil, to a depth of about 26 inches, is mildly alkaline, reddish brown sandy clay loam. The next part, to a depth of about 40 inches, is moderately alkaline, red sandy clay loam. The lower part, to a depth of about 65 inches, is moderately alkaline, red clay loam. The underlying material to a depth of 80 inches or more is moderately alkaline, red very gravelly sandy clay loam.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included with this soil in mapping are small areas of Bonti, Clairemont, Minwells, and Truce soils and a few areas of soils that have a surface layer of loamy fine sand. Included areas range from 1 to 5 acres in size and make up less than 15 percent of the map unit.

The Bastrop soil is used mainly as cropland or rangeland, but some areas are used as pasture. Grain sorghum and wheat are the main crops.

This soil is well suited to crops. Leaving crop residue on the surface conserves moisture and helps to control wind erosion.

This soil is well suited to native range plants, mainly mid and tall grasses. Most areas of range support hooded windmillgrass, sand dropseed, Arizona cottontop, tumble lovegrass, and threeawn and live oak, mesquite, and other woody plants. The potential as habitat for quail, doves, and songbirds is good.

This soil is well suited to most urban and recreational uses. The low strength of the soil and seepage in sewage lagoon areas are the major limitations. Proper design and careful installation can help to overcome these limitations.

This soil is in capability subclass IIe. It is in the Sandy Loam range site.

BfB—Bastrop fine sandy loam, 1 to 3 percent slopes. This very deep, well drained, very gently sloping soil is on terraces. The mapped areas are oblong or irregularly shaped. They range from 10 to 100 acres in size. A few areas, 5 to 10 acres in size, are eroded.

Typically, the surface layer is neutral, reddish brown fine sandy loam about 5 inches thick. The upper part of the subsoil is mildly alkaline, reddish brown sandy clay loam about 6 inches thick. The lower part extends to a depth of about 66 inches. It is red sandy clay loam. It is mildly alkaline to a depth of about 27 inches and is moderately alkaline below that depth. The underlying material to a depth of 80 inches or more is red loam. It has common pebbles of quartz and calcium carbonate.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is moderate.

Included with this soil in mapping are small areas of Bonti, Clairemont, Minwells, and Truce soils and a few areas of soils that have a surface layer of loamy fine sand. These included areas range from 1 to 5 acres in size and make up less than 15 percent of the map unit. Also included are areas of soils that are similar to the Bastrop soil but have slopes of 3 to 5 percent. These areas total about 50 acres in size.

The Bastrop soil is used mainly as cropland or rangeland, but some areas are used as pasture. Grain sorghum and wheat are the main crops.

This soil is suited to crops. Leaving crop residue on the surface conserves moisture and helps to control erosion.

This soil is well suited to native range plants, mainly mid and tall grasses. Most areas of range support hooded windmillgrass, sand dropseed, Arizona cottontop, tumble lovegrass, and threeawn and live oak, mesquite, and other woody plants. The potential as habitat for quail, doves, and songbirds is good.

This soil is well suited to most urban and recreational uses. The low strength of the soil and seepage in sewage lagoon areas are the major limitations. Proper

design and careful installation can help to overcome these limitations. The slope restricts some playground uses.

This soil is in capability subclass IIe. It is in the Sandy Loam range site.

BgB—Bluegrove loam, 1 to 3 percent slopes. This moderately deep, well drained, very gently sloping soil is on uplands. The surface is plane or convex. The mapped areas are irregular in shape. They range from about 5 to more than 100 acres in size and average about 30 acres. Slopes average about 1.5 percent.

Typically, the surface layer is neutral, reddish brown loam about 5 inches thick. The subsoil is neutral, reddish brown clay loam and clay about 22 inches thick. It contains about 10 percent sandstone fragments. Reddish brown and yellowish brown, interbedded sandstone and shale bedrock is at a depth of about 27 inches.

Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are areas of Bonti, Owens, Thurber, and Truce soils; small areas of Bluegrove soils that have a surface layer of flaggy loam; soils that are similar to the Bluegrove soil but are less than 20 inches deep over sandstone bedrock; and soils that have a subsoil that is more clayey than that of the Bluegrove soil. These included areas make up less than 25 percent of the map unit. Also included are soils that are similar to the Bluegrove soil but have a surface layer of fine sandy loam.

The Bluegrove soil is used as cropland, pasture, or rangeland. Small grain and forage sorghum are the main crops. A few areas are used as improved pasture and support coastal bermudagrass.

This soil is poorly suited to cultivated crops. The depth to sandstone bedrock and the low available water capacity are the major limitations. Leaving crop residue on the surface conserves moisture and helps to control water erosion. Contour farming and terraces also conserve moisture and help to control erosion.

This soil is well suited to native range plants. The climax plant community is a mixture of mid and short grasses and scattered live oak and post oak. Most areas of range support Texas wintergrass, vine mesquite, tall dropseed, threeawn, mesquite, pricklypear, and annual plants. Effective management practices include proper stocking rates, controlled grazing, and brush management. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. The depth to bedrock is the major limitation. The soil is well suited to recreational uses.

This soil is in capability subclass IIIe. It is in the Tight Sandy Loam range site.

BmB—Bluegrove flaggy loam, gently sloping. This moderately deep, well drained soil is on uplands. The surface is convex. The mapped areas are irregular in shape and range from about 5 to a few hundred acres in size. Slopes are complex and range from 1 to 8 percent. They average about 3 percent.

Typically, the surface layer is neutral, brown flaggy loam about 4 inches thick. It contains about 30 percent flattened sandstone fragments. The upper part of the subsoil is neutral, reddish brown clay about 4 inches thick. The lower part is very firm, slightly acid, yellowish red clay about 13 inches thick. Below this to a depth of 48 inches or more is very pale brown, coarsely fractured sandstone that has yellowish red clay in the crevices.

Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of wind erosion or water erosion is slight.

Included with this soil in mapping are areas of Bonti, Exray, Owens, Throck, and Truce soils; small areas of Bluegrove soils that are not flaggy; and a soil that is similar to the Bluegrove soil but has more than 35 percent sandstone fragments in the surface layer. These included areas make up less than 15 percent of the map unit. Also included are soils that are similar to the Bluegrove soil but have a surface layer of flaggy fine sandy loam. These soils make up about 25 percent of the map unit.

The Bluegrove soil is not suited to crops because of the stoniness. It is used as rangeland. It is best suited to this use. Droughtiness is the major limitation. Native range plants are mainly mid and short grasses and scattered live oak and post oak. Most areas of range support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite, post oak, catclaw acacia, and annual plants. The potential as habitat for doves, quail, and small animals is fair.

This soil is poorly suited to most urban uses. The depth to bedrock is the major limitation. The soil is only moderately suited to recreational uses because of the surface stoniness.

This soil is in capability subclass VIs. It is in the Sandstone Hill range site.

BoC—Bonti fine sandy loam, 1 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on convex ridges in the uplands. The surface is gently undulating. The mapped areas are

irregular in shape. They range from about 15 to more than 100 acres in size. Slopes average about 2 percent.

Typically, the surface layer is slightly acid, dark brown fine sandy loam about 4 inches thick. The subsurface layer is slightly acid, light brown fine sandy loam about 6 inches thick. The upper part of the subsoil is strongly acid, reddish brown sandy clay about 8 inches thick. The lower part is strongly acid, yellowish red clay about 9 inches thick. Slightly acid, yellowish brown sandstone bedrock is at a depth of about 27 inches.

Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep, but penetration of the clay subsoil by plant roots is difficult. The hazard of water erosion or wind erosion is moderate.

Included with this soil in mapping are Bluegrove soils, Bluegrove soils that have a flaggy surface layer, Truce soils, and small areas of soils that are similar to the Bonti soil but are less than 20 inches deep over bedrock or have more than 15 percent sandstone fragments in the surface layer. Included areas make up less than 25 percent of the map unit.

The Bonti soil is used mainly as rangeland, but some areas are used as cropland. The main crops are small grain, forage sorghum, and peanuts. Most formerly cultivated areas are used as rangeland or improved pasture.

This soil is poorly suited to cultivated crops. Low rainfall and the low available water capacity are the major limitations. Leaving crop residue on the surface conserves moisture and helps to control wind erosion. Conservation cropping systems, terraces, and grassed waterways help to control water erosion and wind erosion.

This soil is moderately suited to native range plants, mainly mid and tall grasses. Droughtiness is the major limitation. Most areas of range support little bluestem, sideoats grama, sand lovegrass, purpletop, post oak, mesquite, and greenbrier. The potential as habitat for doves, quail, and small animals is fair.

This soil is poorly suited to most urban uses. The depth to bedrock, low strength, and the shrink-swell potential are the major limitations. The soil is only moderately suited to recreational uses. The slow permeability and the depth to bedrock are the major limitations.

This soil is in capability subclass IIIe. It is in the Sandy Loam range site.

BrC—Bonti-Exray complex, gently undulating. These well drained soils are on ridgetops in the uplands. The Bonti soil is moderately deep, and the Exray soil is shallow. Slopes are convex and range mainly from 1 to 5 percent. Individual areas of this unit are oblong or irregularly shaped. They range from about 15 to more than 100 acres in size. They are about 60 percent Bonti soil and 20 percent Exray soil. Stones cover as much as 5 percent of the surface. A few scattered boulders are in some areas.

Typically, the surface layer of the Bonti soil is neutral, brown stony fine sandy loam about 4 inches thick. The subsurface layer is slightly acid, light yellowish brown stony fine sandy loam about 4 inches thick. The upper part of the subsoil is strongly acid, red clay about 10 inches thick. The lower part is medium acid, reddish brown clay about 6 inches thick. Medium acid, reddish yellow and brownish yellow, strongly cemented sandstone bedrock is at a depth of about 24 inches.

Typically, the surface layer of the Exray soil is neutral, brown stony fine sandy loam about 2 inches thick. The subsurface layer is slightly acid, light brown stony fine sandy loam about 6 inches thick. The subsoil is medium acid, red clay about 8 inches thick. Red, strongly cemented sandstone bedrock is at a depth of about 16 inches.

Runoff is medium on the Bonti and Exray soils. Internal drainage and permeability are moderately slow. The hazard of water erosion is moderate unless a good plant cover is maintained. Wind erosion is not a hazard. The available water capacity is low in the Bonti soil and very low in the Exray soil.

Included with these soils in mapping are small areas of Bluegrove and Truce soils and areas of sandstone rock outcrop. These included areas make up about 20 percent of the map unit.

The Bonti and Exray soils are not suitable for cultivation because of the depth to bedrock, the stoniness, and the rock outcrop. They are moderately suited to native range plants. The climax plant community is mid and tall grasses that produce a moderate amount of forage. Most areas of range support little bluestem, sideoats grama, mesquite, and post oak. The potential as habitat for doves and quail is fair.

The depth to bedrock and the stoniness are moderate or severe limitations affecting most urban and recreational uses.

These soils are in capability subclass VIs. They are in the Sandy Loam range site.

BxE—Bonti-Exray-Truce complex, hilly, very stony. These well drained soils are on ridges and hillside slopes in the uplands. They are dissected by many drainageways. The Bonti soil is moderately deep, the Exray soil is shallow, and the Truce soil is deep. Slopes are complex and range from 5 to 20 percent. Individual areas of this unit are irregular in shape. They range

from about 25 to 300 acres in size. They are about 40 percent Bonti soil, 30 percent Exray soil, and 20 percent Truce soil. About 5 to 15 percent of the surface is covered with sandstone fragments 3 to 48 inches across. Stones are mostly 3 to 25 feet apart, and boulders are mostly 50 to 200 feet apart.

Typically, the surface layer of the Bonti soil is slightly acid, brown fine sandy loam about 1 inch thick. The subsurface layer is slightly acid, pink fine sandy loam about 4 inches thick. The subsoil is strongly acid, yellowish red sandy clay about 31 inches thick. Reddish yellow, strongly cemented sandstone bedrock is at a depth of about 36 inches.

Typically, the surface layer of the Exray soil is neutral, brown fine sandy loam about 2 inches thick. The subsurface layer is slightly acid, light brown fine sandy loam about 3 inches thick. The subsoil is medium acid, red clay about 13 inches thick. Slightly acid, red, strongly cemented sandstone bedrock is at a depth of about 18 inches.

Typically, the surface layer of the Truce soil is neutral, brown stony fine sandy loam about 1 inch thick. The subsurface layer is slightly acid, light brown stony fine sandy loam about 3 inches thick. The upper part of the subsoil is slightly acid, reddish brown clay about 16 inches thick. The next part is mildly alkaline, reddish yellow clay about 12 inches thick. The lower part is moderately alkaline, yellowish brown clay about 10 inches thick. Calcareous, olive yellow, clayey shale bedrock is at a depth of about 42 inches.

Runoff is rapid on the Bonti, Exray, and Truce soils. Internal drainage and permeability are moderately slow in the Bonti and Exray soils and slow in the Truce soil. The hazard of water erosion is severe on all three soils, and the hazard of wind erosion is slight. The available water capacity is low in the Truce soil, medium in the Bonti soil, and very low in the Exray soil.

Included with these soils in mapping are areas of Owens, Throck, and Bluegrove soils; areas of eroded Truce soils; ledges of rock outcrop; and areas of soils that are very shallow over sandstone bedrock. Included areas make up about 10 percent of the unit.

The Bonti, Exray, and Truce soils are not suitable for cultivation because of the depth to bedrock, the slope, the rock outcrop, and the surface stoniness. They are moderately suited to native range plants. The climax plant community is mid and tall grasses that produce a moderate amount of forage. Most areas of range support little bluestem, sideoats grama, mesquite, and post oak. The potential as habitat for doves, quail, and small animals is fair.

The slope, the surface stoniness, the depth to bedrock, and the rock outcrop are moderate or severe limitations affecting most urban and recreational uses. These limitations are difficult to overcome.

These soils are in capability subclass VIIs. They are in the Sandstone Hill range site.

By—Bosque clay loam, occasionally flooded. This very deep, well drained, nearly level soil is on narrow flood plains along local streams. Slopes are dominantly less than 0.5 percent but are as much as 1 percent in a few places. The mapped areas are long and narrow and are parallel to the stream channels. They range from 10 to 100 acres in size but are mainly less than 50 acres. The soil is flooded about once every 3 to 7 years. The flooding is of short duration. It recedes quickly and causes little damage to permanent vegetation.

Typically, the surface layer is moderately alkaline clay loam about 43 inches thick. The upper part is dark grayish brown, and the lower part is dark brown. The underlying material to a depth of 60 inches or more is calcareous, moderately alkaline, pale brown clay loam.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Frio and Gageby soils. These soils make up less than 15 percent of the map unit.

The Bosque soil is well suited to range, and most of the acreage in this map unit is used as rangeland. The climax plant community is a mixture of mid and tall grasses and scattered shrubs and trees. Effective conservation practices include proper stocking rates and controlled grazing. The potential as habitat for doves, quail, songbirds, and small animals is good.

A few areas are used as cropland. This soil is well suited to cultivated crops. The main crops are grain sorghum and wheat. Practices that help to control erosion include suitable crop rotations, crop residue management, and timely and limited tillage. The occasional flooding may damage crops.

This soil is not suited to urban uses because of the flooding. This limitation can be overcome only by major flood-control measures.

This soil is in capability subclass IIw. It is in the Loamy Bottomland range site.

CaB—Chaney loamy fine sand, 0 to 3 percent slopes. This very deep, moderately well drained, nearly level and gently undulating soil is on uplands. The surface is mostly concave. The mapped areas are irregular in shape and range from 10 to 150 acres in size. Slopes average about 2 percent.

Typically, the surface layer is slightly acid, brown loamy fine sand about 9 inches thick. The upper part of the subsoil is 8 inches of medium acid, reddish yellow

sandy clay that has red mottles. The next part is 23 inches of medium acid, brownish yellow sandy clay that has gray, brown, red, and yellow mottles. The lower part is 12 inches of slightly acid, very pale brown sandy clay loam that has yellow and brown mottles. The underlying material to a depth of 66 inches or more is slightly acid, reddish yellow sandy clay loam that has gray and red mottles.

Runoff is slow or medium. Permeability is slow, and the available water capacity is moderate or high. The root zone is deep. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are soils that have a surface layer of fine sand or loamy sand; soils that are similar to the Chaney soil but do not have mottles in the subsoil; Nimrod and Patilo soils that have a sandy surface layer more than 20 inches thick; and soils having a solum that is more than 60 inches thick. Included soils make up less than 20 percent of the map unit.

The Chaney soil is used mainly as improved pasture or rangeland. Most areas that were formerly used as cropland have been planted to well adapted grasses, such as coastal bermudagrass, weeping lovegrass, and kleingrass. Some areas are still used as cropland. Forage sorghum and peanuts are the main crops (fig. 8).

This soil is moderately suited to cultivated crops. Droughtiness is the major limitation. Leaving crop residue on the surface conserves moisture and helps to control wind erosion.

This soil is well suited to native range plants, mainly mid and tall grasses. Most areas of range support sand bluestem, sideoats grama, panicum, hooded windmillgrass, and threeawn. The woody vegetation includes post oak, greenbrier, tasajillo, and catclaw. The potential as habitat for doves and quail is fair.

Figure 8.—Peanuts in an area of Chaney loamy fine sand, 0 to 3 percent slopes.

This soil is moderately suited to most urban uses. The shrink-swell potential and the clayey texture of the subsoil are the major limitations. The soil is only moderately suited to most recreational uses because of the sandy texture of the surface layer and the slow permeability.

This soil is in capability subclass IIIe. It is in the Loamy Sand range site.

CeD—Chaney stony loamy fine sand, undulating. This deep, moderately well drained, very gently sloping to moderately sloping soil is on uplands. Slopes range from 1 to 8 percent. The surface is billowy or wavy. The mapped areas are long and narrow. They range from about 15 to more than 100 acres in size. Coarse fragments of quartz conglomerate cover about 5 to 20 percent of the surface. These fragments are mostly stones. A few boulders and cobbles are on the surface and in the surface layer.

Typically, the surface layer is medium acid, brown stony loamy fine sand about 4 inches thick. The subsurface layer is neutral, very pale brown stony loamy fine sand about 3 inches thick. The upper part of the subsoil is medium acid, red sandy clay about 7 inches thick. The next part is slightly acid, yellowish red sandy clay about 12 inches thick. Below this is about 10 inches of slightly acid, reddish yellow sandy clay. The lower part of the subsoil is slightly acid, yellowish red gravelly sandy clay loam about 16 inches thick. Below this to a depth of 60 inches or more is weakly cemented sandstone and quartz conglomerate.

Runoff is medium. Permeability is slow, and the available water capacity is moderate. The root zone is deep. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of rock outcrop and areas of loamy soils that are shallow over conglomerate. These included areas make up about 10 percent of the map unit. Also included are soils that are similar to the Chaney soil but are not stony, are gravelly throughout, or have a surface layer of fine sandy loam.

The Chaney soil is used as rangeland or wildlife habitat. It is not suited to crops. It is moderately suited to native range plants, mainly mid grasses. Droughtiness is the major limitation affecting the amount of forage produced. Most areas of range support Texas wintergrass, threeawn, tall dropseed, catclaw, tasajillo, mesquite, hackberry, post oak, and blackjack oak. The potential as habitat for quail, doves, and small animals is good.

This soil is poorly suited to most urban uses. The slope, the slow permeability, and the stoniness are the major limitations. Some areas have been quarried for roadbed gravel. The soil is poorly suited to recreational uses because of the slope and the stoniness.

This soil is in capability subclass VIs. It is in the Loamy Sand range site.

ChC—Cho loam, 0 to 5 percent slopes. This very shallow and shallow, well drained soil is in nearly level to gently sloping areas on uplands. It is underlain by indurated, platy caliche. The surface is convex. The mapped areas are irregular in shape. They range from 5 to 50 acres in size. Slopes average about 2 percent.

Typically, the surface layer is moderately alkaline, dark grayish brown loam about 10 inches thick. The subsoil extends to a depth of about 17 inches. It is about 10 percent brown loam and 90 percent white, indurated, platy caliche. Below this, to a depth of about 34 inches, is pink gravelly clay loam. The underlying material to a depth of 60 inches or more is pale olive shale that has clay texture.

Runoff is medium. Permeability is moderate, and the available water capacity is low. The root zone is shallow or very shallow. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Hensley, Lindy, Palopinto, Rowden, Set, and Throck soils; small areas of hard caliche outcrops; a few areas that are gravelly; soils that are similar to the Cho soil but have a light colored surface layer; and soils that are less than 7 inches deep. Included areas make up less than 25 percent of the map unit.

The Cho soil is not suitable for cultivated crops because of the depth to bedrock. It is used as rangeland or wildlife habitat. It is best suited to native range plants, mainly mid and short grasses. The shallow rooting depth and the very low available water capacity limit the amount of forage produced. Most areas of range support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite, catclaw, and annual plants. The potential as habitat for quail and doves is fair. Nesting places for quail and doves are plentiful.

This soil is poorly suited to most urban uses. The slope, the depth to a cemented pan, and small stones are the major limitations. Some areas are quarried for roadbed material. The soil is only moderately suited to recreational uses because of the slope and the small stones on the surface.

This soil is in capability subclass IVs. It is in the Very Shallow range site.

Cm—Clairemont silty clay loam, occasionally flooded. This very deep, well drained, nearly level soil is on flood plains along the Clear Fork of the Brazos River. Slopes are less than 1 percent but are undulating in a few places. The mapped areas are long and

narrow. They range from 80 to a few hundred acres in size. The soil is flooded once every 3 to 7 years.

Typically, the surface layer is friable, moderately alkaline, reddish brown silty clay loam about 11 inches thick. The upper part of the underlying material is moderately alkaline, reddish brown silty clay loam about 19 inches thick. The lower part to a depth of 65 inches or more is moderately alkaline, light reddish brown silt loam.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are small areas of Clearfork soils; small areas of gently sloping soils adjacent to sloughs; some areas of soils that have a surface layer of silt loam; and soils that are similar to the Clairemont soil but are less clayey throughout or have a dark surface layer. Included areas make up less than 20 percent of the map unit.

The Clairemont soil is used mainly as cropland. Small grain, cotton, and grain sorghum are the main crops. Pecan trees grow well. The occasional flooding is beneficial to established trees.

This soil is well suited to cultivated crops. Leaving crop residue on or near the surface increases the rate of water infiltration and conserves moisture. Diversions may be needed to control runoff from adjacent uplands.

This soil is well suited to native range plants (fig. 9). Low rainfall is the major limitation, but yields of short

Figure 9.—An area of Clairemont silty clay loam, occasionally flooded, used as rangeland.

and mid grasses are good during favorable years. The potential as habitat for deer and turkeys is good. Some livestock and equipment may be lost during severe floods.

This soil is poorly suited to most urban and recreational uses. The flooding is the major hazard.

This soil is in capability subclass IIw. It is in the Loamy Bottomland range site.

Cn—Clairemont silty clay loam, channeled. This very deep, well drained, nearly level and very gently sloping soil is on flood plains, mostly along and including the channel of the Clear Fork of the Brazos River. Slopes range from 0 to 2 percent but average about 1.5 percent. The mapped areas are oblong or elongated. They range from 10 to about 200 acres in size and are 100 to 400 feet wide. Flooding occurs once every 3 years to several times a year. Secondary channels have developed from the frequent flooding. They are 1 to 5 feet deep, are at intervals of about 30 feet, and are parallel to the stream flow.

Typically, the surface layer is reddish brown, silty clay loam about 6 inches thick. The underlying material extends to a depth of 65 inches or more. The upper part is about 40 inches of reddish brown silty clay loam that has thin strata of varying textures. The next part, to a depth of about 58 inches, is yellowish red silt loam that has prominent bedding planes. The lower part is reddish yellow fine sandy loam. The soil is moderately alkaline throughout.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are soils that are similar to the Clairemont soil but have a surface layer of loam, fine sandy loam, or silt loam or have a dark surface layer. These soils make up as much as 30 percent of the map unit.

The Clairemont soil is not suitable for cultivation because of the flooding. It is subject to scouring and the deposition of fresh alluvial sediments after periods of flooding. It is mainly used as rangeland or pasture. A few areas support native pecan trees.

This soil is well suited to native range plants, mainly a mixture of tall and mid grasses. Livestock are lost occasionally because of the flooding. Most areas of range support Texas wintergrass, silver bluestem, Canada wildrye, bermudagrass, western ragweed, mesquite, hackberry, and elm. Effective management practices include proper stocking rates, controlled grazing, and brush management. The potential as habitat for deer and turkeys is good.

This soil is poorly suited to most urban and recreational uses because of the flooding. This limitation is difficult to overcome.

This soil is in capability subclass Vw. It is in the Loamy Bottomland range site.

Co—Clearfork silty clay loam, occasionally flooded. This very deep, well drained, nearly level soil is on the flood plain along the Clear Fork of the Brazos River. Slopes are 0 to 1 percent. The mapped areas are long and narrow. They range from 10 to 200 acres in size.

Typically, the surface layer is moderately alkaline silty clay loam about 28 inches thick. The upper part is reddish brown, and the lower part is dark reddish gray. The subsoil to a depth of 83 inches or more is moderately alkaline, reddish brown silty clay loam.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep. The hazard of water erosion or wind erosion is slight. The soil is flooded about once every 3 to 20 years.

Included with this soil in mapping are small areas of Clairemont soils; soils that are similar to the Clearfork soil but have a lighter colored surface layer; and areas of soils that have a surface layer of clay, silty clay, clay loam, or silt loam. Included areas make up less than 15 percent of the map unit.

The Clearfork soil is suitable for cultivated crops, but it is used mainly as improved pasture and rangeland because of the flooding. Livestock and equipment may be lost during periods of flooding. A few areas support cotton. The soil is well suited to native range plants. During most years the soil produces high yields of mid and tall grasses. The potential as habitat for deer and turkeys is good.

This soil is poorly suited to urban uses because of the flooding. It is only moderately suited to most recreational uses. The flooding and the high content of clay are the major limitations.

This soil is in capability subclass IIw. It is in the Loamy Bottomland range site.

Fr—Frio silty clay, occasionally flooded. This very deep, well drained, nearly level soil is on flood plains along local streams. Slopes are 0 to 1 percent and average about 0.5 percent. The mapped areas are long and narrow and are parallel to stream channels. They range from 10 to about 200 acres in size. In unprotected areas, the soil is flooded about once every 3 to 10 years.

Typically, the surface layer is calcareous, dark grayish brown and dark brown silty clay about 25 inches thick. The subsoil extends to a depth of about 52

inches. It is calcareous, brown silty clay. The underlying material to a depth of 74 inches or more is calcareous, brown silty clay that has films and threads of calcium carbonate. The soil is moderately alkaline throughout.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are small areas of Bosque and Gageby soils and small, frequently flooded stream channels. Included areas make up as much as 20 percent of the map unit.

The Frio soil is used as cropland or rangeland. A few areas support native pecan trees. The main crops are small grain, grain sorghum, and forage sorghum.

This soil is well suited to crops. Low rainfall limits yields. Leaving crop residue on the surface conserves moisture. A sprinkler or surface irrigation system can provide supplemental water.

This soil is well suited to native range plants, mainly a mixture of tall and mid grasses. The flooding is a hazard. Most areas of range support Texas wintergrass, silver bluestem, Canada wildrye, bermudagrass, western ragweed, mesquite, hackberry, pecan, and elm. Effective management practices, such as proper stocking rates, controlled grazing, and brush management, are needed to improve forage quality and increase production. The potential as habitat for turkeys, deer, doves, and quail is good.

This soil is poorly suited to most urban uses because of the severe hazard of flooding. It is only moderately suited to most recreational uses. The flooding and the clayey texture of the surface layer are limitations affecting playgrounds and camp areas.

This soil is in capability subclass IIw. It is in the Loamy Bottomland range site.

Fy—Frio silty clay, frequently flooded. This very deep, well drained, nearly level and very gently sloping soil is on bottom land and in channels as much as 20 feet deep along Hubbard Creek. It is also along small upland streams and drainageways. The surface is complex. Slopes are mostly 0 to 2 percent, but they may exceed 2 percent along old meandering channels and steep banks. The mapped areas are generally elongated bands 50 to 300 feet wide. They range from about 10 to more than 25 acres in size.

Typically, the surface layer is 38 inches thick. It is moderately alkaline, brown silty clay in the upper part and moderately alkaline, dark brown silty clay loam in the lower part. The subsoil extends to a depth of about 60 inches. It is moderately alkaline, brown silty clay and has a few thin strata of loam and clay loam in the lower part. The underlying material to a depth of 70 inches or more is moderately alkaline, yellowish brown clay loam that is stratified with finer and coarser textured material.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. Water erosion, scouring, and deposition are severe because of swift currents during overflows. Flooding is common in the spring and fall. It occurs once every 2 years to twice a year or more. Scouring and deposition occur with each overflow. Layers of gravel are in areas along some major channels and may extend into areas on flood plains that are adjacent to sharp bends in the channels.

Included with this soil in mapping are a few areas of Gageby soils, a few areas of Frio soils that are only occasionally flooded, and a few areas of soils that are similar to the major Frio soil but have a surface layer of fine sandy loam, sandy clay loam, or loam. Included areas make up as much as 25 percent of some mapped areas.

The Frio soil is used for native range, improved pasture, and native and improved pecan orchards. A vegetative cover prevents localized scouring during floods.

This soil is well suited to native range plants, mainly mid and tall grasses. Most areas of range support Texas wintergrass, white tridens, buffalograss, meadow dropseed, Texas grama, mesquite, and live oak. The potential as habitat for turkeys, deer, doves, quail, and small animals is good.

This soil is well suited to pasture. It also is well suited to improved grasses, such as coastal bermudagrass and kleingrass.

This soil is poorly suited to urban and recreational uses. The frequent flooding and the clayey texture are the major limitations.

This soil is in capability subclass Vw. It is in the Loamy Bottomland range site.

Ga—Gageby clay loam, occasionally flooded. This very deep, well drained, nearly level and very gently sloping soil is on the flood plains along local streams. Slopes average about 0.5 percent but range to as much as 2 percent in places. The mapped areas are long and narrow and are parallel to stream channels. They range from 10 to about 300 acres in size.

Typically, the surface layer is moderately alkaline, dark brown clay loam about 22 inches thick. The subsoil extends to a depth of about 42 inches. It is moderately alkaline, yellowish brown clay loam. The upper part of the underlying material, to a depth of about 52 inches, is calcareous, light brown sandy clay loam. The lower part to a depth of 60 inches or more is yellowish brown

clay loam and has films and threads of calcium carbonate.

Runoff is slow or medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is slight. Flooding occurs about once every 5 to 7 years in unprotected areas.

Included with this soil in mapping are areas of Frio soils; soils that have a surface layer of loam, sandy loam, or silty clay loam; soils that are similar to the Gageby soil but are noncalcareous to a depth of about 48 inches; and soils that have a dark surface layer less than 20 inches thick. Included soils make up as much as 20 percent of most mapped areas.

The Gageby soil is used as cropland, pasture, or rangeland. A few areas support native or improved stands of pecan trees. The main crops are small grain, grain sorghum, and forage sorghum.

This soil is well suited to crops. Low rainfall is the major limitation. Leaving crop residue on the surface conserves moisture. A sprinkler or surface irrigation system provides supplemental water.

This soil is well suited to native range plants, mainly a mixture of tall and mid grasses. The flooding is a hazard to livestock and equipment. Most areas of range support Texas wintergrass, silver bluestem, Canada wildrye, bermudagrass, mesquite, post oak, hackberry, pecan, and elm. Effective management practices, such as proper stocking rates, controlled grazing, and brush management, are needed to improve forage quality and increase production. The potential as habitat for turkeys, deer, doves, and quail is good.

This soil is poorly suited to most urban uses because of the severe hazard of flooding. It is only moderately suited to most recreational uses. The flooding restricts the use of this soil for playgrounds and camp areas.

This soil is in capability subclass IIw. It is in the Loamy Bottomland range site.

HaB—Heaton loamy fine sand, 0 to 3 percent slopes. This very deep, well drained, nearly level to gently sloping soil is on high terraces of the Clear Fork of the Brazos River. Slopes range from 0 to 3 percent and average about 2 percent. The mapped areas are irregular in shape. They range from 15 to 100 acres in size.

Typically, the surface layer is neutral, brown loamy fine sand about 7 inches thick. The subsurface layer is slightly acid, reddish yellow loamy fine sand about 16 inches thick. The subsoil extends to a depth of 80 inches or more. In sequence downward, it is about 9 inches of yellowish red, slightly acid sandy clay loam; 10 inches of medium acid, yellowish red sandy clay loam; 18 inches of slightly acid, reddish yellow fine sandy loam; 10 inches of mildly alkaline, reddish yellow fine sandy loam; and 10 inches or more of mildly alkaline, reddish yellow sandy clay loam.

Runoff is slow. Permeability and the available water capacity are moderate. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are small areas of Bastrop fine sandy loam, small areas of Bonti soils, and areas of Heaton soils that have slopes of more than 3 percent. Included areas make up less than 20 percent of the map unit.

The Heaton soil is used mainly as range, but a few areas are cultivated or support pastures of coastal bermudagrass. Small grain and forage sorghum are the main crops.

This soil is suited to small grain or forage sorghum. Leaving crop residue on the surface conserves moisture and helps to control erosion. In dry years emergency tillage is needed to help control wind erosion when the crop residue does not adequately protect the soil.

This soil is moderately suited to native range plants, mainly mid and tall grasses and scattered live oak and post oak. Droughtiness is the major limitation. Most areas of range support silver bluestem, hooded windmillgrass, sideoats grama, purpletop, Texas grama, threeawn, mesquite, greenbrier, and annual plants.

The potential of this soil as habitat for deer, turkeys, quail, squirrels, and furbearing animals is fair. Nesting places for quail and songbirds are plentiful.

This soil is well suited to most urban uses. Excess seepage is a limitation on sites for sewage lagoons and sanitary landfills. Proper design and careful installation can help to overcome this limitation. The soil is only moderately suited to recreational uses because of the sandy surface layer.

This soil is in capability subclass IIIe. It is in the Sandy range site.

HeB—Hensley loam, 1 to 3 percent slopes. This shallow, well drained, very gently sloping soil is on uplands. The surface is plane or convex. The mapped areas are irregular in shape. They range from 25 to more than 100 acres in size. Limestone fragments and cobbles cover as much as 5 percent of the surface.

Typically, the surface layer is neutral, reddish brown loam about 4 inches thick. The subsoil is mildly alkaline, reddish brown clay about 10 inches thick. Coarsely fractured limestone bedrock is at a depth of about 14 inches.

Runoff is medium. Permeability is slow, and the available water capacity is very low. The root zone is

shallow. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are areas of Lindy, Palopinto, and Rowden soils; small areas of extremely stony Hensley soils; and areas of soils that have a surface layer of clay loam. These included areas make up less than 20 percent of the map unit. Also included are a few areas of a soil that is similar to the Hensley soil but has yellow colors in the subsoil.

The Hensley soil is poorly suited to most crops because of the depth to bedrock and the very low available water capacity, but a few areas are used for small grain or forage sorghum.

This soil is well suited to native range plants, mainly mid and tall grasses. Droughtiness is the major limitation. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses and only moderately suited to most recreational uses. The depth to bedrock is the major limitation.

This soil is in capability subclass IIIe. It is in the Redland range site.

HsB—Hensley loam, gently sloping, extremely stony. This shallow, well drained soil is on broad ridgetops in the uplands. Slopes range from 1 to 5 percent. The mapped areas are irregular in shape. They range from 10 to more than 1,000 acres in size. Limestone fragments ranging from 6 inches to several feet across cover 3 to 15 percent of the surface in most areas.

Typically, the surface layer is slightly acid, reddish brown loam about 4 inches thick. Stones and boulders are on the surface. The subsoil is mildly alkaline, reddish brown and red clay loam about 11 inches thick. Indurated limestone bedrock is at a depth of about 15 inches.

Runoff is medium. Permeability is slow, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Lindy, Palopinto, and Rowden soils; some areas of Hensley soils that do not have boulders on the surface; and areas of soils that have a surface layer of clay loam. Included areas make up less than 20 percent of the map unit.

This soil is not suitable for use as cropland because of the stoniness. It is well suited to native range plants, mainly mid and tall grasses. Droughtiness is the major limitation. The potential as habitat for deer, turkeys, quail, and doves is fair. Brush management is needed to enhance wildlife habitat.

This soil is poorly suited to most urban uses. The depth to bedrock is the major limitation. The soil is poorly suited to recreational uses because of the surface stoniness.

This soil is in capability subclass VIs. It is in the Redland range site.

LeA—Leeray clay, 0 to 1 percent slopes. This very deep, well drained, nearly level soil is in upland valleys and on ancient alluvial plains. Slopes average about 0.5 percent. The mapped areas are oblong or irregularly shaped. They range from 15 to several hundred acres in size. The surface is generally plane or slightly concave. Undisturbed areas have gilgai microrelief characterized by microknolls 4 to 12 inches higher than microdepressions. The pattern of knolls and depressions is repeated every 10 to 23 feet.

Typically, the surface layer is moderately alkaline, dark grayish brown clay about 52 inches thick. The upper part of the subsoil is about 10 inches of moderately alkaline, grayish brown clay that has about 10 percent calcium carbonate concretions and soft masses. The lower part is about 6 inches of brownish yellow clay that has some concretions of calcium carbonate. Limestone bedrock is at a depth of about 68 inches.

Runoff is slow. Permeability is rapid when the soil is dry and cracked and is very slow when the soil is wet. The available water capacity is moderate. The root zone is deep. The hazard of water erosion or wind erosion is slight. A few areas may be flooded for a short period after heavy rain.

Included with this soil in mapping are small areas of Hensley, Lindy, Set, Throck, and Thurber soils; areas of soils that are similar to the Leeray soil but are dark reddish brown and are underlain by limestone bedrock at a depth of 20 to 40 inches; and small areas that have slopes of 1 to 3 percent. Included areas make up less than 20 percent of the map unit.

The Leeray soil is used as rangeland or cropland. The main crops are small grain and grain sorghum.

This soil is well suited to small grain and grain sorghum. Leaving crop residue on or near the surface helps to control erosion and conserves soil moisture.

This soil is well suited to native range plants. Low rainfall is the major limitation, but yields of short and mid grasses are good during favorable years. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. A very high shrink-swell potential, low strength, and the risk of corrosion to uncoated steel are the major limitations. Proper design and careful installation can help to overcome these limitations in some areas. Under certain conditions, the sidewalls of trenches can become highly unstable. Trenches that have been

excavated to a depth of more than 5 feet should be shored or should have the sidewalls graded to an angle that ensures safe working conditions.

This soil is poorly suited to recreational uses. The clayey texture and the very slow permeability are limitations.

This soil is in capability subclass IIIs. It is in the Clayey Upland range site.

LeB—Leeray clay, 1 to 3 percent slopes. This very deep, well drained, very gently sloping soil is on uplands. The surface is slightly concave. The mapped areas are irregular in shape. They range from 10 to 200 acres in size. Slopes average about 1.5 percent. Undisturbed areas have gilgai microrelief characterized by microknolls 4 to 12 inches higher than microdepressions. The pattern of knolls and depressions is repeated every 10 to 23 feet.

Typically, the surface layer is moderately alkaline, dark grayish brown clay about 54 inches thick. Slickensides are prominent in the lower part. The subsoil, to a depth of about 74 inches, is moderately alkaline, brown clay that has a few concretions of iron-manganese and calcium carbonate. The underlying material to a depth of 80 inches or more is olive gray shaly clay.

Runoff is medium. Permeability is rapid when the soil is dry and cracked and is very slow when the soil is wet. The available water capacity is moderate. The root zone is deep, but the high content of clay impedes the movement of air and the penetration of plant roots. The hazard of water erosion is moderate, and the hazard of wind erosion is slight. Good tilth is difficult to maintain if the soil is cultivated. Hard clods form if the soil is plowed when wet, but the soil is difficult to plow when dry.

Included with this soil in mapping are small areas of Lindy, Rowden, Set, and Thurber soils and soils that are similar to the Leeray soil but are dark reddish brown and are underlain by limestone at a depth of 32 to 40 inches. Included soils make up less than 20 percent of the map unit.

The Leeray soil is used mainly as rangeland, but some areas are used as cropland. The main crops are wheat and grain sorghum.

This soil is well suited to crops. Low rainfall is the major limitation. Leaving crop residue on the surface conserves moisture. Terraces and grassed waterways help to control water erosion.

This soil is well suited to native range plants, mainly mid and short grasses. Low rainfall is the major limitation. The main grasses are Texas wintergrass, vine mesquite, buffalograss, and curlymesquite. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. Low strength, the shrink-swell potential, the risk of corrosion to uncoated steel, and the clayey texture are the major limitations. Under certain conditions, the sidewalls of trenches can become highly unstable. Trenches that have been excavated to a depth of more than 5 feet should be shored or should have the sidewalls graded to an angle that ensures safe working conditions.

This soil is poorly suited to recreational uses because of the clayey texture of the surface layer.

This soil is in capability subclass IIIe. It is in the Clayey Upland range site.

LnB—Lindy silt loam, 0 to 3 percent slopes. This moderately deep, well drained, nearly level and very gently sloping soil is on ridgetops in the uplands. The mapped areas are rounded or irregularly shaped. They range from 15 to 200 acres in size. Some areas have a few limestone flagstones scattered across the surface.

Typically, the surface layer is neutral, brown or reddish brown silt loam about 5 inches thick. The subsoil is neutral, reddish brown clay about 20 inches thick. Hard limestone bedrock is at a depth of about 25 inches.

Runoff is medium. Permeability is slow, and the available water capacity is low. The root zone is moderately deep, but the clayey texture of the subsoil restricts root penetration. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are small areas of Hensley, Leeray, Palopinto, Rowden, and Throck soils. These soils make up less than 15 percent of the map unit.

The Lindy soil is used mainly as rangeland. It is well suited to grasses. The climax plant community is an open prairie that supports mainly Texas wintergrass, little bluestem, sideoats grama, and forbs and scattered mottes of live oak. Effective management practices include controlled grazing, adequate rest periods, and brush management.

This soil is moderately suited to crops. Sorghum and small grain are the main crops. Terraces and contour farming help to control erosion. Leaving crop residue on the surface conserves moisture and helps to control runoff and maintain soil productivity. The soil also is suited to pasture. Kleingrass and King Ranch bluestem are adapted species.

The potential of this soil as habitat for deer, quail, and doves is good. Brush management enhances the habitat for deer and quail. Disturbing the surface in strips improves the availability of weed seeds for several wildlife species. Excessive grazing reduces the potential of the soil as habitat for wildlife. Live oak is the major browse species for deer.

This soil is only moderately suited to urban and recreational uses. The depth to bedrock, the shrink-swell potential, and the rate of water infiltration are the major limitations. Proper design and careful installation can help to overcome these limitations in some areas.

This soil is in capability subclass IIIe. It is in the Deep Redland range site.

LsD—Lusk gravelly fine sandy loam, undulating. This moderately deep, well drained soil formed in old alluvial sediments of gravelly clay on ancient stream terraces. The surface is slightly convex. The mapped areas are somewhat oval and range from 25 to 150 acres in size. Slopes range from 1 to 8 percent. They average about 2 percent on ridgetops and 5 percent on side slopes.

Typically, the surface layer is mildly alkaline, reddish brown gravelly fine sandy loam about 6 inches thick. The subsoil extends to a depth of about 35 inches. In sequence downward, it is about 4 inches of neutral, reddish brown extremely gravelly sandy clay; 9 inches of neutral, red extremely gravelly sandy clay; 5 inches of neutral, red clay; and 11 inches of mildly alkaline, red very gravelly sandy clay. The upper part of the underlying material is a massive bed about 3 inches thick of red gravelly conglomerate that has about 10 percent sandy clay in seams and crevices. The lower part to a depth of 60 inches or more is massive, yellowish red conglomerate that is cemented with calcium carbonate.

Runoff is medium. Permeability is slow in the subsoil and rapid in the gravelly substratum. The available water capacity is low. The root zone is moderately deep. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Minwells soils and areas of Lusk soils that have a surface layer of loam or sandy loam. Also included are some areas that are less than 20 inches deep over conglomerate and some that are more than 40 inches deep. Included areas make up less than 20 percent of the map unit.

The Lusk soil is used almost entirely as rangeland. It is moderately suited to native range plants, mainly mid and short grasses. The low rainfall and the depth to bedrock are the major limitations. Most areas support Texas wintergrass, tall dropseed, and buffalograss and an overstory of mesquite, live oak, hackberry, elm, pricklypear, tasajillo, and bumelia.

The potential of this soil as habitat for deer, quail, and doves is fair. Scattered shrubs are desirable for deer.

This soil is poorly suited to most urban uses. The slope and the depth to bedrock are the major limitations. Gravel from the lower horizons and the underlying material is mined for use in construction. The soil is moderately suited to recreational uses. The gravel on the surface is a limitation.

This soil is in capability subclass VIs. It is in the Sandy Loam range site.

MfB—Minwells fine sandy loam, 1 to 3 percent slopes. This very deep, well drained, very gently sloping soil is on high river terraces. The surface is complex. The mapped areas are irregular in shape. They range from 15 to more than 100 acres in size.

Typically, the surface layer is neutral, brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. In sequence downward, it is about 7 inches of neutral, reddish brown clay; 18 inches of neutral, red clay that has a few quartz pebbles; 18 inches of neutral, yellowish red clay that has a few siliceous pebbles; and 10 inches of moderately alkaline, reddish yellow sandy clay loam. The underlying material to a depth of 76 inches or more is moderately alkaline, reddish yellow very gravelly sandy loam that has about 60 percent well graded gravel.

Runoff is medium. Permeability is slow, and the available water capacity is moderate. The root zone is deep, and the soil can be easily penetrated by plant roots. The hazard of water erosion or wind erosion is moderate.

Included with this soil in mapping are areas of Bastrop, Bonti, Lusk, Truce, and Wichita soils; small areas of soils that are similar to the Minwells soil but are less than 20 inches deep or have more than 35 percent gravel in the subsoil; and a few nearly level areas. Included areas make up less than 20 percent of the map unit.

The Minwells soil is used mainly as rangeland. It is moderately suited to native range plants, mainly mid and short grasses. Low rainfall is the major limitation. Most areas support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annual plants, mesquite, and post oak. The potential as habitat for doves and quail is fair.

This soil is moderately suited to most urban uses. The shrink-swell potential is a moderate limitation affecting building foundations. The slow permeability in the subsoil is a severe limitation on sites for septic tank absorption fields. Moderately rapid permeability in the underlying material may cause excess seepage into the ground water if the soil is used for sewage lagoons or some types of sanitary landfills. In a few areas, gravel from the lower horizons is mined for use in construction. The soil is well suited to recreational uses.

This soil is in capability subclass IIe. It is in the Sandy Loam range site.

NmB—Nimrod loamy fine sand, 1 to 3 percent slopes. This very deep, moderately well drained, very gently sloping soil is on upland plains. The mapped areas are irregular in shape. They range from 10 to 50 acres in size. Slopes average about 2 percent.

Typically, the surface layer is neutral, dark brown loamy fine sand about 4 inches thick. The subsurface layer is neutral, pink loamy fine sand about 18 inches thick. The subsoil extends to a depth of 70 inches or more. In sequence downward, it is about 8 inches of slightly acid, reddish yellow sandy clay loam; 12 inches of slightly acid, light gray sandy clay loam; 14 inches of neutral, strong brown sandy clay loam; and 14 inches or more of mildly alkaline, reddish yellow sandy clay loam.

Runoff is slow. Permeability is moderately slow, and the available water capacity is low. The root zone is deep. The hazard of water erosion is moderate, and the hazard of wind erosion is severe. A perched water table may be within a depth of 2.0 to 3.5 feet after periods of heavy rainfall.

Included with this soil in mapping are soils that have a surface layer of fine sand and loamy sand; soils that are similar to the Nimrod soil but have a subsoil of sandy clay; soils that have a sandy surface layer less than 20 inches thick or more than 40 inches thick; soils that have weakly cemented sandstone layers in the underlying material; and soils that are less than 60 inches deep. Included soils make up less than 20 percent of the map unit.

The Nimrod soil is used mainly for improved pasture or rangeland. Some areas are used as cropland. The main crop is peanuts. Coastal bermudagrass and weeping lovegrass are well adapted pasture species.

This soil is moderately suited to cultivated crops. The low available water capacity results in droughtiness. Leaving crop residue on the surface conserves moisture and helps to control wind erosion.

This soil is moderately suited to native range plants, mainly mid and tall grasses. Most areas of range support sand bluestem, sideoats grama, hooded windmillgrass, and threeawn. The woody vegetation includes post oak, blackjack oak, greenbrier, tasajillo, and catclaw. The potential as habitat for doves and quail is fair.

This soil is moderately suited to most urban uses. Excessive wetness during periods when the water table is high is the major limitation. The soil is only moderately suited to most recreational uses. The sandy surface layer and the wetness are the major limitations.

This soil is in capability subclass IIIe. It is in the Sandy range site.

Oa—Oil-waste land. This map unit consists of areas where oil and saltwater waste have been spilled on the surface during oil exploration and production. Individual areas range from about 0.5 acre to more than 40 acres in size. Only those areas more than 5 acres in size are delineated on the soil maps. Spills can occur on any soil that has been used for oil exploration and production. The texture of the surface layer varies. In most areas slopes range from 0 to 3 percent, but in some areas they are as much as 12 percent.

Unless they are reclaimed, these areas are poorly suited to any use. Most areas are eroded and devoid of vegetation. Some areas have been reclaimed and seeded to alkali sacaton, kleingrass, old world bluestem, and King Ranch bluestem.

The capability subclass is VIIIs. No range site is assigned.

OcC—Owens clay, 1 to 5 percent slopes. This gently sloping, well drained soil is on uplands. It is moderately deep over weathered shale. Slopes average about 2 percent. The mapped areas are irregular in shape. They range from 5 to 50 acres in size.

Typically, the surface layer is moderately alkaline, light yellowish brown clay about 5 inches thick. The upper part of the subsoil is moderately alkaline, light yellowish brown clay about 7 inches thick. The lower part, to a depth of about 20 inches, is moderately alkaline, pale yellow clay that has a few films, threads, and concretions of calcium carbonate. The underlying material to a depth of 60 inches or more is light gray, weathered, clayey shale.

Runoff is rapid. Permeability is very slow, and the available water capacity is low. The root zone is shallow or moderately deep. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Included with this soil in mapping are small areas of Harpersville, Throck, and Truce soils; small areas of badland; areas of soils in the western part of the county that are similar to the Owens soil but are red or brown; and small areas of Owens soils that have stones and boulders on the surface. Included areas make up less than 20 percent of the map unit.

The Owens soil is used mainly for range, but a few areas are cultivated. Small grain and forage sorghum are the main crops.

This soil is poorly suited to small grain and forage sorghum. Leaving crop residue on or near the surface helps to control erosion and conserves soil moisture.

This soil is moderately suited to native range plants. Low rainfall and droughtiness are the major limitations, but yields of short and mid grasses are good during favorable years. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. The shrink-swell potential, low strength, and the risk of

corrosion to uncoated steel are the major limitations. Proper design and careful installation can help to overcome these limitations in some areas. The soil is poorly suited to recreational uses. The very slow permeability and the clayey texture are limitations.

This soil is in capability subclass IVe. It is in the Shallow Clay range site.

OxE—Owens-Harpersville complex, hilly, extremely stony. These well drained soils are on strongly sloping to steep hillsides. The Owens soil is shallow, and the Harpersville soil is very shallow. Slopes range mostly from about 10 to 30 percent, but they may range from 8 to about 40 percent and can include a few escarpments. Flat fragments of sandstone and limestone that are 1 to 60 inches across have broken off the rock outcrop ledges and cover about 5 to 12 percent of the surface on the lower slopes. Most of the fragments lie flat on the surface, but a few are partially embedded in the soil and are slightly tilted. In most areas the underlying material is alternating thin layers of limestone and thick layers of shale, but a few areas have a few thin layers of sandstone. Individual areas of this unit are long and narrow. They range from 5 to several hundred acres in size. They are about 50 percent Owens and similar soils and 25 percent Harpersville and similar soils.

The Owens soil is on mid and lower hillside slopes. Typically, the surface layer is grayish brown clay about 5 inches thick. The upper part of the subsoil is light brownish gray clay about 11 inches thick. The next part is pale olive clay about 7 inches thick. The lower part, to a depth of about 30 inches, is olive gray clay. The underlying material to a depth of 60 inches or more is light gray clay that grades to shale. The soil is moderately alkaline and calcareous throughout.

The Harpersville soil is on the steeper convex hillside slopes and in areas around branching gullies that are prominent in this unit. Typically, the surface layer is light gray clay about 7 inches thick. The underlying material to a depth of 60 inches or more is light olive gray, weathered, clayey shale. The soil is moderately alkaline throughout.

Natural fertility is low in the Owens and Harpersville soils. Runoff is rapid. Permeability is very slow. The available water capacity is low in the Owens soil and very low in the Harpersville soil. The root zone is shallow or moderately deep in the Owens soil. The hazard of water erosion is severe on both soils, and the hazard of wind erosion is slight. Geological erosion is evident on the Harpersville soil and in the included areas of badland.

Included with these soils in mapping are small areas of Bluegrove soils above rock ledges on summits of hills and ridges; Palopinto soils on summits of hills and ridges; Throck soils on the lower slopes adjacent to the Owens soil; long, narrow outcrops of rock ledges consisting of sandstone and limestone; and barren, eroding areas of badland. Also included, in the western part of the county, are reddish colored soils that are similar to both the Owens and Harpersville soils. Included areas make up about 25 percent of the map unit.

The Owens and Harpersville soils are used as rangeland. They are best suited to this use. Both soils are droughty. The rapid runoff prevents water from soaking into the very slowly permeable soils. The soils support a sparse cover of short grasses, mainly hairy grama, sideoats grama, and threeawn. Careful management is needed to prevent overuse and help to control erosion. Effective management practices include proper stocking rates and controlled grazing. The soils are not suitable for use as cropland because of the slope and the stoniness.

The potential of these soils as habitat for deer is poor, but some areas provide food and nesting places for quail, doves, and songbirds. The numerous rock ledges and stones provide cover for furbearing animals.

These soils are poorly suited to urban and recreational uses. The slope, the stoniness, the very slow permeability, and the shrink-swell potential are difficult to overcome.

These soils are in capability subclass VIIs. The Owens soil is in the Rocky Hill range site, and the Harpersville soil is in the Shaly Hill range site.

PaD—Palopinto very flaggy loam, undulating. This very shallow and shallow, well drained soil is on uplands. The surface is complex. Most areas are on narrow, convex ridges. The mapped areas are irregular in shape. They range from 50 to more than 500 acres in size. Slopes range from 1 to about 8 percent and average about 3 percent.

Typically, the surface layer is moderately alkaline, dark brown very flaggy loam and extremely flaggy clay loam about 11 inches thick. It contains about 30 to 40 percent limestone flagstones and 20 percent gravel, cobbles, and boulders. Hard, platy limestone bedrock is at a depth of about 11 inches. About 20 percent of the surface is covered with limestone flagstones and cobbles.

Runoff is rapid. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow or shallow. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Cho, Hensley, and Leeray soils and areas of rock outcrop.

Figure 10.—An area of Palopinto-Set complex, moderately steep, extremely stony.

Included areas make up less than 25 percent of the map unit.

The Palopinto soil is not suitable for crops because of the stoniness and the depth to bedrock.

This soil is used as rangeland. It is moderately suited to native range plants, mainly short and mid grasses. Low rainfall and the depth to bedrock are the major limitations. Most areas of range support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite, and annual plants. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. The depth to bedrock, the stoniness, and the slope are the major limitations. The soil is poorly suited to recreational uses because of the depth to bedrock and large stones.

This soil is in capability subclass VIs. It is in the Low Stony Hill range site.

PeE—Palopinto-Set complex, moderately steep, extremely stony. These well drained soils are on upland hillsides and along escarpments (fig. 10). The Palopinto soil is very shallow, and the Set soil is deep. Slopes range from about 8 to 30 percent. The soils are underlain by alternating layers of shaly clay and limestone bedrock that crops out at vertical intervals of about 10 to 50 feet. These outcrops form narrow scarps and ledges. Individual areas of this unit are mainly long and narrow. They range from about 100 to several hundred acres in size. They are about 55 percent Palopinto and similar soils, 20 percent Set and similar soils, and 25 percent included soils and rock outcrop. About 8 percent of the surface is covered with gravel- to boulder-sized fragments of limestone.

The Palopinto soil is on strongly sloping to moderately steep, convex ridges and benches on hillsides. Typically, the upper part of the surface layer is

mildly alkaline, dark grayish brown very stony loam about 4 inches thick. The lower part is moderately alkaline, dark grayish brown extremely stony loam about 4 inches thick. Coarsely fractured, hard limestone bedrock is at a depth of about 8 inches.

The Set soil is on strongly sloping to steep hillsides. Typically, the surface layer is calcareous, dark grayish brown extremely stony clay about 12 inches thick. The upper part of the subsoil is calcareous, dark brown clay loam about 12 inches thick. The lower part, to a depth of about 42 inches, is yellowish brown and light yellowish brown silty clay that has many calcium carbonate concretions and soft masses. The underlying material to a depth of 60 inches or more is light brownish gray shaly clay.

Runoff is rapid on the Palopinto and Set soils. Permeability is slow in the Set soil and moderate in the Palopinto soil. The available water capacity is very low in the Palopinto soil and high in the Set soil. The hazard of water erosion or wind erosion is slight on both soils.

Included with these soils in mapping are areas of Harpersville, Owens, and Throck soils. These included soils make up about 5 percent of the map unit. Also included are soils that are similar to the Palopinto soil but have a surface layer of clay loam, silty clay loam, silt loam, or loam or have prominent accumulations of calcium carbonate in the lower part of the surface layer; soils that are similar to the Set soil but have a lighter colored surface layer or have fewer carbonates in the subsoil; and areas of rock outcrop, mainly white and yellowish brown, hard limestone about 3 to 20 feet thick. The rock outcrop is coarsely fractured and massive and tilts about 10 degrees downward to the west.

These soils are not suitable for crops because of the stoniness and the slope.

These soils are used as rangeland. They are moderately suited to native plants. Limited rainfall and the rapid runoff rate limit yields in some years. Most areas support Texas wintergrass, sideoats grama, tall dropseed, vine mesquite, and mesquite. Hackberry and greenbrier grow near and between some of the rock ledges.

These soils have fair potential as habitat for wildlife, especially deer, quail, turkeys, and furbearing animals. Nesting areas for quail, doves, and songbirds are plentiful.

These soils are poorly suited to most urban uses. The large limestone fragments, the depth to bedrock, and the slope are the major limitations. The soils are poorly suited to recreational uses because of the large stones and the slope.

These soils are in capability subclass VIIs. The Palopinto soil is in the Steep Rocky range site, and the Set soil is in the Clay Loam Slopes range site.

PoB—Patilo fine sand, 0 to 3 percent slopes. This very deep, moderately well drained, nearly level and gently undulating soil is on uplands. The landscape consists of a pattern of small basins, knolls, and short ridges formed by the reworking of the surface by the wind. The mapped areas are oblong or irregularly shaped. They range from 10 to about 100 acres in size. Slopes average about 1.5 percent.

Typically, the surface layer is neutral, yellowish brown fine sand about 3 inches thick. The subsurface layer is neutral, very pale brown fine sand about 51 inches thick. The upper part of the subsoil, to a depth of about 72 inches, is medium acid, light gray sandy clay loam that has a few mottles in shades of brown, yellow, and red. The lower part to a depth of 80 inches or more is strongly acid, light gray sandy clay loam that has mottles in shades of yellow, brownish yellow, and red.

Runoff is very slow. Permeability is very rapid in the sandy surface layer and moderately slow in the subsoil. The available water capacity is low. The root zone is deep. A perched water table may be within a depth of 4 to 6 feet after periods of heavy rainfall. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are areas of Chaney and Nimrod soils; a few areas that have slopes of more than 3 percent; a few small moderately eroded areas; and a few areas of soils that have a surface layer of loamy fine sand. Included areas make up about 15 percent of the map unit.

The Patilo soil is used mainly as rangeland. A few areas are used as improved pasture and support coastal bermudagrass and weeping lovegrass.

This soil is droughty. It is poorly suited to nonirrigated cultivated crops but is well suited to orchard and truck crops. A surface cover of crops or crop residue should be maintained at all times to prevent excessive wind erosion. Sand accumulates in the fence rows around most fields. The main crops are peanuts, grain sorghum, and oats.

This soil is moderately suited to native range plants, mainly mid and tall grasses. Low rainfall, droughtiness, and low fertility are the major limitations. Most areas of range support sand lovegrass, fall witchgrass, red lovegrass, little bluestem, purpletop, annual plants, greenbrier, shinnery oak, and post oak. The potential as habitat for doves and quail is good.

This soil is moderately suited to most urban uses. The moderately slow permeability in the subsoil, seepage, the wetness, and the loose, sandy surface layer are the major limitations. The soil is poorly suited to recreational uses because of the sandy texture of the

surface layer and the hazard of wind erosion.

This soil is in capability subclass IIIs. It is in the Deep Sand range site.

RdB—Rowden clay loam, 0 to 3 percent slopes. This moderately deep, well drained, nearly level and very gently sloping soil is on uplands. The mapped areas are rounded or irregularly shaped. They range from 10 to several hundred acres in size. The surface is plane or slightly concave. Some areas have a few flagstones on the surface. Slopes average about 1.5 percent.

Typically, the surface layer is neutral, dark brown clay loam about 5 inches thick. The upper part of the subsoil is neutral, dark reddish gray clay about 10 inches thick. The lower part is moderately alkaline, reddish brown clay about 10 inches thick. Coarsely fractured limestone bedrock is at a depth of about 25 inches.

Runoff is slow or medium. Permeability is slow, and the available water capacity is low. The root zone is moderately deep, but the clayey texture of the lower layers restricts root penetration. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are small areas of Hensley, Leeray, Lindy, Palopinto, and Throck soils and a few areas that have a loamy surface layer. Included areas make up less than 15 percent of the map unit.

The Rowden soil is used mainly as range. It is well suited to this use. The climax plant community is grassland and supports mainly big bluestem, little bluestem, indiangrass, sideoats grama, forbs, and scattered live oak.

This soil is moderately suited to small grain and forage sorghum. Terraces and contour farming help to control erosion. Leaving crop residue on the surface conserves moisture and helps to control runoff and maintain soil productivity. The soil is well suited to pasture. Kleingrass and King Ranch bluestem are adapted species.

The potential of this soil as habitat for wildlife is good. Brush management enhances the habitat for deer and quail. Disturbing the surface in strips improves the availability of weed seeds for quail and doves. Excessive grazing by livestock reduces the suitability for wildlife habitat. Live oak is the major browse species for deer.

This soil is poorly suited to urban uses. The depth to bedrock and the shrink-swell potential are the major limitations. The soil is well suited to recreational uses.

This soil is in capability subclass IIIe. It is in the Clay Loam range site.

SeC—Set clay loam, 2 to 6 percent slopes. This very deep, well drained, gently sloping soil is on uplands and knolls. The mapped areas are irregular in shape. They range from about 10 to more than 400 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 12 inches thick. The upper part of the subsoil is yellowish brown clay loam about 10 inches thick. The next part is light yellowish brown clay loam about 13 inches thick. The lower part, to a depth of about 45 inches, is yellowish brown clay. The underlying material to a depth of 60 inches or more is light olive brown clay and weathered shale interbedded with seams of red shale. The soil is calcareous and moderately alkaline throughout.

Runoff is rapid. Permeability is slow, and the available water capacity is high. The root zone is deep, but the clayey layers may restrict some root penetration. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Included with this soil in mapping are Leeray soils in the lower areas, Throck soils on the upper slopes, and soils that are similar to the Set soil but are underlain by limestone bedrock. Included areas make up less than 20 percent of the map unit.

The Set soil is used mainly as rangeland, but a few areas are used as cropland. The main crops are small grain and forage sorghum.

This soil is moderately suited to crops. Leaving crop residue on the surface conserves moisture and helps to control water erosion and maintain soil productivity. Terraces and contour farming also help to control erosion.

This soil is well suited to native range plants, mainly mid and tall grasses. The potential as habitat for quail and doves is fair.

This soil is poorly suited to most urban uses. The shrink-swell potential, the clayey texture, low strength, and the risk of corrosion to uncoated steel are the major limitations. The soil is only moderately suited to recreational uses because of the slow permeability and the clayey texture.

This soil is in capability subclass IIIe. It is in the Clay Slopes range site.

ThC—Throck clay, 1 to 5 percent slopes. This well drained, gently sloping soil is on uplands. It is moderately deep and deep over weathered shale. The surface is convex. The mapped areas are irregular in shape. They range from 10 to more than 200 acres in size. Slopes average about 3.5 percent.

Typically, the surface layer is clay about 6 inches thick. It is yellowish brown in the upper 2 inches and

grayish brown in the lower 4 inches. The subsoil extends to a depth of about 51 inches. In sequence downward, it is about 9 inches of grayish brown clay, 14 inches of brown clay, 8 inches of grayish brown clay, and 14 inches of pale brown clay. The underlying material to a depth of 76 inches or more is layered, grayish brown, weak red, and light brownish gray clay and weathered shale. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is slow, and the available water capacity is high. The root zone is moderately deep or deep. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Included with this soil in mapping are areas of Bonti, Exray, Hensley, Lindy, and Owens soils. These soils make up less than 20 percent of the map unit.

The Throck soil is used mainly as rangeland, but some areas are used as cropland. The main crops are small grain and forage sorghum.

This soil is moderately suited to crops. Leaving crop residue on the surface helps to control erosion and conserves moisture. In some areas diversion terraces are needed to control runoff from the higher slopes. Terraces and grassed waterways help to control erosion.

This soil is well suited to native range plants, mainly short and mid grasses. Low rainfall is the major limitation. The potential as habitat for doves and quail is fair.

This soil is moderately suited to most urban uses. Low strength, the risk of corrosion to uncoated steel, the shrink-swell potential, and the clayey texture are the major limitations. The soil is only moderately suited to recreational uses because of the slope and the clayey texture of the surface layer.

This soil is in capability subclass IVe. It is in the Clay Slopes range site.

TrA—Thurber clay loam, 0 to 1 percent slopes. This very deep, moderately well drained, nearly level soil is on uplands. The surface is plane or slightly concave. The mapped areas are oval or irregularly shaped. They range from 5 to 100 acres in size.

Typically, the surface layer is neutral, very dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil is mildly alkaline, very dark grayish brown clay about 6 inches thick. The next part is moderately alkaline, dark brown clay about 17 inches thick. The lower part is moderately alkaline, brown clay about 18 inches thick. The underlying material to a depth of 60 inches or more is moderately alkaline, light brown clay loam.

Runoff is slow. Permeability is very slow, and the available water capacity is high. The root zone is deep. The hazard of water erosion or wind erosion is slight. Tilth is poor. The surface layer is very hard and massive when the soil is dry.

Included with this soil in mapping are small areas of Bluegrove, Bonti, Leeray, Throck, and Truce soils; areas of soils that are similar to the Thurber soil but are underlain by sandstone or limestone at a depth of about 40 to 54 inches; areas of soils that have a surface layer of clay or loam; and areas that have slopes of more than 1 percent. Included areas make up less than 15 percent of the map unit.

The Thurber soil is used mainly for range, but a few areas are cultivated. Small grain and forage sorghum are the main crops. The soil can be worked easily within only a very narrow range in moisture content. Leaving crop residue on the surface helps to control runoff and wind erosion and helps to maintain tilth and productivity.

This soil is well suited to native range plants. Low rainfall is the major limitation, but yields of short and mid grasses are good during favorable years. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. The shrink-swell potential, low strength, the clayey texture, and the risk of corrosion to uncoated steel are the major limitations. The soil is only moderately suited to recreational uses because of the very slow permeability.

This soil is in capability subclass IIIs. It is in the Claypan Prairie range site.

TrB—Thurber clay loam, 1 to 3 percent slopes. This very deep, moderately well drained, very gently sloping soil is on uplands. The surface is plane or slightly concave. The mapped areas are oval or irregularly shaped. They range from 5 to 200 acres in size. Slopes average about 2 percent.

Typically, the surface layer is mildly alkaline, grayish brown clay loam about 4 inches thick. The subsoil extends to a depth of 62 inches or more. In sequence downward, it is about 14 inches of mildly alkaline, dark grayish brown clay; 20 inches of moderately alkaline, dark brown clay; and 24 inches or more of moderately alkaline, brown clay.

Runoff is slow. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clayey texture of the subsoil restricts root penetration. Tilth is poor. The surface layer is very hard and massive when the soil is dry. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are areas of Bluegrove, Bonti, Leeray, Throck, and Truce soils; small areas of soils that have a surface layer of silty clay loam, clay, or loam; and soils that are underlain by

sandstone or limestone below a depth of 42 inches. Included areas make up less than 15 percent of the map unit.

The Thurber soil is used mainly as rangeland, but some areas are used as cropland. The main crops are small grain and forage sorghum.

This soil is moderately suited to crops. The low rainfall limits some yields. Leaving crop residue on the surface helps to control runoff, conserves moisture, and improves tilth and productivity. The soil can be worked easily within only a very narrow range in moisture content. Diversion terraces may be needed in some fields to control runoff from the higher slopes.

This soil is moderately suited to native range plants, mainly mid and short grasses. The very slow permeability and the massive surface layer when the soil is dry limit the rate of water infiltration. Most areas of range support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annual plants, and mesquite. The potential as habitat for doves and quail is fair.

This soil is poorly suited to most urban uses. The shrink-swell potential and the clayey texture are the major limitations. Properly designing and carefully installing foundations for roads, buildings, and utilities help to overcome these limitations. The soil is only moderately suited to recreational uses because of the very slow permeability.

This soil is in capability subclass IIIe. It is in the Claypan Prairie range site.

TuB—Truce fine sandy loam, 1 to 3 percent slopes. This well drained, very gently sloping soil is on uplands. The surface is convex. The mapped areas are irregular in shape. They range from 15 to more than 100 acres in size. Slopes average about 2 percent.

Typically, the surface layer is neutral, yellowish brown fine sandy loam about 10 inches thick. The upper part of the subsoil is neutral, reddish brown clay about 12 inches thick. The next part is neutral, strong brown clay about 16 inches thick. The lower part is mildly alkaline, reddish brown clay about 6 inches thick. The underlying material to a depth of 60 inches or more is moderately alkaline, reddish brown, weathered, clayey shale.

Runoff is medium. Permeability is slow, and the available water capacity is low. The root zone is deep, but the clayey texture of the subsoil restricts root penetration. The hazard of water erosion or wind erosion is moderate.

Included with this soil in mapping are areas of Bluegrove, Bonti, Owens, and Throck soils and a few severely eroded areas. Included areas make up less than 20 percent of the map unit.

The Truce soil is used mainly as rangeland, but some areas are used as cropland. The main crops are small grain and forage sorghum.

This soil is poorly suited to crops. Poor tilth and the low available water capacity are the major limitations. Poor tilth is caused by compaction and the loss of organic matter after repeated cultivation. Growing high-residue crops, such as sorghum, and incorporating all crop residue into the soil can improve tilth. Leaving crop residue on the surface conserves moisture and helps to control erosion. Terraces and grassed waterways also are needed to control water erosion.

This soil is moderately suited to native range plants, mainly mid and short grasses. The low available water capacity is the major limitation. Most areas of range support Texas wintergrass, vine mesquite, tall dropseed, curlymesquite, annual plants, and mesquite. If the native plants are depleted, reestablishing them is difficult. The potential as habitat for doves and quail is fair.

This soil is moderately suited to most urban uses. The slow permeability, the shrink-swell potential, low strength, and the risk of corrosion to uncoated steel are the major limitations. The soil is well suited to most recreational uses.

This soil is in capability subclass IIIe. It is in the Tight Sandy Loam range site.

TuC2—Truce fine sandy loam, 1 to 5 percent slopes, eroded. This well drained, gently sloping soil is on uplands. The surface is convex. The mapped areas are irregular in shape. They range from 5 to more than 75 acres in size. Slopes average about 3.5 percent. About 60 percent of the area is eroded. Gullies are 1 to 3 feet deep and 5 to 15 feet wide. They occur about every 100 to 300 feet across the slope. They formed mainly in trails and small watercourses.

Typically, the surface layer is neutral, light brown fine sandy loam about 4 inches thick. The upper part of the subsoil is mildly alkaline, reddish brown clay about 16 inches thick. The next part is moderately alkaline, strong brown clay about 14 inches thick. The lower part also is moderately alkaline, strong brown clay. It is about 8 inches thick. The underlying material to a depth of 60 inches or more is moderately alkaline, reddish brown, weathered, clayey shale.

Runoff is medium. Permeability is slow, and the available water capacity is low. The root zone is deep, but penetration by plant roots is difficult. The hazard of water erosion is severe, and the hazard of wind erosion is moderate.

Included with this soil in mapping are areas of Bluegrove, Bonti, Owens, and Throck soils. These soils make up less than 15 percent of the map unit.

The Truce soil is used mainly as rangeland, but some areas are used as cropland. The main crops are small grain and forage sorghum.

This soil is poorly suited to crops. Poor tilth and the low available water capacity are the major limitations. Poor tilth is caused by compaction and loss of organic matter after repeated cultivation. Growing high-residue crops, such as sorghum, and incorporating all crop residue into the soil can improve tilth. Leaving crop residue on the surface conserves moisture and helps to control erosion. Terraces and grassed waterways also are needed to control water erosion.

This soil is moderately suited to native range plants, mainly mid and short grasses. The low available water capacity is the major limitation. Most areas of range support Texas wintergrass, vine mesquite, tall dropseed, curlymesquite, annual plants, and mesquite. If the native plants are depleted, reestablishing them is difficult. The potential as habitat for doves and quail is fair.

This soil is moderately suited to most urban uses. The slow permeability, the shrink-swell potential, low strength, and the risk of corrosion to uncoated steel are the major limitations. The soil is well suited to most recreational uses.

This soil is in capability subclass IVe. It is in the Tight Sandy Loam range site.

WcA—Wichita clay loam, 0 to 1 percent slopes. This very deep, well drained, nearly level soil is on high terraces along creeks and rivers. The surface is plane or slightly convex. The mapped areas are irregular in shape. They range from 10 to more than 30 acres in size. Slopes average about 0.6 percent.

Typically, the surface layer is mildly alkaline, dark brown clay loam about 6 inches thick. The upper part of the subsoil is mildly alkaline, reddish brown clay about 10 inches thick. The next part is moderately alkaline, yellowish red clay loam about 30 inches thick. The lower part to a depth of 60 inches or more is moderately alkaline, reddish yellow clay loam that has about 15 percent calcium carbonate.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep. The hazard of water erosion or wind erosion is slight.

Included with this soil in mapping are areas of Leeray, Minwells, Thurber, and Truce soils; a few small areas of soils that are similar to the Wichita soil but have a dark surface layer; soils that are underlain by limestone below a depth of 50 inches; and some small areas of Wichita soils that are gently sloping or have a loamy surface layer. Included areas make up less than 15 percent of the map unit.

The Wichita soil is used mainly as cropland, but some areas are used as rangeland. The main crops are wheat, oats, and grain sorghum.

This soil is well suited to crops. Leaving crop residue on the surface conserves moisture and helps to control runoff. If the soil is irrigated, a well designed irrigation system and the proper application of water are essential and fertilizer is needed. A sprinkler or surface irrigation system can be used. Diversion terraces may be needed to control runoff from the higher slopes.

This soil is well suited to range. A periodic lack of rainfall is the major limitation. The climax vegetation is mainly mid and short grasses. Most areas of range support buffalograss, Texas wintergrass, Texas grama, threeawn, mesquite, and pricklypear. The potential as habitat for quail and doves is fair.

This soil is moderately suited to most urban uses. Low strength, the shrink-swell potential, the risk of corrosion to uncoated steel, and the clayey texture are the major limitations. Proper design and careful installation can help to overcome these limitations. The soil is well suited to most recreational uses.

This soil is in capability subclass IIc. It is in the Clay Loam range site.

WcB—Wichita clay loam, 1 to 3 percent slopes. This very deep, well drained, very gently sloping soil is on stream terraces. The surface is plane or slightly convex. The mapped areas are irregular in shape. They range from 10 to more than 40 acres in size. Slopes average about 2 percent.

Typically, the surface layer is mildly alkaline, reddish brown clay loam about 8 inches thick. The upper part of the subsoil is moderately alkaline, reddish brown clay loam about 16 inches thick. The next part is moderately alkaline, firm, reddish brown clay loam about 16 inches thick. Below this, to a depth of about 66 inches, is moderately alkaline, yellowish red clay loam that has about 15 percent calcium carbonate. The lower part of the subsoil to a depth of 76 inches or more is moderately alkaline, reddish yellow clay loam that has some carbonates.

Runoff is slow or medium. Permeability is moderately slow, and the available water capacity is high. The root zone is deep. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included with this soil in mapping are areas of Leeray, Minwells, Thurber, and Truce soils; a few small areas of soils that are similar to the Wichita soil but have a dark surface layer or are underlain by limestone below a depth of 50 inches; and some areas of Wichita soils that are nearly level or have a loamy surface layer. Included areas make up less than 15 percent of the map unit.

The Wichita soil is used mainly as cropland, but some areas are used as rangeland. The main crops are wheat, oats, and grain sorghum.

This soil is well suited to crops. Leaving crop residue on the surface conserves moisture and helps to control erosion. If the soil is irrigated, a well designed irrigation system and the proper application of water are essential and fertilizer is needed. A sprinkler or surface irrigation system can be used. Terraces and grassed waterways help to control water erosion.

This soil is well suited to range. A periodic lack of rainfall is the major limitation. The climax vegetation is mainly mid and short grasses. Most areas of range support buffalograss, Texas wintergrass, Texas grama, threeawn, mesquite, and pricklypear. The potential as habitat for quail and doves is fair.

This soil is moderately suited to most urban uses. Low strength, the shrink-swell potential, the risk of corrosion to uncoated steel, and the clayey texture are the major limitations. Proper design and careful installation can help to overcome these limitations. The soil is well suited to most recreational uses.

This soil is in capability subclass IIe. It is in the Clay Loam range site.

Prime Farmland

In this section, prime farmland is defined and the soils in Stephens County that are considered prime farmland are listed.

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

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

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

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

About 93,340 acres in Stephens County, or nearly 16 percent of the total acreage, meets the requirements for prime farmland. Areas of these soils are scattered throughout the county. General soil map units 4, 6, and 7 have the largest areas of prime farmland soils; general soil map unit 2 has substantial areas; and general soil map units 1, 3, and 5 have small scattered areas.

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

BfA	Bastrop fine sandy loam, 0 to 1 percent slopes
BfB	Bastrop fine sandy loam, 1 to 3 percent slopes
By	Bosque clay loam, occasionally flooded
Cm	Clairemont silty clay loam, occasionally flooded
Co	Clearfork silty clay loam, occasionally flooded
Fr	Frio silty clay, occasionally flooded
Ga	Gageby clay loam, occasionally flooded
LeA	Leeray clay, 0 to 1 percent slopes
LeB	Leeray clay, 1 to 3 percent slopes
WcA	Wichita clay loam, 0 to 1 percent slopes
WcB	Wichita clay loam, 1 to 3 percent slopes

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

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

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

According to records of the local office of the Soil Conservation Service, about 46,800 acres in the county is used for crops. The main crops are grain sorghum and wheat. Cotton and oats are grown on small acreages.

Soil erosion is the major problem on nearly all of the cropland in the county. Water erosion is a hazard where slopes are more than 1 percent (fig. 11). Contour farming, terraces, grassed waterways, and a permanent cover of plants minimize the risk of water erosion. Wind erosion is a hazard, especially during droughty periods and during windstorms that occur in winter and spring. Leaving residue from grain sorghum and small grain on the surface minimizes wind erosion.

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 if the soil is shallow. Second, water erosion on farmland results in sedimentation of streams. Controlling water erosion minimizes the pollution of streams by sediment and improves the quality of water for urban and recreational uses and for wildlife. Erosion-control practices provide a protective surface cover, help to control runoff, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for long periods can hold soil erosion losses to amounts that do not reduce yields.

Crop residue management is an effective erosion-control practice. Leaving crop residue on the surface helps to protect the soil against crusting and the impact of raindrops and reduces the runoff rate. It also

Figure 11.—An eroded drainage channel in an area of Leeray clay, 1 to 3 percent slopes.

provides shade for the soil and thus reduces the soil temperature and the evaporation rate. Crop residue increases the content of organic matter, improves tilth, and minimizes compaction caused by farm machinery. It should be protected from overgrazing and burning. Using tillage equipment that leaves residue on the surface is effective in controlling erosion and minimizing compaction.

Minimizing tillage is effective in controlling erosion on sloping land. This practice is appropriate on most of the soils in the county.

Diversion terraces and field terraces reduce the length of the slope and reduce the runoff rate. They are most practical in areas of deep and moderately deep soils that have smooth slopes. All terraces require suitable outlets to dispose of excess water. If natural grassed drainageways are not available as outlets, grassed waterways should be constructed before the terraces are built.

Information regarding the design of erosion-control measures for each kind of soil is available in local offices of the Soil Conservation Service.

Soil fertility is medium in most of the upland soils. Nitrogen and phosphorus are the most deficient nutrients. The soils on flood plains, such as Clairemont, Clearfork, Frio, and Gageby soils, contain higher levels of plant nutrients than most of the soils in the uplands.

Soil tilth is important in the germination of seeds and in the rate of water infiltration. Soils that have good tilth are granular, porous, and friable. Tilth can be improved by adding large amounts of organic matter, such as cotton burrs or crop residue. The clayey Leeray soils sometimes remain wet until late in spring. If these soils are wet when plowed, they tend to become cloddy

when they dry, which makes preparing a good seedbed difficult. Plowing in the fall generally results in good tilth in spring, but wind erosion is a management concern unless a vegetative cover is maintained.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

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

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

The estimated yields reflect the productive capacity of each soil for each of the principal crops. 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 listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland *(4)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

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

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Rangeland

Robert E. Purdom, Jr., district conservationist, and Bobby J. Waddell, range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland occurs as areas where native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. Rangeland receives no regular or frequent cultural treatment. Good management practices, such as balancing livestock numbers with forage production and using a system of rotation grazing, allow desirable plants to improve vigor, produce seed, and establish seedlings.

Stephens County is within the Texas North-Central Prairies major land resource area. About 90 percent of the county is rangeland. Raising livestock is the major agricultural enterprise in the county. Most of the rangeland is used for cow-calf production. Stocker cattle make up a significant part of some herds. Several ranches specialize in breeding and selling purebred or crossbred cattle. Grazing on native rangeland is often supplemented by the seasonal use of improved pastures and grazeable cropland.

The rangelands of Stephens County were originally open savannahs and supported post oak and live oak; tall and mid grasses, such as indiangrass, little bluestem, big bluestem, switchgrass, and sideoats grama; and a variety of legumes and forbs. After the area was settled, the plant communities changed drastically. Wildfires, which once retarded brush encroachment, were suppressed. Fences were constructed, and domestic livestock were confined at very heavy stocking rates. They were allowed to overgraze the tall-growing, productive grasses. The oak canopy and invader species, such as mesquite and ashe juniper, increased, shading the understory plant community. Thus the tall grasses were replaced by shade-tolerant forage plants, such as Texas wintergrass and other cool-season grasses. The continuous impact of these factors has reduced many areas of the county to a brush-infested plant community of short and mid grasses.

Good range management can help to reestablish the original savannah plant community on the rangeland in Stephens County. Brush management reduces the overstory canopy and thus provides the necessary sunlight and moisture for regrowth of the desired species. Brush management can include a prescribed burning program and the application of herbicides. Mechanical methods may also be needed. Reseeding may be necessary in some areas after brush management practices have been applied.

Range management requires a knowledge of the kinds of soil and of the natural potential plant community, or climax vegetation. Climax vegetation is the stabilized plant community that reproduces itself and changes very little as long as the environment remains unchanged. It consists of plants that grew in the area when it was first settled.

Range management also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the climax plant community on a particular range site. The more closely the existing community resembles the climax community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use. Good management practices, such as deferred grazing, proper grazing use, and a planned grazing system, are essential if the range condition is to be maintained or improved.

Range Sites and Condition Classes

A range site is a distinctive kind of rangeland that produces a characteristic plant community that differs from the climax vegetation on other range sites in kind, amount, and proportion of range plants. Soils that produce about the same kinds and amounts of forage make up a range site. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreasers are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that increase in abundance as the decreasers and increasers decline. They cannot compete with the climax vegetation for moisture, nutrients, and light. They have little value for grazing.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there. A range is in excellent condition if 76 to 100 percent of the vegetation is of the

same kind as that in the climax stand, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

Table 6 shows, for each soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are suited to rangeland are listed.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the climax vegetation. It includes the current year's growth of leaves and twigs of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Twenty range sites have been identified in Stephens County. They are Clay Loam, Clay Loam Slopes, Clay Slopes, Clayey Upland, Claypan Prairie, Deep Redland, Deep Sand, Loamy Bottomland, Loamy Sand, Low Stony Hill, Redland, Rocky Hill, Sandstone Hill, Sandy, Sandy Loam, Shallow Clay, Shaly Hill, Steep Rocky, Tight Sandy Loam, and Very Shallow.

Clay Loam Range Site.—The Rowden and Wichita soils in map units RdB, WcA, and WcB are in this range site. Sideoats grama, vine-mesquite, and buffalograss are dominant on this site. Woody plants are not significant. Heavy grazing by cattle decreases the extent of sideoats grama and vine-mesquite and increases the extent of buffalograss and Texas wintergrass. If heavy grazing continues for many years, annual grasses, threeawn, Texas grama, mesquite, condalia, and pricklypear dominate the site.

Clay Loam Slopes Range Site.—The Set soil in map unit PeE is in this range site. Big bluestem, little bluestem, sideoats grama, and vine-mesquite are dominant on this site. Heavy grazing by cattle decreases the extent of big bluestem and increases the extent of little bluestem, sideoats grama, vine-mesquite, silver bluestem, and Texas wintergrass. If heavy grazing continues for many years, these plants are replaced by hairy tridens, Scribner panicum, hairy grama, Texas grama, and hooded windmillgrass. Eventually woody plants, such as buckeye, juniper, mesquite, and shinnery oak, dominate the site.

Clay Slopes Range Site.—The Set and Throck soils in map units SeC and ThC are in this range site. Big bluestem and little bluestem are dominant on this site. Woody species make up less than 5 percent of the vegetation. Heavy grazing by cattle decreases the extent of these plants and increases the extent of sideoats grama, vine-mesquite, and tall dropseed. If heavy grazing continues for many years, meadow dropseed, threeawn, mesquite, pricklypear, catclaw acacia, and broomweed dominate the site.

Clayey Upland Range Site.—The Leeray soils in map units LeA and LeB are in this range site. Sideoats grama, Texas wintergrass, vine-mesquite, and Texas bluegrass are dominant on this site. Heavy grazing by cattle decreases the extent of sideoats grama, vine-mesquite, and Texas bluegrass and increases the extent of silver bluestem, buffalograss, curlymesquite, and Texas wintergrass. If heavy grazing continues, condalia, mesquite, pricklypear, threeawn, and broomweed dominate the site.

Claypan Prairie Range Site.—The Thurber soils in map units TrA and TrB are in this range site (fig. 12). Sideoats grama, Arizona cottontop, vine-mesquite, and dropseed are dominant on this site. Woody plants are not significant when the site is in excellent condition. Heavy grazing by cattle results in a plant community dominated by buffalograss and Texas wintergrass. If heavy grazing continues for many years, mesquite, condalia, pricklypear, and threeawn dominate the site.

Deep Redland Range Site.—The Lindy soil in map unit LnB is in this range site. Big bluestem, little bluestem, and indiangrass are dominant on this site. Woody species make up less than 10 percent of the vegetation. Heavy grazing by cattle increases the extent of sideoats grama, Texas wintergrass, silver bluestem, and buffalograss. Continued heavy grazing results in a plant community dominated by buffalograss, Texas wintergrass, mesquite, persimmon, ashe juniper, and low-quality forbs.

Deep Sand Range Site.—The Patilo soil in map unit PoB is in this range site. Post oak and blackjack oak are dominant on this site. Sand lovegrass and small amounts of indiangrass and purpletop tridens are on the site when it is in excellent condition. Heavy grazing by cattle increases the extent of oak, and the grasses are replaced by sand dropseed and Scribner panicum. If heavy grazing continues, the stands of oak increase in density and shade out the understory. These oaks seldom exceed 4 inches in diameter.

Loamy Bottomland Range Site.—The Bosque, Clairemont, Clearfork, Frio, and Gageby soils in map units By, Cm, Cn, Co, Fr, Fy, and Ga are in this range site. Indiangrass, switchgrass, big bluestem, and little bluestem are dominant on this site. Forbs and woody plants are abundant. Heavy grazing by cattle increases the extent of Texas wintergrass, buffalograss, and threeawn. If heavy grazing continues, the range site is dominated by a plant community of buffalograss and other short grasses and annual forbs.

Figure 12.—An area of Thurber clay loam, 1 to 3 percent slopes, used as rangeland. The range site is Claypan Prairie.

Loamy Sand Range Site.—The Bastrop and Chaney soils in map units BaC, CaB, and CeD are in this range site. Big bluestem, indiangrass, switchgrass, and little bluestem are dominant on this site. Heavy grazing by cattle results in an increase in the density of stands of oak and thickets of greenbrier. If heavy grazing continues, mesquite invades and threeawn, fall witchgrass, sand dropseed, and tumble windmillgrass increase.

Low Stony Hill Range Site.—The Palopinto soil in map unit PaD is in this range site. The site is characterized by live oak-post oak savannah vegetation dominated by sideoats grama and little bluestem. Heavy grazing by cattle increases the extent of curlymesquite, slim tridens, and Texas wintergrass. If heavy grazing continues, threeawn, red grama, hairy tridens, agarito, pricklypear, and shinnery oak dominate the site.

Redland Range Site.—The Hensley soils in map units HeB and HsB are in this range site. The climax vegetation is a savannah of oak dominated by little bluestem and other tall grasses. Heavy grazing by cattle increases the extent of sideoats grama, Texas wintergrass, silver bluestem, and buffalograss. If heavy grazing continues, buffalograss, Texas grama, and hairy tridens increase and mesquite, persimmon, ashe juniper, lotebush, and low-quality forbs invade.

Rocky Hill Range Site.—The Owens soil in map unit OxE is in this range site. Big bluestem, indiangrass, switchgrass, and little bluestem are dominant on this site. If heavy grazing by cattle is allowed, sideoats grama, silver bluestem, and little bluestem dominate. If heavy grazing continues, red grama, Texas grama, threeawn, western ragweed, and annuals increase. Woody species, such as agarito, catclaw, mesquite, and pricklypear, also increase.

Sandstone Hill Range Site.—The Bluegrove, Bonti, Exray, and Truce soils in map units BmB and BxE are in this range site. Little bluestem, big bluestem,

indiangrass, and switchgrass are dominant in this open plant community of post oak. Heavy grazing by cattle increases the extent of silver bluestem, hairy grama, and woody species. If heavy grazing continues, threeawn, sand dropseed, and annual grasses become dominant and low-quality forbs increase. Undesirable woody species, such as elm, greenbrier, mesquite, and juniper also invade.

Sandy Range Site.—The Heaton and Nimrod soils in map units HaB and NmB are in this range site. This savannah of post oak is dominated by an understory of little bluestem, big bluestem, and indiangrass. If heavy grazing by cattle is allowed, tall grasses are replaced by silver bluestem and western ragweed. If heavy grazing continues, sand dropseed, lovegrasses, hooded windmillgrass, and annual forbs increase under a dominant plant community of post oak.

Sandy Loam Range Site.—The Bastrop, Bonti, Exray, Lusk, and Minwells soils in map units BfA, BfB, BoC, BrC, LsD, and MfB are in this range site. The climax vegetation is a savannah of post oak-blackjack oak dominated by an understory of little bluestem, indiangrass, and sand bluestem. If heavy grazing by cattle is allowed, silver bluestem, hooded windmillgrass, and hairy grama become dominant and skunkbush sumac increases. If heavy grazing continues, threeawn, dropseed, red lovegrass, and annual grasses increase and mesquite and greenbrier invade the site.

Shallow Clay Range Site.—The Owens soil in map unit OcC is in this range site. Sideoats grama is dominant on this low-production site. If heavy grazing by cattle is allowed, buffalograss replaces sideoats grama. If heavy grazing continues, threeawn, Texas grama, and undesirable brush, such as pricklypear, mesquite, juniper, and condalia, dominate the site. Areas of bare ground are invaded by annuals in the spring.

Shaly Hill Range Site.—The Harpersville soil in map unit OxE is in this range site. Sideoats grama, cane bluestem, and silver bluestem are dominant on this site. Heavy grazing by cattle increases the extent of silver bluestem, Texas wintergrass, and rough tridens. If heavy grazing continues, curlymesquite and threeawn dominate and mesquite, tasajillo, and lotebush invade the site.

Steep Rocky Range Site.—The Palopinto soil in map unit PeE is in this range site. Little bluestem, sideoats grama, and live oak are dominant on this site. Heavy grazing by cattle increases the extent of sideoats grama, silver bluestem, and Texas wintergrass. If heavy grazing continues, red grama, hairy tridens, and annual grasses become dominant. Ashe juniper eventually invades and increases to become the dominant species on the site.

Tight Sandy Loam Range Site.—The Bluegrove and Truce soils in map units BgB, TuB, and TuC2 are in this range site. The climax vegetation is a savannah of post oak dominated by an understory of sideoats grama, vine-mesquite, little bluestem, and Texas wintergrass. Heavy grazing by cattle increases the extent of buffalograss, Texas wintergrass, and hooded windmillgrass. If heavy grazing continues, mesquite, buffalograss, curlymesquite, hairy tridens, and Texas grama become dominant.

Very Shallow Range Site.—The Cho soil in map unit ChC is in this range site. Sideoats grama is dominant on this site, which is characterized by a plant community of mid and short grasses. If heavy grazing by cattle is allowed, woody species, such as catclaw and mesquite, invade the site. Texas grama, hairy tridens, red grama, and undesirable forbs also invade. If heavy grazing continues, bare areas appear and gullies begin to form. Brush is stunted because the soil is shallow.

Recreation

In table 7, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information this survey, for example, interpretations for septic tank absorption fields in table

10 and interpretations for dwellings without basements and for local roads and streets in table 9.

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

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

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

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

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

Wildlife Habitat

Willard E. Richter, biologist, Soil Conservation Service, prepared this section.

Stephens County has habitat that is suitable for a diverse and plentiful wildlife population. The primary wildlife species include white-tailed deer, turkeys, bobwhite quail, scaled quail, fox squirrel, doves, jackrabbit, and cottontail rabbit. Nongame species, such as songbirds, hawks, owls, amphibians, and numerous species of reptiles, inhabit areas throughout the county. Furbearers, including fox, raccoon, opossum, skunk, ringtail cat, nutria, bobcat, and coyote, are also in the county.

Hubbard Creek Reservoir, Possum Kingdom Lake, Lake Daniel, the Clear Fork of the Brazos River, and Hubbard Creek provide habitat for fish. Catfish, black bass, striper bass, white bass, sunfish, and several species of minnows are found in these lakes and streams. Numerous livestock water ponds, ranging in size from 0.5 acre to more than 5.0 acres, are throughout the county. They have been stocked with catfish, bass, and sunfish and thus provide good opportunities for fishing. Waterfowl use the water areas for resting, feeding, and roosting during their fall and spring migrations.

Leasing private land for hunting deer, turkeys, quail, and doves is a common practice in the county. The income from commercial hunting makes up a significant portion of the total agricultural income.

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

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are switchgrass, lovegrass, kleingrass, Johnsongrass, clover, alfalfa, and winterpea.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, grama, dropseed, Texas wintergrass, croton, sunflower, ragweed, orange zexmenia, and dalea.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush, kidneywood, littleleaf sumac, lotebush, mesquite, oak, greenbrier, grape, dewberry, wild plum, and agarito.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, doves, meadowlarks, field sparrows, badgers, cottontail rabbit, jackrabbit, fox, turkeys, deer, and antelope.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, turkeys, meadowlarks, coyote, jackrabbit, bobcat, and bobwhite quail.

Engineering

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

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

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

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

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

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology;

locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

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

Sanitary Facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the

soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

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

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard

construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome;

moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

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

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

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

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

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

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

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates

determined mainly by converting volume percentage in the field to weight percentage.

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

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

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to wind erosion. Soils are grouped according to the following distinctions:

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

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short

periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

The soils in Stephens County that are susceptible to flooding are Bosque, Clairemont, Clearfork, Frio, and Gageby soils (fig. 13).

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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

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

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

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several pedons in the survey area are given in table 16 and the results of chemical analysis in table 17. Information on the mineralogy of several pedons is given in table 18. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory Staff, Soil Conservation Service, Lincoln, Nebraska.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows.

Figure 13.—A partially flooded pasture in an area of Clairemont silty clay loam, occasionally flooded.

The codes in parentheses refer to published methods *(6)*.

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).

Carbonate clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1d).

Water retained—pressure extraction, percentage of ovendry weight of less than 2 mm material; ⅓ or 1/10 bar (4B1), 15 bars (4B2).

Bulk density—of less than 2 mm material, saran-coated clods field moist (4A1a), ⅓ bar (4A1d), ovendry (4A1h).

Linear extensibility—change in clod dimension based on whole soil (4D).

Organic carbon—wet combustion, Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c).

Cation-exchange capacity—ammonium acetate, pH 7.0, steam distillation (5A8b).

Reaction (pH)—1:1 water dilution (8C1f).
Reaction (pH)—calcium chloride (8C1f).
Carbonate as calcium carbonate—(fraction less than 2 mm) manometric (6E1g).
Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).
Exchangeable sodium percentage—ammonium acetate, pH 7.0 (5D2).
X-ray diffraction (7A2).

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The soil samples were tested by the State Department of Highways and Public Transportation, Austin, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Specific gravity—T 100 (AASHTO), D 854 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(5)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustolls (*Calci,* meaning calcareous, plus *ustoll,* the suborder of the Mollisols that has a dry moisture regime).

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(3)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(5)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Bastrop Series

The Bastrop series consists of very deep, well drained, moderately permeable, nearly level to gently sloping soils. These soils formed in old alluvial sediments on high terraces. Slopes range from 0 to 5

percent. The soils are fine-loamy, mixed, thermic Udic Paleustalfs.

The Bastrop soils in Stephens County are taxadjuncts because they are drier than is defined as the range for the series.

Typical pedon of Bastrop fine sandy loam, 1 to 3 percent slopes; from the intersection with Farm Road 1481 in Crystal Falls, 0.9 mile north on Farm Road 578, 0.5 mile east on county road, 30 feet north, in an area of rangeland:

A—0 to 5 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular and subangular blocky structure; hard, friable; common fine roots; common fine pores; common wormcasts; 1 to 3 percent fine siliceous pebbles; neutral; clear smooth boundary.

Bt1—5 to 11 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable; few very fine roots; common pores and wormcasts; common distinct clay films on faces of peds; 1 to 3 percent fine siliceous pebbles; mildly alkaline; gradual smooth boundary.

Bt2—11 to 27 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; common pores and wormcasts; few distinct clay films on faces of peds; 1 to 3 percent fine siliceous pebbles; mildly alkaline; gradual smooth boundary.

Bt3—27 to 48 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine roots; common fine pores; few distinct clay films on faces of peds; 1 to 3 percent fine siliceous pebbles; moderately alkaline; gradual smooth boundary.

Bt4—48 to 66 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; common fine and medium pores; few very fine roots; few distinct clay films on faces of peds; 1 to 3 percent fine siliceous pebbles; moderately alkaline; clear smooth boundary.

BCk—66 to 80 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak medium granular structure; slightly hard, very friable; common fine and medium pores; about 5 percent soft masses and concretions of calcium carbonate; 3 to 5 percent very fine to medium siliceous pebbles; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Secondary carbonates are below a depth of 60 inches in a few pedons. They occur mostly as films, threads, and very fine concretions.

The A horizon is fine sandy loam or loamy fine sand. The fine sandy loam is 4 to 8 inches thick, and the loamy fine sand is 4 to 18 inches thick. This horizon is reddish brown, pale brown, light brownish gray, grayish brown, dark grayish brown, light brown, light reddish brown, yellowish red, or reddish yellow. Reaction ranges from medium acid to mildly alkaline.

The Bt horizon is yellowish red, reddish brown, brown, reddish yellow, light reddish brown, strong brown, or red. The texture is sandy clay loam or clay loam. Reaction ranges from slightly acid to moderately alkaline.

The C horizon, if it occurs, is yellowish red, reddish yellow, or light reddish brown. The texture is loam or sandy clay loam. Buried horizons are below a depth of 60 inches in some pedons. They are clay, clay loam, or the very gravelly analogs of those textures. Reaction ranges from neutral to moderately alkaline in the C horizon.

Bluegrove Series

The Bluegrove series consists of moderately deep, well drained, moderately slowly permeable soils on gently sloping and undulating uplands. These soils formed in material weathered from sandstone. Slopes range from 1 to 8 percent. The soils are fine, mixed, thermic Typic Haplustalfs.

Typical pedon of Bluegrove loam, 1 to 3 percent slopes (fig. 14); from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles west on U.S. Highway 180, 1.4 miles north on Farm Road 3099, 1.0 mile east on county road, 0.1 mile north and 675 feet west, in an area of rangeland:

A1—0 to 2 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak fine granular and subangular blocky structure; slightly hard, friable; common fine roots; common medium pores; few sandstone fragments on the surface; neutral; abrupt smooth boundary.

A2—2 to 5 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine granular and weak very fine subangular blocky structure; hard, very friable; common fine roots; neutral; clear smooth boundary.

Bt1—5 to 8 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium angular blocky structure; very hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; neutral; gradual smooth boundary.

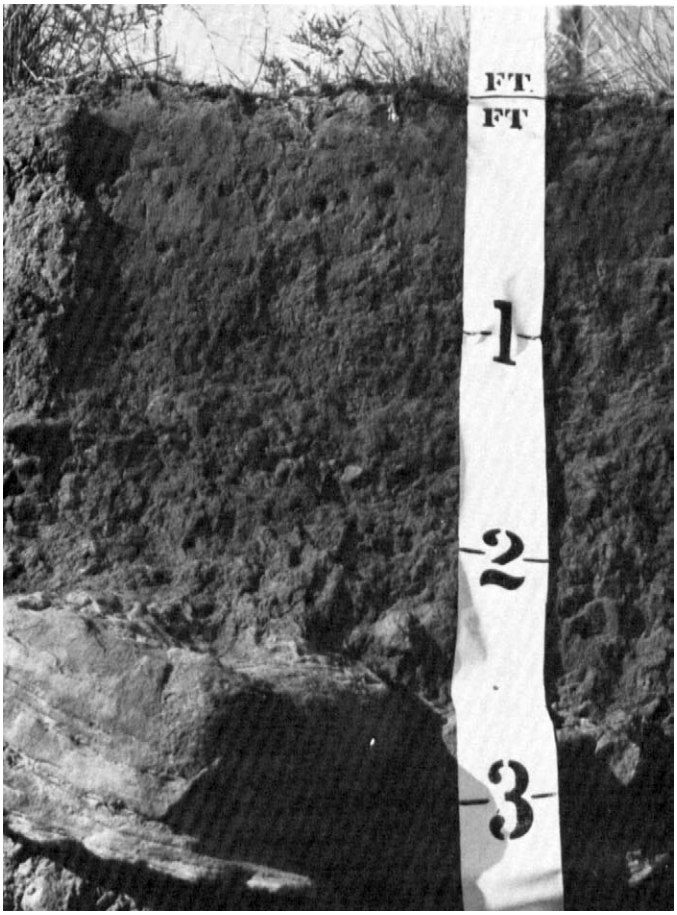

Figure 14.—Profile of Bluegrove loam, 1 to 3 percent slopes. Sandstone bedrock is at a depth of about 30 inches.

Bt2—8 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium and coarse angular blocky structure; very hard, firm; few fine and medium roots; few fine pores; few distinct clay films on faces of peds; about 5 percent, by volume, sandstone fragments 0.5 to 1.0 inch across; common very fine iron-manganese concretions; neutral; abrupt smooth boundary.

Bt3—16 to 27 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium and coarse angular blocky structure; very hard, firm; few distinct clay films on faces of peds; about 10 percent, by volume, weakly and strongly cemented sandstone fragments; neutral; abrupt smooth boundary.

Cr—27 to 56 inches; interbedded layers of reddish brown (5YR 4/4) and yellowish brown (10YR 5/6) shale and sandstone bedrock 0.4 to 0.8 inch thick; few fine and medium roots in sandstone fractures.

The thickness of the solum, or the depth to sandstone bedrock, ranges from 20 to 40 inches. The average content of clay in the control section ranges from 35 to 55 percent.

The A horizon is 4 to 8 inches thick. It is brown, reddish brown, or dark brown. It has few to 35 percent, by volume, coarse fragments of flaggy sandstone. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, yellowish red, or red. The texture is clay loam or clay. Reaction ranges from slightly acid to mildly alkaline. In some pedons this horizon is sandy clay in the upper part. Some pedons have a stone line of strongly cemented sandstone flagstones in the lower part.

The Cr horizon is weakly to strongly cemented, thinly bedded sandstone interbedded with layers of reddish brown, yellowish brown, yellowish red, reddish yellow, or olive brown shale 1 to 7 inches thick.

Bonti Series

The Bonti series consists of moderately deep, well drained, moderately slowly permeable soils on gently sloping to moderately steep uplands. These soils formed in material weathered from sandstone. Slopes range from 1 to 20 percent. The soils are fine, mixed, thermic Ultic Paleustalfs.

Typical pedon of Bonti fine sandy loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 183 and U.S. Highway 180 in Breckenridge, 3.9 miles east on U.S. Highway 180, 9.1 miles south on Farm Road 207, 2.4 miles northeast on county road, 180 feet east, in an area of rangeland:

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; common fine roots; common fine pores; 1 to 3 percent very fine quartz pebbles; 1 to 3 percent sandstone fragments; slightly acid; clear smooth boundary.

E—4 to 10 inches; light brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, friable; common fine roots; common fine pores; slightly acid; clear smooth boundary.

Bt1—10 to 18 inches; reddish brown (5YR 5/4) sandy clay, reddish brown (5YR 4/4) moist; moderate medium angular blocky structure; very hard, firm; few fine roots; common fine pores; few wormcasts; common distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—18 to 27 inches; yellowish red (5YR 5/6) clay,

yellowish red (5YR 4/6) moist; moderate medium and coarse angular blocky structure; very hard, firm; few fine roots; few fine pores; 1 to 3 percent sandstone fragments in the lower part; common distinct clay films on faces of peds; strongly acid; abrupt smooth boundary.

R—27 to 30 inches; yellowish brown and brownish yellow, strongly cemented sandstone bedrock; slightly acid.

The thickness of the solum and the depth to sandstone bedrock range from 20 to 40 inches. Sandstone fragments cover as much as 30 percent of the surface. These fragments range in size from 0.5 inch to 48 inches across the long axis. The content of similar fragments within the solum ranges from 0 to about 20 percent. The fragments range in size from 0.5 inch to 20 inches across.

The A horizon is 3 to 6 inches thick. It is brown, yellowish brown, dark yellowish brown, or dark brown. Reaction is neutral or slightly acid.

The E horizon, if it occurs, is 3 to 6 inches thick. It is brown, light brown, reddish yellow, strong brown, light yellowish brown, pink, or yellowish brown. Reaction is neutral or slightly acid.

The Bt horizon is reddish brown, light reddish brown, red, yellowish red, or reddish yellow. In some pedons it has few red, brown, or yellow mottles in the lower part. The texture is clay, clay loam, or sandy clay. The content of clay ranges from 35 to 50 percent. Reaction is medium acid or strongly acid. In some pedons the upper part of the Bt horizon has a stone line of sandstone fragments that are 1 to 4 inches thick and 4 to 20 inches across. Base saturation is 50 to 75 percent in the Bt horizon.

The R layer is strongly cemented or indurated, fine grained or conglomeratic sandstone bedrock.

Bosque Series

The Bosque series consists of very deep, well drained, moderately permeable, nearly level soils on flood plains. These soils formed in calcareous alluvial sediments. Slopes are 0 to 1 percent. The soils are fine-loamy, mixed, thermic Cumulic Haplustolls.

Typical pedon of Bosque clay loam, occasionally flooded; from the intersection with Farm Road 717 in Caddo, 0.7 mile east on U.S. Highway 180, 6.2 miles southeast on county road, 0.7 mile southwest and 800 feet northwest on private road (entrance is about 1 mile southwest of the Palo Pinto County line on the county road), 15 feet west, in an area of rangeland:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular and subangular blocky structure; hard, friable; common fine roots; common fine and medium pores; common wormcasts; 1 to 3 percent very fine siliceous pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—9 to 22 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, firm, sticky; common fine roots; common fine pores and wormcasts; common threads and films of calcium carbonate; 1 to 3 percent very fine siliceous pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

A3—22 to 43 inches; dark brown (10YR 4/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm, sticky; few fine roots; few fine pores; common films and threads of calcium carbonate; slightly effervescent; moderately alkaline; clear wavy boundary.

C—43 to 60 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; massive; hard, firm, sticky; common very fine pores; common threads, films, and very fine concretions of calcium carbonate; 3 to 5 percent iron-manganese concretions; slightly effervescent; moderately alkaline.

The texture of the 10- to 40-inch control section ranges from loam to clay loam. The content of clay ranges from 20 to 35 percent. The mollic epipedon is 20 to 50 inches thick. Most pedons have threads and films of calcium carbonate. Reaction is mildly alkaline or moderately alkaline.

The A horizon is dark brown, dark grayish brown, or very dark grayish brown. It is dominantly clay loam but contains smaller amounts of loam.

The Bw horizon, if it occurs, is brown or yellowish brown. Some pedons have an Ab horizon, which has colors similar to those of the A horizon.

The C horizon is light brown or pale brown. The texture commonly ranges from clay loam to loam, but in some pedons it is clay. The content of clay ranges from 20 to 45 percent.

Chaney Series

The Chaney series consists of very deep, moderately well drained, slowly permeable, nearly level to undulating soils on uplands. These soils formed in sandy and clayey material weathered from interbedded sandstone and shale. Slopes range from 0 to 8 percent. The soils are fine, mixed, thermic Aquic Paleustalfs.

Typical pedon of Chaney loamy fine sand, 0 to 3 percent slopes; from the intersection with Farm Road 207 in LaCasa, 3.1 miles south on Farm Road 717, 2.6 miles southwest on county road, 200 feet east along fence, 60 feet south, in an area of cropland:

Ap—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; common fine roots; slightly acid; abrupt smooth boundary.

E—6 to 9 inches; brown (7.5YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; loose, very friable; common fine roots; 1 to 3 percent siliceous pebbles; slightly acid; abrupt smooth boundary.

Bt1—9 to 17 inches; reddish yellow (7.5YR 6/6) sandy clay, strong brown (7.5YR 5/6) moist; common medium prominent red (2.5YR 4/6) and few fine faint yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; few very fine iron-manganese concretions; medium acid; clear wavy boundary.

Bt2—17 to 28 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common medium distinct yellowish red (5YR 5/6) and light gray (10YR 7/2) mottles; moderate medium angular and subangular blocky structure; very hard, very firm; few fine and medium roots; few fine pores; very few faint clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—28 to 40 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common coarse distinct light gray (10YR 7/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very hard, very firm; few fine roots and pores; few distinct clay films on faces of peds; medium acid; gradual smooth boundary.

BC—40 to 52 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; common medium distinct yellowish brown (10YR 5/8) and yellow (10YR 8/6) mottles; weak fine and medium subangular blocky structure; very hard, very firm; few fine roots and pores; 1 to 3 percent very fine siliceous pebbles; slightly acid; gradual smooth boundary.

C—52 to 66 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; coarse light gray (10YR 7/2) and light red (2.5YR 5/8) mottles; massive; hard, friable; few fine pores; 1 to 3 percent siliceous pebbles; slightly acid.

The thickness of the solum ranges from 30 to 60 inches. The combined thickness of the A and E horizons ranges from 6 to 20 inches. These horizons are generally mixed by cultivation.

The A horizon is 2 to 6 inches thick. It is pale brown, dark brown, brown, or dark grayish brown. The texture is loamy fine sand or stony loamy fine sand. Reaction ranges from neutral to medium acid.

The E horizon is 4 to 14 inches thick. It is very pale brown, pale brown, brown, light brown, or light yellowish brown. The texture and reaction are the same as those of the A horizon.

The Bt horizon is 20 to 38 inches thick. It is brownish yellow, yellowish red, dark yellowish brown, yellowish brown, reddish yellow, reddish brown, red, dark red, or yellow. It is mottled in shades of yellow, gray, and brown. The texture is sandy clay or clay. The content of clay ranges from 35 to 50 percent. Reaction ranges from medium acid to neutral.

The BC horizon has colors in shades of red, brown, yellow, and gray. The texture is sandy clay loam to clay. Reaction ranges from medium acid to neutral.

The texture of the C horizon ranges from sandy clay loam to shaly clay. Reaction is medium acid or slightly acid. Some pedons have weakly cemented layers of sandstone.

Cho Series

The Cho series consists of well drained, moderately permeable soils that are very shallow and shallow to indurated caliche. These soils are on nearly level to gently sloping uplands. They formed in calcareous, loamy material on outwash plains. Slopes range from 0 to 5 percent. The soils are loamy, carbonatic, thermic, shallow Petrocalcic Calciustolls.

Typical pedon of Cho loam, 0 to 5 percent slopes; from the intersection with U.S. Highway 180 in the eastern part of Breckenridge, 0.7 mile north on industrial loop road, 0.5 mile north and 0.2 mile east on county road, 0.1 mile south, in an area of rangeland:

A—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; slightly hard, friable; common fine roots; common pores; 10 to 15 percent caliche pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bkm—10 to 17 inches; pinkish white (7.5YR 8/2) indurated caliche; broken into plates 2 to 6 inches across and 0.2 inch to 2.0 inches thick; about 10 percent brown (10YR 5/3) loam between plates and

in solution channels; few matted roots between fractures; moderately alkaline; clear wavy boundary.

BCk—17 to 34 inches; pink (7.5YR 7/4) gravelly clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; about 60 percent, by volume, calcium carbonate; about 10 to 15 percent weakly and strongly cemented concretions and fragments; few dark stains in root channels; violently effervescent; moderately alkaline; abrupt wavy boundary.

2Ck—34 to 60 inches; pale olive (5Y 6/3) shale with clay texture, olive (5Y 5/3) moist; massive; very hard, firm; about 40 to 50 percent, by volume, calcium carbonate concretions; about 15 to 25 percent soft calcium carbonate; moderately alkaline.

The depth to a strongly cemented Bkm horizon, or petrocalcic horizon, ranges from 7 to 14 inches.

The A horizon is dark brown or dark grayish brown. The content of calcium carbonate is more than 40 percent. Coarse fragments of limestone pebbles and calcium carbonate concretions range, by volume, from 5 to 15 percent.

Some pedons have a Bw horizon that is 1 to 5 inches thick. This horizon has chroma and value one unit higher than those in the A horizon. The Bkm horizon is 2 to 10 inches thick.

The Ck horizon is pink to very pale brown, calcareous loam or clay loam. It is massive and weakly cemented. The content of soft and hard calcium carbonate ranges from 40 to 70 percent.

The 2Ck horizon is weathered shale overlain by outwash veneer.

Clairemont Series

The Clairemont series consists of very deep, well drained, moderately permeable, nearly level and very gently sloping soils. These soils formed in calcareous alluvial sediments on the flood plain along the Clear Fork of the Brazos River. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed (calcareous), thermic Typic Ustifluvents.

Typical pedon of Clairemont silty clay loam, occasionally flooded; from the intersection of Farm Road 1481 in Crystal Falls, about 0.8 north on Farm Road 578, 1.8 miles east on county road, 0.3 mile south to fence, 1,200 feet southeast, in an area of cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky and granular structure; slightly hard, friable; common roots; common fine pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—6 to 11 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, friable; few roots; few pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2—11 to 30 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable; few very fine roots; common distinct bedding planes; slightly effervescent; moderately alkaline; gradual smooth boundary.

C3—30 to 65 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; massive; hard, friable; few very fine roots; common distinct bedding planes; few pores; few threads of calcium carbonate; slightly effervescent; moderately alkaline.

The content of clay in the control section ranges from 18 to 35 percent. The A horizon is reddish brown, brown, or light brown.

The C horizon is stratified reddish brown, reddish yellow, yellowish red, or strong brown. The texture is silt loam, silty clay loam, or loam. Some pedons have thin strata of other textures that are 2 to 6 inches thick.

Clearfork Series

The Clearfork series consists of very deep, well drained, slowly permeable, nearly level soils on flood plains along the major streams. These soils formed in calcareous, clayey and loamy alluvial sediments. Slopes are 0 to 1 percent. The soils are fine, mixed, thermic Cumulic Haplustolls.

Typical pedon of Clearfork silty clay loam, occasionally flooded; from the intersection with U.S. Highway 180 in Breckenridge, 12.9 miles northwest on U.S. Highway 183, 4.6 miles west on county road, 0.8 mile north-northeast on a ranch trail, 30 feet south, in an area of rangeland:

A1—0 to 4 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate coarse subangular blocky structure; very hard, very firm, very sticky and plastic; many fine roots and pores; many wormcasts; dry weather cracks about 0.5 inch wide; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—4 to 17 inches; reddish brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; common pores and wormcasts; dry weather cracks 0.25 to 0.5 inch wide; few threads and films of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

A3—17 to 28 inches; dark reddish gray (5YR 4/2) silty

clay loam, dark reddish brown (5YR 3/2) moist; moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots and pores; few wormcasts; few films and threads of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw1—28 to 59 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots and pores; common wormcasts; common films and threads of calcium carbonate; few thin lenses of silt loam; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw2—59 to 76 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; many fine tubular pores; few wormcasts; few broken chitinous shell fragments; few threads of calcium carbonate; few thin discontinuous lenses of silt loam; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw3—76 to 83 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine tubular pores; few wormcasts; few films and threads of calcium carbonate; slightly effervescent; moderately alkaline.

The content of clay in the control section ranges from 30 to 45 percent and averages more than 35 percent. Reaction is moderately alkaline throughout the solum.

The A horizon is 20 to 34 inches thick. It is dark brown, reddish brown, dark reddish brown, or dark reddish gray.

The Bw horizon is reddish brown, yellowish red, dark brown, or strong brown. The texture is clay, silty clay, or silty clay loam. Most pedons have thin discontinuous strata of loam or silt loam.

Exray Series

The Exray series consists of shallow, well drained, moderately slowly permeable soils on gently sloping to moderately steep uplands. These soils formed in strongly cemented sandstone. Slopes range from 1 to 20 percent. The soils are clayey, mixed, thermic Lithic Rhodustalfs.

Typical pedon of Exray stony fine sandy loam, in an area of Bonti-Exray complex, gently undulating; from the intersection with U.S. Highway 180 in Breckenridge, 1.8 miles south on U.S. Highway 183, 0.6 mile east on Farm Road 2231, 0.25 mile south on ranch trail, 120 feet east, in an area of rangeland:

A—0 to 2 inches; brown (10YR 5/3) stony fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; common fine and medium roots; many fine pores; 1 to 3 percent very fine siliceous pebbles; about 10 percent flagstones; neutral; clear smooth boundary.

E—2 to 8 inches; light brown (7.5YR 6/4) stony fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; common fine roots; many fine pores; 1 to 3 percent fragments of sandstone and siliceous pebbles in the lower part; about 10 percent flagstones; slightly acid; clear smooth boundary.

Bt—8 to 16 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate fine angular blocky structure; extremely hard, very firm; few fine roots; few very fine pores; many distinct clay films on faces of peds; 1 to 3 percent sandstone fragments 2 to 6 inches across; medium acid; abrupt wavy boundary.

R—16 to 20 inches; red (2.5YR 4/6), strongly cemented sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 14 to 20 inches. The content of gravel- to stone-sized coarse fragments ranges from a few to 25 percent in the surface layer.

The A horizon is dark brown, brown, yellowish brown, or pale brown. It is fine sandy loam or stony fine sandy loam. Reaction is slightly acid or neutral.

The E horizon is brown, light brown, or light yellowish brown. It is stony fine sandy loam or fine sandy loam. Reaction is slightly acid or neutral. The combined thickness of the A and E horizons ranges from 4 to 10 inches.

The Bt horizon is mostly red. It is sandy clay or clay. The content of clay ranges from 35 to 50 percent. Reaction is medium acid or slightly acid.

The red sandstone bedrock is strongly cemented and fractured. In some pedons it has fractures 6 to 20 inches apart.

Frio Series

The Frio series consists of very deep, well drained, moderately slowly permeable soils on nearly level flood plains adjacent to local streams. These soils formed in loamy and clayey, calcareous alluvium. Slopes range from 0 to 2 percent. The soils are fine,

montmorillonitic, thermic Cumulic Haplustolls.

Typical pedon of Frio silty clay, occasionally flooded; from the intersection with U.S. Highway 180 in Breckenridge, 3.4 miles north on U.S. Highway 183, 3.6 miles north on Farm Road 578, 1.0 mile west on gravel road, 0.3 mile northwest, in a field:

A1—0 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium granular and fine subangular blocky structure; very hard, very firm; few fine pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A2—14 to 25 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate coarse and medium angular blocky structure; very hard, very firm; few fine roots and pores; few dry weather cracks 0.2 to 0.5 inch wide; common shiny pressure faces; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—25 to 52 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse and medium angular blocky structure; very hard, very firm; few fine roots and pores; few shiny pressure faces; few threads and films of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

C—52 to 74 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; massive; very hard, very firm; few films and threads of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon ranges from 24 to 50 inches. The content of clay in the 10- to 40-inch control section ranges from 35 to 50 percent. Calcium carbonate equivalent ranges from 15 to 40 percent.

The A horizon is dark grayish brown, brown, or dark brown. It is silty clay, clay, or silty clay loam. In most pedons it has dry weather cracks as much as 0.5 inch wide.

The B horizon is brown or dark brown and has films and threads of calcium carbonate. It is silty clay, clay, or silty clay loam.

The C horizon has colors and textures similar to those of the B horizon. Strata of light brown silty clay loam occur at varying depths. They range from 0.4 inch to 3.0 inches in thickness.

Gageby Series

The Gageby series consists of very deep, well drained, moderately permeable soils on nearly level and very gently sloping flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent but are dominantly about 0.5 percent. The soils are fine-loamy, mixed, thermic Cumulic Haplustolls.

Typical pedon of Gageby clay loam, occasionally flooded; from the intersection with U.S. Highway 180 in Breckenridge, 1.8 miles south on U.S. Highway 183, 1.0 mile east on Farm Road 2231, 1.5 miles south-southeast along old railroad right-of-way, 120 feet east, in a pasture:

Ap—0 to 7 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky and granular structure; hard, friable; common fine roots; common fine and medium pores; moderately alkaline; clear smooth boundary.

A—7 to 22 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky and granular structure; hard, firm or friable; common fine roots; common very fine pores; few very fine calcium carbonate concretions; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—22 to 42 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine granular and moderate medium subangular blocky structure; hard, firm or friable; few fine roots; common medium to very fine pores; common very fine calcium carbonate concretions; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—42 to 52 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; few fine roots; common fine pores; common very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—52 to 60 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine roots; common threads and films of calcium carbonate; thin lenses of fine sandy loam and loamy material on the exterior of peds; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 30 to more than 60 inches. The depth to secondary carbonates ranges from 0 to 25 inches. The 10- to 40-inch control section is loam, sandy clay loam, or clay loam. The content of clay ranges from 18 to 35 percent.

The A horizon ranges from 20 to about 40 inches in thickness. It is brown, dark brown, or very dark grayish brown. It is moderately alkaline and calcareous or mildly alkaline and noncalcareous above a depth of 25 inches.

It is moderately alkaline and calcareous below that depth.

The Bw and C horizons are brown, dark brown, grayish brown, or yellowish brown. They are loam, silt loam, sandy clay loam, or clay loam. They contain few or common calcium carbonates occurring as threads, films, and concretions.

The Gageby soils in Stephens County are outside the range in characteristics for series because they contain secondary carbonates within a depth of 28 inches. Also, the plant community differs from that of the Gageby soils more commonly found farther west. In Stephens County these soils are in the Loamy Bottomland range site.

Harpersville Series

The Harpersville series consists of well drained, very slowly permeable soils on strongly sloping to steep, erosional uplands. These soils are very shallow over weathered shale bedrock. Slopes range from 8 to about 40 percent. The soils are clayey, mixed (calcareous), thermic Ustic Torriorthents.

Typical pedon of Harpersville clay, in an area of Owens-Harpersville complex, hilly, extremely stony; from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles east on U.S. Highway 180, 10.8 miles northeast on Texas Highway 67, 2.3 miles south on Farm Road 717, 0.7 mile southwest on county road, 550 feet east, in an area of rangeland:

A—0 to 7 inches; light gray (5Y 7/2) clay, olive gray (5Y 5/2) moist; moderate fine and medium angular blocky structure; very hard, firm, very sticky and plastic; common fine and few medium roots; few fine pores; about 5 percent sandstone fragments in the form of flagstones, stones, and boulders; few seams of olive gray shale in the lower 2 inches; very slightly effervescent; moderately alkaline; clear smooth boundary.

C1—7 to 15 inches; light olive gray (5Y 6/2), weathered, clayey shale, olive gray (5Y 4/2) moist; coarsely fractured parting to thin plates; extremely hard, extremely firm; few roots in crevices; few films and threads of calcium carbonate along crevices; noncalcareous interiors of peds; moderately alkaline; abrupt wavy boundary.

C2—15 to 60 inches; light olive gray (5Y 6/2), weathered, clayey shale, olive gray (5Y 4/2) moist; shale fragments parting to medium and thick plates; extremely hard, extremely firm; noncalcareous; moderately alkaline.

The thickness of the solum, or the depth to weathered shale bedrock, ranges from 3 to 12 inches. The thickness of the A horizon also ranges from 3 to 12 inches. Coarse fragments of sandstone or limestone cover 1 to about 15 percent of the surface.

The A horizon is brown, grayish brown, light brownish gray, light olive brown, yellowish brown, light yellowish brown, or olive yellow. It is clay, silty clay, or clay loam.

The C horizon has colors in shades of olive, brown, yellow, and gray, which are inherited from the underlying material. This material is stratified, weakly consolidated, weathered shale that can be excavated by a backhoe.

Heaton Series

The Heaton series consists of very deep, well drained, moderately permeable, nearly level to gently sloping soils on terraces. These soils formed in loamy sediments. Slopes range from 0 to 3 percent. The soils are loamy, siliceous, thermic Arenic Paleustalfs.

Typical pedon of Heaton loamy fine sand, 0 to 3 percent slopes; from the intersection with Farm Road 1481 in Crystal Falls, 2.0 miles north on Farm Road 578, 125 feet east of road:

A—0 to 7 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak very fine subangular blocky structure; soft, very friable; many fine roots; 1 to 3 percent very fine siliceous pebbles; neutral; clear smooth boundary.

E—7 to 23 inches; reddish yellow (7.5YR 7/6) loamy fine sand, reddish yellow (7.5YR 6/6) moist; single grained; soft, very friable; common fine roots; 1 to 3 percent very fine siliceous pebbles; slightly acid; abrupt wavy boundary.

Bt1—23 to 32 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few pores and wormcasts; few distinct clay films on faces of peds; 1 to 3 percent very fine siliceous pebbles; slightly acid; gradual wavy boundary.

Bt2—32 to 42 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; few very fine roots; few distinct clay films on faces of peds; 1 to 3 percent very fine siliceous pebbles; medium acid; clear smooth boundary.

Bt3—42 to 60 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few very fine roots; few fine pores; few distinct clay

films on faces of peds; 1 to 3 percent very fine siliceous pebbles; about 10 percent yellow (10YR 7/6), stripped sand grains; slightly acid; clear smooth boundary.

Bt4—60 to 70 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; common prominent mottles in shades of red, brown, and yellow; weak medium subangular blocky structure; hard, friable; few very fine roots; few fine and medium pores; few irregular and discontinuous clay films and clay bridges; mildly alkaline; gradual wavy boundary.

2Bt5—70 to 80 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine roots; few very fine pores; common fine and medium distinct white (10YR 8/1) and brown (7.5YR 5/4) mottles; few very fine concretions of calcium carbonate in the lower part; noncalcareous matrix; mildly alkaline.

The combined thickness of the A and E horizons ranges from 21 to 30 inches. The thickness of the solum ranges from 60 to more than 80 inches.

The A horizon is 4 to 7 inches thick. It is brown, yellowish brown, or light yellowish brown. Reaction is slightly acid or neutral.

The E horizon is 15 to 26 inches thick. It is pink or reddish yellow.

The Bt horizon above a depth of 60 inches is reddish yellow or yellowish red. Reaction ranges from medium acid to neutral in this part of the horizon. The Bt horizon below a depth of 60 inches is red or reddish yellow. In some pedons it is mottled in shades of brown or yellow. Some pedons have stripped sand grains below a depth of 50 inches. Reaction ranges from slightly acid to moderately alkaline below a depth of 60 inches.

Hensley Series

The Hensley series consists of shallow, well drained, slowly permeable soils on very gently sloping or gently sloping uplands. These soils formed in residuum over limestone. Slopes range from 1 to 3 percent. The soils are clayey, mixed, thermic Lithic Rhodustalfs.

Typical pedon of Hensley loam, gently sloping, extremely stony; from the intersection with U.S. Highway 183 in Breckenridge, 5.5 miles east on U.S. Highway 180, 1.0 mile northeast on county road, 660 feet west of road:

A—0 to 4 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; common fine tubular pores; limestone fragments 6 inches to several feet across covering about 10 percent of the surface; slightly acid; abrupt smooth boundary.

Bt1—4 to 8 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; very hard, very firm; few fine roots; few fine tubular pores; few distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt2—8 to 15 inches; red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; very hard, very firm; few fine roots; few fine tubular pores; few distinct clay films; about 1 percent limestone cobbles; mildly alkaline; abrupt irregular boundary.

R—15 to 20 inches; indurated limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 10 to 18 inches. The percentage of the surface covered by coarse fragments of limestone ranges from 0 to about 15 percent. The fragments range in size from gravel to boulders.

The A horizon is reddish brown or brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, red, or dark reddish brown. It is clay or clay loam. Reaction is neutral or mildly alkaline. The content of limestone fragments ranges from 0 to 10 percent.

The R layer is coarsely fractured limestone bedrock.

Leeray Series

The Leeray series consists of very deep, well drained, very slowly permeable soils on nearly level and very gently sloping uplands. These soils formed in calcareous clay. Slopes range from 0 to 3 percent. The soils are fine, montmorillonitic, thermic Typic Chromusterts.

Typical pedon of Leeray clay, 1 to 3 percent slopes; from the intersection with Farm Road 717 in Caddo, 0.7 mile east on U.S. Highway 180, 3.2 miles southeast on county road, 0.15 mile south on second county road, 55 feet west, in an area of cropland:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; very hard, very firm, sticky; common fine and few medium roots; 1 to 3 percent siliceous pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

A1—6 to 17 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine angular blocky structure; extremely hard, very firm, sticky; few fine roots; 1 to 3 percent siliceous and caliche pebbles; few distinct shiny pressure faces on peds; slightly effervescent; moderately alkaline; gradual wavy boundary.

A2—17 to 54 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, sticky; few medium roots; few very fine calcium carbonate concretions; few very fine soft masses of calcium carbonate; few very fine black iron-manganese concretions; prominent and distinct intersecting slickensides; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk—54 to 74 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky; prominent grooved intersecting slickensides; 1 to 3 percent siliceous pebbles less than 1.0 inch across; common very fine concretions and soft masses of calcium carbonate; common very fine black iron-manganese concretions; few streaks of gray and olive shale along closed cracks in the lower part; slightly effervescent; moderately alkaline; gradual wavy boundary.

Ck—74 to 80 inches; olive gray (5Y 5/2), weathered, clayey shale, olive gray (5Y 4/2) moist; massive; very hard, very firm, sticky; about 15 percent concretions and soft masses of calcium carbonate; few very fine distinct black iron-manganese concretions; common streaks of light brownish gray shale; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to more than 80 inches. Reaction is mildly alkaline or moderately alkaline to a depth of 10 inches and is moderately alkaline below that depth. Undisturbed areas have gilgai microrelief. Dry weather cracks, 1 to 3 inches wide, extend to a depth of more than 20 inches. Intersecting slickensides and pressure faces begin at a depth of 14 to 20 inches. The content of clay in the control section ranges from 40 to about 60 percent.

The thickness of the A horizon varies from 6 to 20 inches on microknolls to about 20 to 60 inches in microdepressions. It is dark grayish brown, very dark grayish brown, or dark brown.

The Bk horizon is 12 to 30 inches thick. It is brown, light brown, light yellowish brown, dark yellowish brown, pale brown, grayish brown, or light olive brown. The texture is clay or silty clay.

The Ck horizon is pale brown, light yellowish brown, light olive brown, very pale brown, brownish yellow, olive brown, olive gray, or grayish brown. It is clay, silty clay, or weathered shale. The content of calcium carbonate ranges from 5 to 20 percent. Some pedons are underlain by unweathered shale or limestone bedrock below a depth of 60 inches.

Lindy Series

The Lindy series consists of moderately deep, well drained, slowly permeable soils on nearly level and very gently sloping uplands. These soils formed in loamy to clayey material over thick beds of limestone. Slopes range from 0 to 3 percent. The soils are fine, mixed, thermic Udic Haplustalfs.

The Lindy soils in Stephens County are taxadjuncts to the series because they have an abrupt textural change between the A2 and Bt1 horizons.

Typical pedon of Lindy silt loam, 0 to 3 percent slopes (fig. 15); from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles east on U.S. Highway 180, 1.6 miles northeast on Texas Highway 67, 1.5 miles east and 0.2 mile north on county road, 50 feet east, in an area of rangeland:

A1—0 to 2 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak medium platy structure; hard, friable; common fine roots; common fine and medium tubular pores; common wormcasts; neutral; abrupt smooth boundary.

A2—2 to 5 inches; reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable; common fine and medium roots; common fine tubular pores; common very fine iron-manganese concretions; 1 to 3 percent limestone pebbles; neutral; abrupt smooth boundary.

Bt1—5 to 11 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine and medium roots; few fine tubular pores; many distinct clay films on faces of peds; few very fine iron-manganese concretions; neutral; clear smooth boundary.

Bt2—11 to 19 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm; common fine and medium roots; few wormcasts; many distinct clay films on faces of peds; common very fine iron-manganese concretions; neutral; clear smooth boundary.

Figure 15.—Profile of Lindy silt loam, 0 to 3 percent slopes. Limestone bedrock is at a depth of about 60 centimeters. Depth is marked in tenths of a meter.

Bt3—19 to 25 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm; few fine and medium roots; few wormcasts; few distinct clay films on faces of peds; 1 to 3 percent very fine limestone pebbles; common very fine iron-manganese concretions; neutral; abrupt smooth boundary.
R—25 to 40 inches; indurated limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. The lower boundary of the solum is abrupt. In some pedons, it is clear, gradual, or diffuse and vertical fractures and some horizontal fractures in the limestone are filled with soil material. Reaction ranges from slightly acid to mildly alkaline throughout the profile.

The A horizon is reddish brown or brown. Coarse fragments cover as much as about 0.9 percent of the surface.

The Bt horizon is reddish brown, red, dark red, or yellowish red. The texture is clay or clay loam. The content of clay ranges from 35 to about 60 percent.

Lusk Series

The Lusk series consists of moderately deep, well drained, slowly permeable soils on undulating ancient stream terraces. These soils formed in gravelly alluvium. Slopes range from 1 to 8 percent. The soils are clayey-skeletal, mixed, thermic Typic Paleustalfs.

Typical pedon of Lusk gravelly fine sandy loam, undulating; from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles west on U.S. Highway 180, 6.0 miles north on Farm Road 3099, 10 feet west, in an area of rangeland:

A—0 to 6 inches; reddish brown (5YR 4/4) gravelly fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, friable; common fine roots; common pores; about 15 percent quartz pebbles 0.5 inch to 1.5 inches in diameter; mildly alkaline; abrupt smooth boundary.
Bt1—6 to 10 inches; reddish brown (5YR 4/4) extremely gravelly sandy clay, dark reddish brown (2.5YR 3/4) moist; moderate fine subangular blocky structure; very hard, firm; few fine and medium roots; few fine pores; few wormcasts; few distinct clay films on faces of peds; about 60 percent well graded quartz pebbles; neutral; gradual smooth boundary.
Bt2—10 to 19 inches; red (2.5YR 5/6) extremely gravelly sandy clay, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; very hard, firm; few fine and medium roots; few fine pores; few wormcasts; few distinct clay films on faces of peds; about 75 percent well graded quartz pebbles; neutral; abrupt smooth boundary.
Bt3—19 to 24 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky and granular structure; few roots; few fine pores; few distinct clay films on faces of peds; about 5 percent well graded quartz pebbles; neutral; abrupt smooth boundary.
Bt4—24 to 35 inches; red (2.5YR 4/6) very gravelly sandy clay, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky and granular structure; few fine roots and pores; few distinct clay films on faces of peds; about 60 percent well graded quartz pebbles; few very fine calcium carbonate concretions; mildly alkaline; abrupt smooth boundary.
Cr&Bt—35 to 38 inches; red (2.5YR 4/6) extremely gravelly and cobbly coarse sand; massive; porous; carbonate-cemented conglomerate (Cr) containing

about 90 percent quartz sand and gravel and 1 to 3 percent calcium carbonate pebbles; about 10 percent sandy clay material (Bt) fingering into the conglomerate; quartz pebbles 0.1 to 0.8 inch in diameter; conglomerate hardens when exposed and dry; slightly effervescent; moderately alkaline; clear smooth boundary.

Cr—38 to 60 inches; yellowish red (5YR 5/8), weakly cemented carbonate and silica conglomerate containing about 80 percent quartz sand and gravel and about 15 percent calcium carbonate; massive; quartz pebbles 0.1 to 0.8 inch in diameter; conglomerate hardens when exposed and dry; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of coarse fragments in the control section averages, by volume, 35 to 70 percent quartz pebbles. Secondary carbonates are within a depth of 28 inches.

The A horizon is reddish brown, brown, or dark brown. It contains, by volume, 15 to 25 percent quartz pebbles 0.5 inch to 1.5 inches in diameter. Reaction ranges from slightly acid to mildly alkaline.

The Bt horizon is red, dark red, or reddish brown. The upper part of the horizon is neutral or slightly acid, and the lower part is mildly alkaline or moderately alkaline. The texture of the fine-earth fraction is clay, sandy clay, or clay loam. The content of quartz pebbles ranges from 5 to 75 percent.

The Cr horizon is red or yellowish red. The texture ranges from extremely gravelly and cobbly loam to coarse sand, weakly cemented by silica and calcium carbonate. A few pedons are underlain by strongly cemented conglomerate, and a few others are underlain at a depth of several feet by beds of loose gravel or sand.

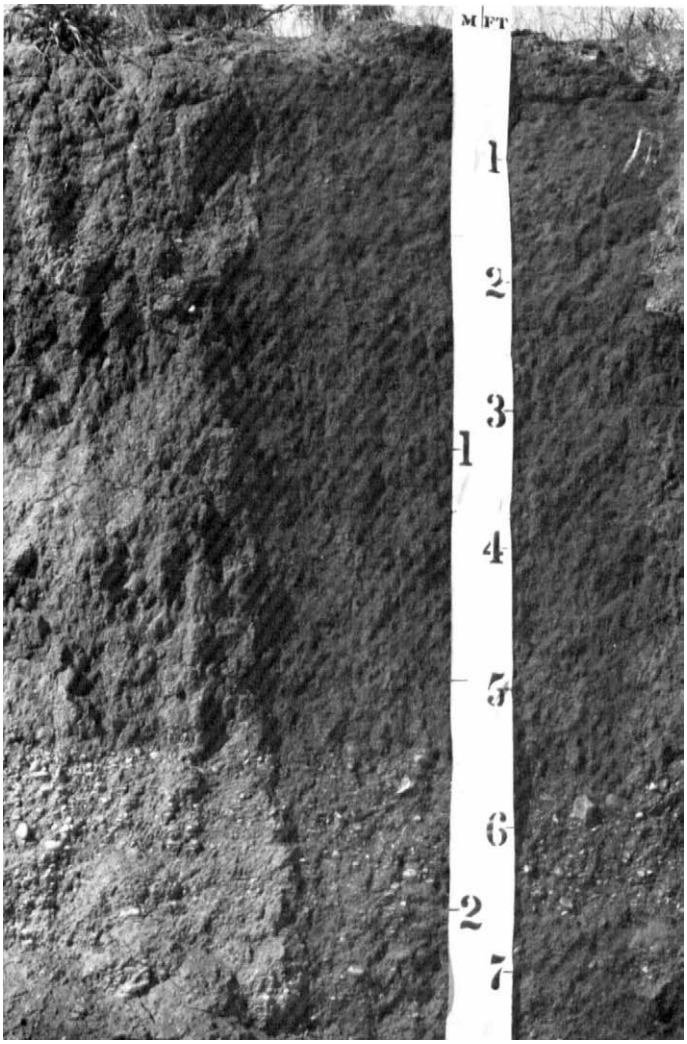

Figure 16.—Profile of Minwells fine sandy loam, 1 to 3 percent slopes. A layer of gravelly soil is between depths of about 6 and 7 feet.

Minwells Series

The Minwells series consists of very deep, well drained, slowly permeable, very gently sloping soils on high ancient terraces. These soils formed in clayey and loamy sediments underlain by gravelly alluvium. Slopes range from 1 to 3 percent. The soils are fine, mixed, thermic Udic Paleustalfs.

The Minwells soils in Stephens County are taxadjuncts because they are drier than is defined as the range for the series.

Typical pedon of Minwells fine sandy loam, 1 to 3 percent slopes (fig. 16); from the intersection with U.S. Highway 180 in Breckenridge, 14.7 miles north on U.S. Highway 183, 0.9 mile west on county road, 80 feet north, in an area of rangeland:

A—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; few fine pores; 1 to 3 percent quartz pebbles; neutral; clear smooth boundary.

Bt1—7 to 14 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate coarse prismatic structure parting to strong medium subangular blocky; very hard, firm; few fine roots and pores; 1 to 3 percent quartz pebbles 0.1 to 0.4 inch in diameter; many distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—14 to 32 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate coarse prismatic

structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few pores; common distinct clay films on faces of peds; few quartz pebbles 0.1 to 0.4 inch in diameter; neutral; gradual smooth boundary.

Bt3—32 to 50 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few fine roots and pores; few siliceous pebbles; patchy clay films on faces of prisms; neutral; gradual smooth boundary.

BCk—50 to 60 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak fine subangular blocky structure; hard, friable; about 20 percent soft masses and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

2Ck—60 to 76 inches; reddish yellow (5YR 6/6) very gravelly sandy loam, reddish yellow (5YR 5/6) moist; massive; hard, friable; 50 to 65 percent well graded chert and quartz gravel; 5 to 15 percent calcium carbonate concretions; content of gravel increases with depth; slightly effervescent; moderately alkaline.

The thickness of the solum and the depth to beds of gravel range from 48 to about 80 inches.

The A horizon is 4 to 15 inches thick. It is light reddish brown, reddish brown, light brown, or brown. Reaction ranges from slightly acid to mildly alkaline.

The Bt horizon is 26 to 60 inches thick. It is reddish brown, red, or yellowish red. The texture is clay loam, sandy clay, or clay. The content of clay ranges from 35 to about 45 percent.

The BCk or BC horizon ranges from 10 to about 40 inches thick. This horizon is reddish brown, red, yellowish red, or reddish yellow. The texture is clay loam, sandy clay loam, or gravelly sandy clay loam. Reaction ranges from neutral to moderately alkaline.

The 2Ck horizon is red, yellowish red, or reddish yellow. The texture ranges from sandy loam to sandy clay loam or is the gravelly to extremely gravelly analogs of the textures within that range.

Nimrod Series

The Nimrod series consists of very deep, moderately well drained, moderately slowly permeable soils on very gently sloping uplands. These soils formed in loamy and sandy material weathered from sandstone. Slopes range from 1 to 3 percent. The soils are loamy, siliceous, thermic Aquic Arenic Paleustalfs.

Typical pedon of Nimrod loamy fine sand, 1 to 3 percent slopes; from the intersection with Farm Road 207 in LaCasa, 3.0 miles south on Farm Road 717, 300 feet east of intersection, in an area of rangeland:

A—0 to 4 inches; dark brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; single grained; slightly hard, very friable; many fine roots; 1 to 3 percent siliceous pebbles; neutral; clear smooth boundary.

E—4 to 22 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; slightly hard, very friable; common fine roots; 1 to 3 percent siliceous pebbles; neutral; abrupt wavy boundary.

Bt1—22 to 30 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium prominent mottles of light brownish gray (10YR 6/2), very pale brown (10YR 7/4), brownish yellow (10YR 6/6), and red (2.5YR 5/8); moderate coarse subangular blocky structure; very hard, very firm; few fine and medium pores and roots; common distinct clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt2—30 to 42 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium distinct grayish brown (10YR 5/2) and pale brown (10YR 6/3) and few medium prominent red (2.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; very hard, very firm; few fine roots and pores; common distinct clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt3—42 to 56 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; common medium prominent white (10YR 8/2), yellow (10YR 7/6), and red (2.5YR 4/6) and few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; hard, firm; few distinct clay films on faces of peds; neutral; gradual wavy boundary.

BC—56 to 70 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; common medium prominent white (10YR 8/2) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; hard, friable; few very fine roots; 1 to 3 percent siliceous pebbles; mildly alkaline.

The solum ranges from 60 to 80 inches in thickness. The combined thickness of the A and E horizons ranges from 20 to 40 inches. The A horizon and part of the E horizon are generally mixed by cultivation.

The A horizon is 2 to 6 inches thick. It is dark brown, brown, dark grayish brown, or pale brown. Reaction is neutral or mildly alkaline.

The E horizon is 14 to 34 inches thick. It is pale

brown, brown, light brown, light yellowish brown, or pink. Reaction is slightly acid or neutral.

The Bt horizon is 30 to 45 inches thick. It is light gray, reddish yellow, light brownish gray, strong brown, or yellow. It has mottles of yellowish red, dark red, gray, white, pale brown, grayish brown, very pale brown, or red. Reaction is slightly acid or neutral.

The BC horizon and the C horizon, if it occurs, range from sandy clay loam to sandy clay. Reaction is mildly alkaline. Some pedons have weakly cemented sandstone layers in the C horizon.

The Nimrod soils in Stephens County are outside the range in characteristics for the series because reaction is less acid than is defined as the range.

Owens Series

The Owens series consists of well drained, very slowly permeable soils on gently sloping to steep uplands. These soils are moderately deep over weathered shale bedrock. Slopes range from 1 to 40 percent. The soils are fine, mixed, thermic Typic Ustochrepts.

Typical pedon of Owens clay, in an area of Owens-Harpersville complex, hilly, extremely stony; from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles east on U.S. Highway 180, 10.8 miles northeast on Texas Highway 67, 2.3 miles south on Farm Road 717, 0.7 mile southwest on county road, 525 feet east, in an area of rangeland:

A—0 to 5 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong fine and medium subangular blocky structure; very hard, very firm; many fine roots; about 5 percent limestone fragments 10 to 24 inches in diameter; calcareous; moderately alkaline; abrupt smooth boundary.

Bw1—5 to 10 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; very hard, very firm; common fine roots; common medium tubular pores; about 1 percent stones; calcareous; moderately alkaline; gradual smooth boundary.

Bw2—10 to 16 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; few fine soft masses of calcium carbonate; about 2 percent shale pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw3—16 to 23 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; strong medium angular blocky structure; very hard, very firm; few fine roots; few very fine tubular pores; about 10 percent shale pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

B/C1—23 to 30 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; common coarse olive yellow (2.5Y 6/6) mottles; strong medium and coarse angular blocky structure; very hard, very firm; few fine roots between peds; few films and threads and soft calcium carbonate deposits mostly on faces of peds; about 30 percent light gray (5Y 7/2), weathered, clayey shale (C1); slightly effervescent; moderately alkaline; clear smooth boundary.

B/C2—30 to 40 inches; light gray (5Y 7/2) clay, light olive gray (5Y 6/2) moist; common coarse olive yellow (2.5Y 6/6) mottles; moderate fine and medium subangular blocky structure; extremely hard, extremely firm; few fine roots between peds; few soft calcium carbonate deposits along cleavage planes; about 40 percent light gray (5Y 7/2), weathered, clayey shale (C2); noncalcareous matrix; moderately alkaline; clear wavy boundary.

C3—40 to 54 inches; light gray (5Y 7/2), weathered, clayey shale; massive parting to angular rocklike fragments; very hard, very firm; few soft calcium carbonate deposits along cleavage planes; noncalcareous matrix; moderately alkaline; clear smooth boundary.

C4—54 to 60 inches; light gray (5Y 7/2), weathered, clayey shale; angular rocklike structure; very hard, very firm; few soft calcium carbonate deposits along cleavage planes; noncalcareous matrix; moderately alkaline.

The solum is 20 to 40 inches thick. Reaction is moderately alkaline throughout the profile.

The A horizon is 3 to 10 inches thick. It is olive, pale olive, olive brown, light olive brown, light yellowish brown, brown, grayish brown, or light brownish gray. Cobble-sized, stone-sized, and boulder-sized fragments of limestone, sandstone, and ironstone are on the surface and in the surface layer of some pedons. This horizon is noncalcareous in some pedons.

The Bk or Bw horizon is 4 to 24 inches thick. It is olive, pale olive, olive brown, light olive brown, light yellowish brown, brown, grayish brown, or light brownish gray. The texture is clay, silty clay, or clay loam. The content of clay ranges from 35 to 60 percent.

The B/C horizon, if it occurs, ranges from 4 to 20 inches in thickness. It has colors in shades of olive, gray, brown, or yellow. In most pedons it has a few secondary carbonates.

The C horizon has colors in shades of olive, gray, yellow, or red. In some pedons the weathered shale

material grades into consolidated, unweathered shale. Some pedons have thin layers of interbedded sandstone or limestone.

Palopinto Series

The Palopinto series consists of very shallow and shallow, well drained, moderately permeable, stony soils on undulating to moderately steep upland ridges. These soils formed in material weathered from limestone. Slopes range from 1 to 20 percent. The soils are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Typical pedon of Palopinto very flaggy loam, undulating; from the intersection of Farm Road 207 in LaCasa, 0.5 mile south on Farm Road 171, 2.0 miles east on Farm Road 207, 0.35 mile north along fence, 35 feet west, in an area of rangeland:

A1—0 to 2 inches; dark brown (10YR 4/3) very flaggy loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; about 35 percent limestone flagstones and 20 percent stones, cobbles, and gravel; moderately alkaline; clear smooth boundary..

A2—2 to 5 inches; dark brown (10YR 4/3) very flaggy clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine roots; few fine tubular pores; about 30 percent limestone flagstones and 20 percent stones, cobbles, and gravel; moderately alkaline; clear wavy boundary.

A3—5 to 11 inches; about 50 percent dark brown (10YR 4/3) extremely flaggy clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; about 40 percent limestone flagstones and 20 percent boulders, cobbles, and gravel; content of coarse fragments increases with depth; surface of coarse fragments is a calcareous and noncalcareous matrix; moderately alkaline; abrupt wavy boundary.

R—11 to 20 inches; hard, platy, unweathered limestone bedrock.

The thickness of the solum, or the depth to hard limestone bedrock, ranges from 6 to 20 inches. The content of coarse fragments of flattened limestone ranges from 35 to 85 percent. These fragments range from 0.5 inch to more than 40 inches in diameter. Reaction is mildly alkaline or moderately alkaline. The solum is noncalcareous or slightly effervescent.

The A horizon is dark brown, dark grayish brown, or dark brown. The texture of the fine-earth fraction is loam or clay loam but includes some silty clay loam and silt loam.

Patilo Series

The Patilo series consists of very deep, moderately well drained, moderately slowly permeable, nearly level and gently undulating soils on uplands. These soils formed in thick, sandy eolian deposits. Slopes range from 0 to 3 percent. The soils are loamy, siliceous, thermic Grossarenic Paleustalfs.

Typical pedon of Patilo fine sand, 0 to 3 percent slopes; from the intersection with Farm Road 207 at LaCasa, 3.0 miles south on Farm Road 717, 1.5 miles west and 0.6 mile south on county road, 500 feet south along fence, 50 feet east, in an area of rangeland:

A—0 to 3 inches; yellowish brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; common fine roots; neutral; clear wavy boundary.

E—3 to 54 inches; very pale brown (10YR 8/3) fine sand, very pale brown (10YR 7/3) moist; single grained; loose; common fine roots; neutral; clear wavy boundary.

Bt1—54 to 72 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common prominent red (10R 4/6), dark red (10R 3/6), yellow (10YR 7/6), and brownish yellow (10YR 6/6) and few medium faint gray (10YR 6/1) mottles; moderate coarse angular blocky structure; very hard, very firm; few very fine roots; many distinct thin clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—72 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common prominent distinct red (10R 4/8) and common medium distinct yellow (10YR 7/6) and brownish yellow (10YR 6/6) mottles; moderate coarse angular blocky structure; very hard, very firm; few very fine roots; few distinct clay films on faces of peds; strongly acid.

The thickness of the solum ranges from 65 to more than 80 inches.

The A horizon is 3 to 8 inches thick. It is brown, dark brown, light gray, pale brown, or yellowish brown. Reaction ranges from neutral to medium acid.

The E horizon is 38 to about 70 inches thick. It is very pale brown, pink, or reddish yellow. Reaction ranges from neutral to medium acid.

The Bt horizon is yellowish red, light gray, brownish yellow, or reddish yellow. It has varying amounts of gray, brown, yellow, and red mottles. The content of

clay is 27 to 35 percent. Reaction ranges from slightly acid to strongly acid.

Rowden Series

The Rowden series consists of moderately deep, well drained, slowly permeable, nearly level and very gently sloping soils on uplands. These soils formed in loamy and clayey material over hard limestone bedrock. Slopes range from 0 to 3 percent. The soils are fine, mixed, thermic Typic Argiustolls.

Typical pedon of Rowden clay loam, 0 to 3 percent slopes; from the intersection with Texas Highway 67 in Ivan, 5.0 miles east on Farm Road 1148, 0.6 mile south on Farm Road 3253, 425 feet west, in an area of rangeland:

A—0 to 5 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; common wormcasts; few rounded iron-manganese concretions; 1 to 3 percent siliceous pebbles; neutral; clear wavy boundary.

Bt1—5 to 15 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; moderate medium angular blocky structure; very hard, firm; few fine roots; few fine and medium pores; few wormcasts; few iron-manganese concretions; 1 to 3 percent siliceous pebbles; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—15 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; strong medium angular blocky structure; very hard, very firm; few very fine roots; few iron-manganese concretions; few very fine calcium carbonate concretions; common patchy clay films on faces of peds; slightly effervescent; moderately alkaline; abrupt wavy boundary.

R—25 to 48 inches; coarsely fractured limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. The content of limestone pebbles and cobbles ranges from 0 to about 3 percent in the solum and on the surface.

The A horizon ranges from 5 to 10 inches in thickness. It is dark brown, dark grayish brown, or dark reddish gray. Reaction ranges from neutral to moderately alkaline.

The Bt horizon ranges from 15 to 30 inches in thickness. It is dark reddish gray, reddish brown, or strong brown. Reaction ranges from neutral to moderately alkaline. Some pedons have a Btk horizon. This horizon has few or common soft masses and concretions of calcium carbonate.

The R layer is coarsely fractured, hard limestone bedrock.

Set Series

The Set series consists of well drained, slowly permeable soils that are deep over weathered shale bedrock. These gently sloping to moderately steep soils are on uplands. They formed in clayey, loamy, and shaly sediments. Slopes range from 2 to 30 percent. The soils are fine-silty, carbonatic, thermic Typic Calciustolls.

Typical pedon of Set clay loam, 2 to 6 percent slopes; from the intersection with U.S. Highway 180 in Caddo, 5.18 miles south on Farm Road 717, 2.0 miles west and 0.5 mile south on county road, 200 feet east along fence, 90 feet south:

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; common very fine and fine roots; common fine pores; few wormcasts; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—12 to 22 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few very fine and fine roots; common fine pores; few wormcasts; approximately 25 percent, by volume, soft masses and fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk2—22 to 35 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few very fine roots and pores; about 45 percent medium to very fine soft masses and very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk—35 to 45 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; very hard, very firm; few very fine roots; seams of weathered shale increasing with depth; about 35 percent very fine to medium soft masses and fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; diffuse wavy boundary.

Ck—45 to 60 inches; interbedded light olive brown (2.5Y 5/6) clay and weathered shale with seams of

red (10R 4/4) shale; massive; very hard, very firm; few soft masses of calcium carbonate decreasing with increasing depth; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The texture of the subsoil is clay loam, clay, silty clay, or silty clay loam. Less than 15 percent is coarser than very fine sand. The calcium carbonate equivalent ranges from 40 to about 65 percent in the control section.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, brown, or grayish brown. The texture is clay loam, clay, or the stony analogs of those textures.

The Bk and BCk horizons are yellowish brown, light yellowish brown, grayish brown, brown, light olive brown, pale olive, or light brownish gray. They have common or many concretions and soft masses of calcium carbonate. The texture is clay loam, silty clay loam, silty clay, or clay.

The Ck horizon has colors in shades of olive, brown, or gray. It is weathered, clayey shale interbedded with calcareous, clayey and loamy materials. It generally has few or common concretions or soft masses of calcium carbonate, but in some pedons it does not have carbonates.

Throck Series

The Throck series consists of well drained, slowly permeable soils on gently sloping uplands. These soils are deep over weathered shale bedrock. Slopes range from 1 to 5 percent. The soils are fine, mixed, thermic Typic Ustochrepts.

The Throck soils in Stephens County are taxadjuncts because they have less calcium carbonate and a higher shrink-swell potential than is defined as the range for the series.

Typical pedon of Throck clay, 1 to 5 percent slopes; from the intersection with U.S. Highway 183 in Breckenridge, 2.5 miles east on U.S. Highway 180, 5.2 miles north on Texas Highway 67, 200 feet east, in a pasture:

A1—0 to 2 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate very fine granular structure; hard, firm, sticky; many fine and very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A2—2 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine angular blocky structure; very hard, firm, sticky and plastic; common very fine roots; common fine and very fine tubular pores; about 2 percent pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—6 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium angular blocky structure parting to moderate very fine subangular blocky; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; pressure faces on faces of peds; less than 1 percent gravel-sized fragments of limestone; few very fine gypsum crystals and few very fine soft masses of lime; slightly effervescent; moderately alkaline; clear smooth boundary.

By—15 to 29 inches; brown (10YR 5/3) clay, brown or dark brown (10YR 4/3) moist; moderate coarse angular blocky structure parting to moderate medium angular blocky; very hard, very firm, very sticky and plastic; few very fine roots; common very fine tubular pores; pressure faces on faces of peds; common slickensides as much as 10 inches across and slanted 20 to 30 degrees; few very fine soft masses of lime and few fine gypsum crystals; slightly effervescent; moderately alkaline; clear smooth boundary.

Bky1—29 to 37 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few faint light olive brown (2.5Y 5/4) mottles; weak very fine prismatic structure parting to weak fine angular blocky; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; common slickensides as much as 10 inches across and slanted 20 to 30 degrees; pressure faces on faces of peds; few very fine concretions and soft masses of lime; few pockets of fine gypsum crystals; about 2 percent limestone pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bky2—37 to 45 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; few very fine faint light brownish gray (2.5Y 6/2) mottles; weak fine and medium angular blocky structure parting to weak fine and medium subangular blocky; few very fine roots and tubular pores; common very fine concretions and soft masses of lime; few pockets of fine gypsum crystals 0.5 inch to 2.0 inches across; slightly effervescent; moderately alkaline; clear smooth boundary.

Bky3—45 to 51 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; few very fine faint pale yellow (2.5Y 7/4) mottles; moderate fine and medium angular blocky structure; few very fine tubular pores; few roots along the face of slickensides; common pockets of gypsum crystals 1 to 5 millimeters across; few small slickensides;

slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—51 to 59 inches; grayish brown (2.5Y 5/2), weathered, clayey shale, dark grayish brown (2.5Y 4/2) moist; few very fine pale yellow (2.5Y 7/4) mottles; massive when moist, vertical and horizontal fractures occur when dry; thin layer of gypsum crystals at a depth of 52 inches; few thin dark brown coatings, few very fine dark brown filaments, and very few thin carbonate coatings on fracture faces; few weakly effervescent fracture faces; noncalcareous matrix; clear smooth boundary.

C2—59 to 76 inches; about 50 percent weak red (10R 5/3) and 50 percent light brownish gray (2.5Y 6/2), weathered, clayey shale, weak red (10R 5/3) and light brownish gray (2.5Y 6/2) moist; massive; fractures to coarse angular blocky fragments; few brownish yellow (10YR 6/6) iron stains; few slickensides; few dark brown filaments on few fracture faces; few weakly effervescent fracture faces; noncalcareous matrix; moderately alkaline.

The thickness of the solum ranges from 30 to about 60 inches. The texture of the control section is clay loam, silty clay, or clay. The content of clay ranges from 35 to about 60 percent.

The A horizon is 4 to 9 inches thick. It is grayish brown, brown, or dark grayish brown. Limestone fragments cover 1 to 15 percent of the surface.

The Bw horizon is 6 to 10 inches thick. It is brown, grayish brown, light olive brown, or yellowish brown. The content of limestone fragments ranges, by volume, from a few to 30 percent. These fragments are mostly less than 3 inches across.

The Bk and Bky horizons are yellowish brown, grayish brown, pale brown, light olive brown, or strong brown. The content of soft masses of calcium carbonate ranges, by volume, from 3 to 15 percent. Some pedons do not have gypsum crystals.

The C horizon is gray, grayish brown, light brownish gray, brown, yellowish brown, olive yellow, and light olive brown. Interbedded strata of limestone 4 to 24 inches thick are in most pedons at varying depths.

Thurber Series

The Thurber series consists of very deep, moderately well drained, very slowly permeable soils on nearly level and very gently sloping uplands (fig. 17). These soils formed in calcareous ancient outwash and alluvial sediments. Slopes range from 0 to 3 percent. The soils are fine, montmorillonitic, thermic Typic Haplustalfs.

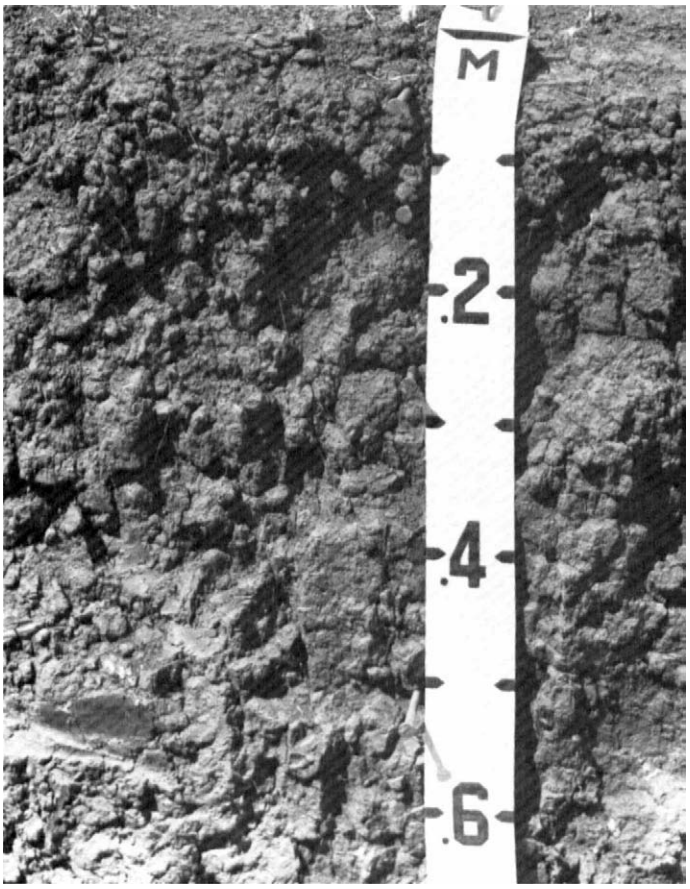

Figure 17.—Profile of a Thurber clay loam. Note the medium and coarse angular blocky structure, which contributes to the very slow permeability of these soils.

Typical pedon of Thurber clay loam, 1 to 3 percent slopes; from the intersection with U.S. Highway 180 in Breckenridge, 8.0 miles north on U.S. Highway 183, 1.4 miles west on county road, 80 feet south, in an area of rangeland:

A—0 to 4 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate thin and medium platy structure in the upper 2 inches, massive below; very hard, very firm; common fine roots and pores; few wormcasts; 1 to 3 percent siliceous pebbles as much as 1 inch across; mildly alkaline; clear smooth boundary.

Bt1—4 to 18 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse angular blocky structure; very hard, very firm; few very fine roots; common very fine pores; many distinct clay films on faces of

peds; 1 to 3 percent siliceous pebbles as much as 1 inch across; mildly alkaline; clear wavy boundary.

Bt2—18 to 38 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; strong fine and medium angular blocky structure; very hard, very firm; few very fine roots and pores; many distinct clay films on faces of peds; few very fine iron-manganese and calcium carbonate concretions; 1 to 3 percent siliceous pebbles as much as 1 inch in diameter; moderately alkaline; gradual wavy boundary.

Btk—38 to 50 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate fine and medium angular blocky structure; very hard, very firm; common distinct clay films on faces of peds; few very fine roots; few films and threads and very fine soft masses and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual wavy boundary.

BCk—50 to 62 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; weak fine angular blocky structure; hard, firm; 1 to 3 percent siliceous pebbles as much as 1 inch in diameter; few iron-manganese concretions; common films and threads and very fine soft masses of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to secondary carbonates ranges from 16 to 28 inches. The surface layer is hard and massive when dry.

The A horizon is 4 to 12 inches thick. It is brown, dark brown, dark grayish brown, or very dark grayish brown. Reaction is neutral or mildly alkaline.

The Bt horizon is dark grayish brown, dark brown, brown, or very dark grayish brown. Reaction is mildly alkaline in the upper part and moderately alkaline in the lower part.

The Btk horizon is brown, grayish brown, light brownish gray, yellowish brown, or dark yellowish brown. The content of calcium carbonate ranges, by volume, from a few concretions to about 10 percent.

The BCk and C horizons are brown, olive gray, pale brown, light brownish gray, light brown, or light yellowish brown. The texture is clay or clay loam.

Truce Series

The Truce series consists of well drained, slowly permeable soils on very gently sloping to hilly uplands. These soils are deep over weathered shale bedrock. Slopes range from 1 to 20 percent. The soils are fine, mixed, thermic Udic Paleustalfs.

The Truce soils in Stephens County are taxadjuncts because they are drier than is defined as the range for the series.

Typical pedon of Truce fine sandy loam, 1 to 3 percent slopes; from the intersection with U.S. Highway 180 in Breckenridge, 11.4 miles northwest on U.S. Highway 183, 1.0 mile west on Snake Den Road, 0.2 mile west on ranch road to cattleguard, 0.5 mile northwest on ranch road, 50 feet west, in an area of rangeland:

A—0 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; slightly hard, friable; common fine roots; few pores; neutral; abrupt smooth boundary.

Bt1—10 to 22 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots and pores; few distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—22 to 38 inches; strong brown (7.5YR 5/6) clay, strong brown (7.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, very firm; few sandstone pebbles; few fine rounded black concretions; few distinct clay films on faces of peds; neutral; gradual wavy boundary.

BC—38 to 44 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; very hard, very firm; moderate fine and medium subangular blocky structure; pores filled with brownish loamy material from the surface; few weakly cemented iron-manganese concretions; few distinct clay films on faces of peds; mildly alkaline; abrupt wavy boundary.

C—44 to 60 inches; reddish brown (5YR 5/4), weathered, clayey shale, dark reddish brown (5YR 4/4) moist; massive; hard, firm; common soft masses and concretions of calcium carbonate; slightly effervescent; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The content of sandstone fragments ranges, by volume, from 0 to 25 percent in the A horizon. The fragments range in size from less than 1 inch to 24 inches across. Some pedons have stones and boulders on the surface.

The A horizon is 2 to 10 inches thick. It is brown, pale brown, light brown, yellowish brown, or dark grayish brown. Reaction is slightly acid or neutral. The E horizon, if it occurs, is 1 to 7 inches thick. It has value one or two units lighter than that in the A horizon.

The upper part of the Bt horizon is reddish brown or yellowish red. The lower part is reddish brown, reddish

yellow, yellowish red, yellowish brown, brown, dark brown, or strong brown. In some pedons this horizon has few or common mottles of brown, grayish brown, reddish brown, or yellowish brown. The texture is clay, sandy clay, or clay loam. The content of clay ranges from 35 to about 50 percent. Reaction ranges from slightly acid to moderately alkaline. In some pedons secondary carbonates are below a depth of 30 inches.

The C horizon is weathered, clayey shale or soft, partially weathered shale. It has colors in shades of olive, yellow, brown, and gray. Reaction ranges from neutral to moderately alkaline. In some pedons carbonates are in the fractures in the upper few inches of this horizon.

Wichita Series

The Wichita series consists of very deep, well drained, moderately slowly permeable soils on nearly level and very gently sloping upland terraces. These soils formed in calcareous, loamy alluvial materials. Slopes range from 0 to 3 percent. The soils are fine, mixed, thermic Typic Paleustalfs.

Typical pedon of Wichita clay loam, 1 to 3 percent slopes; from the intersection with U.S. Highway 183 in Breckenridge, 10.1 miles west on U.S. Highway 180, 0.2 mile north on paved road to boat ramp, 50 feet west, in a field:

Ap—0 to 5 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak thin platy structure parting to weak fine granular; hard, friable; common fine roots and pores; few wormcasts; 1 to 3 percent siliceous pebbles; mildly alkaline; abrupt smooth boundary.

A—5 to 8 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak medium granular structure; hard, friable; common fine roots and pores; few wormcasts; 1 to 3 percent siliceous pebbles; mildly alkaline; clear smooth boundary.

Bt1—8 to 24 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; common fine pores; few wormcasts; common distinct clay films on faces of peds; few very fine calcium carbonate concretions; 1 to 3 percent siliceous pebbles; slightly effervescent below a depth of 12 inches; moderately alkaline; gradual smooth boundary.

Bt2—24 to 40 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, firm; few very fine roots; common thin clay films on faces of peds; common calcium carbonate concretions and few threads and films of calcium carbonate near concretions; 1 to 3 percent siliceous pebbles; slightly effervescent; moderately alkaline; gradual smooth boundary.

Btk—40 to 66 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak medium angular and subangular blocky structure; slightly hard, firm; common very fine pores; few dark stains between root channels; few thin clay films on faces of peds; about 15 percent films, threads, soft masses, and concretions of calcium carbonate; 1 to 3 percent siliceous pebbles; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk—66 to 76 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; very hard, firm; common fine pores; common films and threads and medium to very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Secondary carbonates are within a depth of 28 inches. The depth to a calcic horizon ranges from 40 to 60 inches.

The A horizon is 5 to 10 inches thick. It is reddish brown, brown, or dark brown. Reaction is neutral or mildly alkaline.

The upper part of the Bt horizon is 8 to 16 inches thick, and the lower part is 10 to 24 inches thick. The Bt horizon is reddish brown or yellowish red. The texture is clay or clay loam. The content of clay ranges from 35 to 45 percent.

The Btk horizon is 8 to 26 inches thick. It is reddish brown, reddish yellow, strong brown, brown, or yellowish red. The content of calcium carbonate ranges from 5 to 20 percent.

The C horizon, if it occurs, has colors in shades of red. The texture is clay loam, clay, or silty clay. In some pedons this horizon has strata of loam or fine sandy loam. The content of carbonates ranges from less than 1 percent to about 5 percent.

Formation of the Soils

Soil is a natural, three-dimensional body on the earth's surface that supports plants and has specific properties. Soil properties result from the integrated effect of climate and living matter acting on parent material, as conditioned by relief over periods of time.

The interaction of five main factors results in differences among the soils. These factors are the physical and chemical composition of the parent material, the climate under which the soil material has accumulated and has existed since accumulation, the plant and animal life on and in the soil, the relief of the land and its effect on runoff, and the length of time the soils have had to form. The effect of a factor can differ from place to place. It is the interaction of all the factors that determines the kind of soil that forms.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The soils in Stephens County formed in parent material of the Pennsylvanian, Permian, Cretaceous, and Quaternary periods. The Quaternary period is represented by Pleistocene and Recent deposits. All of the formations lie in a northeast to southwest direction, except for the Recent and Pleistocene deposits, which parallel the Clear Fork of the Brazos River.

Materials of the Permian period influenced the soils in the western one-third of the county. They represent the eastern exposure of the Permian period and the western flank of the Bend arch. The dominant sediment is gray or red shale that contains limestone and sandstone in varying amounts.

The Moran and Pueblo Formations occur in the county from west to east. They formed during the Permian period. They consist of sandstone, limestone, and shale in varying thicknesses. Bluegrove, Exray, and Bonti soils formed over sandstone; Palopinto, Hensley, and Rowden soils formed over limestone; and Owens, Throck, and Thurber soils formed over shale.

Parent material of the Pennsylvanian period in Stephens County is composed of sandstone, limestone, and shale in varying thicknesses. From west to east in the county are the Harpersville, Thrifty, and Graham Formations of the Cisco Group; the Home Creek Limestone, Colony Creek Shale, Ranger Limestone, Placid Shale, Winchell Limestone, and Wolf Mountain Shale of the Canyon Group; and the Palo Pinto and Mineral Wells Formations of the Strawn Group. Exray, Bonti, and Bluegrove soils formed over sandstone; Palopinto, Hensley, and Rowden soils formed over limestone; and Truce, Owens, Throck, and Set soils formed over shale.

Basal sands of the Cretaceous era are in the southeastern part of the county. They occur as a sandy mantle over materials of the Pennsylvanian period. Thick beds of siliceous conglomerate are evident in places. Chaney, Nimrod, and Thurber soils are examples of soils that formed in these materials.

Quaternary terrace deposits occur near the Clear Fork of the Brazos River. The dominant soils in this area are Minwells and Wichita soils. These soils are characterized by beds of siliceous gravel at varying depths below the surface.

Recent deposits are on flood plains along streams. Gageby and Frio soils are on the flood plains along Hubbard Creek, and Clairemont and Clearfork soils are on the flood plains along the Clear Fork of the Brazos River.

Climate

The subtropical climate of Stephens County has had a definite effect on soil formation. Rainfall, evaporation, temperature, and wind are some of the influencing factors. The rainfall has not been great enough to leach the minerals from the soils. As a result, most of the soils have a layer that has an accumulation of calcium carbonate. Deep soils are seldom wet below the root zone. The climate in Stephens County is fairly uniform. The average annual rainfall at Breckenridge is 26 inches. Most of the rainfall occurs during the growing season.

Stephens County has mild winters and hot summers,

which contribute to the continuous decomposition of residue from plants and animals by micro-organisms.

Living Organisms

Plants, animals, insects, and micro-organisms are important factors in the formation of soils. Living organisms affect gains or losses in organic matter content and plant nutrients. Physical properties of the soil, such as structure and porosity, also are affected by living organisms.

The amount and kind of vegetation in Stephens County has had an influence on soil development. Decaying leaves, roots, and stems add organic matter to the soil. The network of channels resulting from the decomposition of roots improves soil porosity.

Organic matter is important to soil formation because it can retain large amounts of water and plant nutrients. It also affects the development of soil structure and improves porosity by causing the aggregation of soil particles into larger ones that have more airspace between them.

Insects, earthworms, and animals add organic material to the soil during their life cycles. Those that burrow into the soil mix soil particles and improve porosity.

Organic matter tends to accumulate in soils that have a high content of clay. Leeray soils are examples of clayey soils that have a relatively high content of organic matter. Chaney and Patilo soils are sandy soils that have a low content of organic matter. Alluvial soils that are flooded periodically have the highest content of organic matter in the county. These soils receive additional organic matter in the sediments deposited by floodwater. Bosque and Clearfork soils are examples.

Relief

Relief, or lay of the land, influences soil development through its effect on drainage, runoff, and the depth of water penetration. The relief of Stephens County ranges from nearly level to steep.

The degree of profile development and the depth to which it occurs depend on the amount of water and the depth of penetration of water, if other factors of soil formation are equal. Soils in nearly level areas absorb more water and generally have more distinctly and more deeply developed horizons than soils in the more sloping areas. Many of the soils on the steeper slopes erode almost as rapidly as they form.

Leeray soils are among the most deeply developed soils in the county. The nearly level Lindy and Rowden soils are of intermediate depth. The more sloping Cho and Hensley soils show shallow development, and the strongly sloping to steep Harpersville soils show the least development. The Harpersville soils have a surface layer that is underlain by weathered shale bedrock at a very shallow depth.

Time

A great length of time is required for the formation of soils that have distinct horizons. The difference in the length of time that parent materials have been in place is generally reflected in the degree of development of the soil profile.

The soils in Stephens County range from young to old. The younger soils show very little profile development, but the older soils have distinct soil horizons. Clairemont, Frio, and Clearfork soils are examples of young soils, and Throck and Cho soils are examples of older soils.

Some older soils are calcareous and have a prominent accumulation of calcium carbonate, or a calcic horizon, in the lower part of the solum. As the soils continue to age, the calcium carbonate is leached downward to the lower horizons and may become cemented, or indurated. Indurated horizons, or petrocalcic horizons, require a great length of time to develop, possibly millions of years. Cho soils have petrocalcic horizons.

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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.

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.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or caliche as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels, i.e., clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers

especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally,

material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments that are 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with

hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The

degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent

material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. 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 and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited in stream valleys by heavily loaded streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Breckenridge, 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*	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--	55.7	29.6	42.7	83	6	74	1.42	0.13	2.37	3	0.9
February-	60.6	34.4	47.5	86	12	96	1.24	.37	1.93	3	.9
March----	68.5	41.4	55.0	93	19	227	1.44	.39	2.28	3	.4
April----	78.6	52.5	65.6	96	32	468	2.82	1.10	4.25	5	.0
May------	84.8	60.0	72.4	101	40	694	3.70	1.86	5.30	6	.0
June-----	93.3	68.9	81.1	105	53	933	2.49	.78	3.89	4	.0
July-----	97.7	72.7	85.2	108	61	1,091	2.04	.50	3.26	3	.0
August---	97.1	70.9	84.0	107	57	1,054	1.65	.48	2.58	3	.0
September	89.6	63.7	76.7	103	45	801	3.21	.90	5.07	5	.0
October--	79.1	51.9	65.5	97	32	481	3.14	.58	5.10	4	.0
November-	66.2	40.4	53.3	87	21	155	1.73	.36	2.81	4	.2
December-	59.2	32.9	46.1	83	12	51	1.17	.26	1.88	3	.2
Yearly:											
Average	77.5	51.6	64.6	---	---	---	---	---	---	---	---
Extreme	---	---	---	109	6	---	---	---	---	---	---
Total--	---	---	---	---	---	6,125	26.05	18.96	32.86	46	2.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Breckenridge, 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----	Mar. 22	Apr. 1	Apr. 13
2 years in 10 later than----	Mar. 14	Mar. 26	Apr. 8
5 years in 10 later than----	Feb. 28	Mar. 14	Mar. 29
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 7	Nov. 1	Oct. 26
2 years in 10 earlier than--	Nov. 15	Nov. 7	Oct. 30
5 years in 10 earlier than--	Nov. 30	Nov. 17	Nov. 8

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Breckenridge, 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	247	220	204
8 years in 10	256	230	210
5 years in 10	275	247	222
2 years in 10	293	265	235
1 year in 10	303	274	241

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BaC	Bastrop loamy fine sand, 1 to 5 percent slopes	610	0.1
BfA	Bastrop fine sandy loam, 0 to 1 percent slopes	1,270	0.2
BfB	Bastrop fine sandy loam, 1 to 3 percent slopes	6,690	1.1
BgB	Bluegrove loam, 1 to 3 percent slopes	57,460	9.8
BmB	Bluegrove flaggy loam, gently sloping	7,010	1.2
BoC	Bonti fine sandy loam, 1 to 5 percent slopes	18,610	3.2
BrC	Bonti-Exray complex, gently undulating	48,860	8.3
BxE	Bonti-Exray-Truce complex, hilly, very stony	31,870	5.4
By	Bosque clay loam, occasionally flooded	4,060	0.7
CaB	Chaney loamy fine sand, 0 to 3 percent slopes	7,330	1.2
CeD	Chaney stony loamy fine sand, undulating	1,210	0.2
ChC	Cho loam, 0 to 5 percent slopes	1,120	0.2
Cm	Clairemont silty clay loam, occasionally flooded	2,190	0.4
Cn	Clairemont silty clay loam, channeled	3,130	0.5
Co	Clearfork silty clay loam, occasionally flooded	6,650	1.1
Fr	Frio silty clay, occasionally flooded	5,605	1.0
Fy	Frio silty clay, frequently flooded	1,170	0.2
Ga	Gageby clay loam, occasionally flooded	25,090	4.3
HaB	Heaton loamy fine sand, 0 to 3 percent slopes	210	*
HeB	Hensley loam, 1 to 3 percent slopes	2,020	0.3
HsB	Hensley loam, gently sloping, extremely stony	28,285	4.8
LeA	Leeray clay, 0 to 1 percent slopes	7,550	1.3
LeB	Leeray clay, 1 to 3 percent slopes	32,640	5.6
LnB	Lindy silt loam, 0 to 3 percent slopes	32,750	5.6
LsD	Lusk gravelly fine sandy loam, undulating	280	*
MfB	Minwells fine sandy loam, 1 to 3 percent slopes	6,230	1.1
NmB	Nimrod loamy fine sand, 1 to 3 percent slopes	590	0.1
Oa	Oil-waste land	1,700	0.3
OcC	Owens clay, 1 to 5 percent slopes	2,560	0.4
OxE	Owens-Harpersville complex, hilly, extremely stony	35,740	6.1
PaD	Palopinto very flaggy loam, undulating	29,460	5.0
PeE	Palopinto-Set complex, moderately steep, extremely stony	17,980	3.0
PoB	Patilo fine sand, 0 to 3 percent slopes	270	*
RdB	Rowden clay loam, 0 to 3 percent slopes	22,530	3.8
SeC	Set clay loam, 2 to 6 percent slopes	1,690	0.3
ThC	Throck clay, 1 to 5 percent slopes	19,720	3.3
TrA	Thurber clay loam, 0 to 1 percent slopes	10,325	1.8
TrB	Thurber clay loam, 1 to 3 percent slopes	54,645	9.3
TuB	Truce fine sandy loam, 1 to 3 percent slopes	23,040	3.9
TuC2	Truce fine sandy loam, 1 to 5 percent slopes, eroded	13,670	2.3
WcA	Wichita clay loam, 0 to 1 percent slopes	290	*
WcB	Wichita clay loam, 1 to 3 percent slopes	1,340	0.2
	Water areas more than 40 acres in size	14,367	2.4
	Total	589,817	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Grain sorghum	Cotton	Wheat	Improved bermudagrass
		Bu	Lbs	Bu	AUM*
BaC---------- Bastrop	IIIe	35	200	25	4.0
BfA, BfB---------- Bastrop	IIe	40	250	25	5.0
BgB---------- Bluegrove	IIIe	38	220	25	3.0
BmB---------- Bluegrove	VIs	---	---	---	---
BoC---------- Bonti	IIIe	30	---	20	3.5
BrC---------- Bonti-Exray	VIs	---	---	---	---
BxE---------- Bonti-Exray-Truce	VIIs	---	---	---	---
By---------- Bosque	IIw	55	450	30	6.5
CaB---------- Chaney	IIIe	30	---	20	6.0
CeD---------- Chaney	VIs	---	---	---	---
ChC---------- Cho	IVs	---	---	---	---
CM---------- Clairemont	IIw	40	350	30	6.0
Cn---------- Clairemont	Vw	---	---	---	6.0
Co---------- Clearfork	IIw	30	325	30	6.0
Fr---------- Frio	IIw	65	450	40	7.0
Fy---------- Frio	Vw	---	---	---	7.0
Ga---------- Gageby	IIw	35	350	25	6.0
HaB---------- Heaton	IIIe	35	---	25	5.5
HeB---------- Hensley	IIIe	20	---	20	3.0

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Grain sorghum	Cotton	Wheat	Improved bermudagrass
		Bu	Lbs	Bu	AUM*
HsB---- Hensley	VIs	---	---	---	---
LeA---- Leeray	IIIs	50	300	25	4.0
LeB---- Leeray	IIIe	40	250	25	4.0
LnB---- Lindy	IIIe	45	250	25	4.0
LsD---- Lusk	VIs	---	---	---	---
MfB---- Minwells	IIe	25	---	15	4.5
NmB---- Nimrod	IIIe	35	---	25	6.0
Oa**---- Oil-waste land	VIIIs	---	---	---	---
OcC---- Owens	IVe	---	---	10	1.5
OxE---- Owens-Harpersville	VIIs	---	---	---	---
PaD---- Palopinto	VIs	---	---	---	---
PeE---- Palopinto-Set	VIIs	---	---	---	---
PoB---- Patilo	IIIs	---	---	---	4.5
RdB---- Rowden	IIIe	40	250	25	4.0
SeC---- Set	IIIe	30	---	20	3.5
ThC---- Throck	IVe	25	150	15	3.0
TrA---- Thurber	IIIs	30	225	25	3.5
TrB---- Thurber	IIIe	30	200	20	3.5
TuB---- Truce	IIIe	35	---	20	3.0
TuC2---- Truce	IVe	15	---	10	3.0

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Grain sorghum	Cotton	Wheat	Improved bermudagrass
		Bu	Lbs	Bu	AUM*
WcA---------- Wichita	IIc	35	250	30	4.0
WcB---------- Wichita	IIe	30	225	25	4.0

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
BaC---------- Bastrop	Loamy Sand----------	5,500	4,500	3,000
BfA, BfB---------- Bastrop	Sandy Loam----------	5,000	4,000	3,000
BgB---------- Bluegrove	Tight Sandy Loam----------	4,000	3,200	2,500
BmB---------- Bluegrove	Sandstone Hill----------	4,000	3,200	2,500
BoC---------- Bonti	Sandy Loam----------	5,500	3,500	3,000
BrC*:				
Bonti----------	Sandy Loam----------	5,000	3,500	2,500
Exray----------	Sandy Loam----------	5,000	3,500	2,500
BxE*:				
Bonti----------	Sandstone Hill----------	5,000	3,000	2,000
Exray----------	Sandstone Hill----------	5,000	3,000	2,500
Truce----------	Sandstone Hill----------	4,000	3,000	2,500
By---------- Bosque	Loamy Bottomland----------	6,000	4,500	3,500
CaB, CeD---------- Chaney	Loamy Sand----------	4,500	4,000	3,000
ChC---------- Cho	Very Shallow----------	2,500	2,000	1,000
Cm, Cn---------- Clairemont	Loamy Bottomland----------	5,000	3,500	2,200
Co---------- Clearfork	Loamy Bottomland----------	6,000	3,500	2,500
Fr, Fy---------- Frio	Loamy Bottomland----------	5,500	4,000	3,000
Ga---------- Gageby	Loamy Bottomland----------	6,000	4,500	3,000
HaB---------- Heaton	Sandy----------	4,500	3,500	2,000
HeB, HsB---------- Hensley	Redland----------	4,500	3,500	2,500
LeA, LeB---------- Leeray	Clayey Upland----------	4,500	3,500	2,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
LnB Lindy	Deep Redland	6,000	5,000	4,000
LsD Lusk	Sandy Loam	3,500	2,800	2,000
MfB Minwells	Sandy Loam	4,000	3,000	2,400
NmB Nimrod	Sandy	4,500	3,500	2,000
OcC Owens	Shallow Clay	3,800	2,000	1,500
OxE*:				
Owens	Rocky Hill	1,700	1,200	900
Harpersville	Shaly Hill	1,600	1,200	800
PaD Palopinto	Low Stony Hill	3,500	3,000	1,000
PeE*:				
Palopinto	Steep Rocky	3,000	2,500	1,000
Set	Clay Loam Slopes	4,000	3,000	2,000
PoB Patilo	Deep Sand	3,000	2,000	1,000
RdB Rowden	Clay Loam	4,500	3,500	2,500
SeC Set	Clay Slopes	4,500	3,500	2,500
ThC Throck	Clay Slopes	3,500	2,500	1,400
TrA, TrB Thurber	Claypan Prairie	3,500	3,000	2,000
TuB, TuC2 Truce	Tight Sandy Loam	4,000	3,000	2,000
WcA, WcB Wichita	Clay Loam	3,000	2,300	1,700

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BaC, BfA, BfB Bastrop	Slight	Slight	Moderate: slope.	Slight	Slight.
BgB Bluegrove	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
BmB Bluegrove	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Slight	Moderate: large stones, depth to rock.
BoC Bonti	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
BrC*: Bonti	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Slight	Moderate: large stones.
Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
BxE*: Bonti	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Slight	Moderate: slope, large stones.
Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
Truce	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
By Bosque	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
CaB Chaney	Slight	Slight	Slight	Slight	Slight.
CeD Chaney	Slight	Slight	Moderate: large stones, slope, small stones.	Slight	Moderate: large stones.
ChC Cho	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: cemented pan.
Cm Clairemont	Severe: flooding.	Slight	Moderate: flooding.	Severe: erodes easily.	Moderate: flooding.
Cn Clairemont	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Severe: erodes easily.	Severe: flooding.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Co Clearfork	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Fr Frio	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.	Severe: too clayey.
Fy Frio	Severe: flooding.	Moderate: flooding, too clayey.	Severe: flooding.	Moderate: too clayey, flooding.	Severe: flooding, too clayey.
Ga Gageby	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
HaB Heaton	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
HeB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
HsB Hensley	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, depth to rock.
LeA Leeray	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
LeB Leeray	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
LnB Lindy	Slight	Slight	Slight	Slight	Moderate: depth to rock.
LsD Lusk	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
MfB Minwells	Slight	Slight	Moderate: slope.	Slight	Slight.
NmB Nimrod	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, too sandy, wetness.	Moderate: too sandy.	Moderate: droughty.
Oa* Oil-waste land	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt.
OcC Owens	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
OxE*: Owens	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope, too clayey.	Severe: large stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OxE*:					
Harpersville	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: large stones, slope, percs slowly.	Severe: slope.	Severe: large stones, droughty, slope.
PaD	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Slight	Severe: depth to rock.
PeE*:					
Palopinto	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
Set	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: large stones, slope.
PoB	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
RdB	Slight	Slight	Slight	Slight	Moderate: depth to rock.
SeC	Slight	Slight	Moderate: slope.	Slight	Slight.
ThC	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
TrA	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
TrB	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
TuB, TuC2	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
WcA	Slight	Slight	Slight	Slight	Slight.
WcB	Slight	Slight	Moderate: slope.	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
BaC---------- Bastrop	Fair	Good	Good	Good	Good	Good.
BfA, BfB---------- Bastrop	Good	Good	Good	Good	Good	Good.
BgB---------- Bluegrove	Fair	Good	Good	Fair	Good	Fair.
BmB---------- Bluegrove	Poor	Poor	Good	Fair	Poor	Fair.
BoC---------- Bonti	Fair	Good	Good	Good	Good	Good.
BrC*:						
Bonti----------	Poor	Poor	Good	Good	Fair	Good.
Exray----------	Poor	Poor	Fair	Fair	Poor	Fair.
BxE*:						
Bonti----------	Very poor	Very poor	Good	Good	Poor	Good.
Exray----------	Very poor	Very poor	Fair	Fair	Poor	Fair.
Truce----------	Very poor	Very poor	Good	Good	Poor	Good.
By---------- Bosque	Good	Good	Good	Good	Good	Good.
CaB---------- Chaney	Fair	Good	Good	Good	Good	Good.
CeD---------- Chaney	Poor	Poor	Good	Good	Fair	Good.
ChC---------- Cho	Fair	Poor	Poor	Poor	Poor	Poor.
Cm---------- Clairemont	Good	Good	Fair	Good	Good	Fair.
Cn---------- Clairemont	Very poor	Poor	Fair	Good	Poor	Fair.
Co---------- Clearfork	Poor	Fair	Poor	Fair	Poor	Poor.
Fr---------- Frio	Good	Good	Fair	Good	Good	Fair.
Fy---------- Frio	Very poor	Poor	Fair	Good	Poor	Fair.
Ga---------- Gageby	Good	Good	Good	Good	Good	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
HaB---- Heaton	Fair	Good	Good	Good	Good	Good.
HeB, HsB---- Hensley	Poor	Poor	Fair	Fair	Poor	Fair.
LeA, LeB---- Leeray	Fair	Fair	Fair	Fair	Fair	Fair.
LnB---- Lindy	Fair	Good	Good	Good	Good	Good.
LsD---- Lusk	Poor	Poor	Fair	Fair	Poor	Fair.
MfB---- Minwells	Good	Good	Good	Good	Good	Good.
NmB---- Nimrod	Fair	Good	Good	Good	Good	Good.
Oa*---- Oil-waste land	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
OcC---- Owens	Fair	Fair	Fair	Poor	Fair	Poor.
OxE*:						
Owens----	Very poor	Very poor	Fair	Fair	Very poor	Poor.
Harpersville----	Very poor	Very poor	Fair	Fair	Very poor	Poor.
PaD---- Palopinto	Poor	Poor	Fair	Fair	Fair	Fair.
PeE*:						
Palopinto----	Very poor	Very poor	Fair	Fair	Poor	Fair.
Set----	Very poor	Poor	Fair	Fair	Poor	Fair.
PoB---- Patilo	Fair	Good	Fair	Fair	Fair	Fair.
RdB---- Rowden	Fair	Good	Good	Good	Good	Good.
SeC---- Set	Fair	Good	Fair	Fair	Fair	Fair.
ThC---- Throck	Fair	Good	Fair	Fair	Fair	Fair.
TrA, TrB---- Thurber	Fair	Fair	Fair	Fair	Fair	Fair.
TuB---- Truce	Good	Good	Good	Good	Good	Good.
TuC2---- Truce	Fair	Good	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
WcA, WcB---------- Wichita	Good	Good	Fair	Fair	Good	Fair.

* 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." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BaC, BfA, BfB----- Bastrop	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
BgB---------- Bluegrove	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: depth to rock.
BmB---------- Bluegrove	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones, depth to rock.
BoC---------- Bonti	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: depth to rock.
BrC*:						
Bonti----------	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: large stones.
Exray----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
BxE*:						
Bonti----------	Severe: depth to rock.	Moderate: depth to rock, slope, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, large stones.
Exray----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
Truce----------	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: large stones, droughty, slope.
By---------- Bosque	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
CaB---------- Chaney	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CeD---------- Chaney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.
ChC---------- Cho	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.

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	Lawns and landscaping
Cm Clairemont	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Cn Clairemont	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Co Clearfork	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Moderate: flooding.
Fr Frio	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: too clayey.
Fy Frio	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding, too clayey.
Ga Gageby	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
HaB Heaton	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
HeB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
HsB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: large stones, depth to rock.
LeA, LeB Leeray	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
LnB Lindy	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: depth to rock.
LsD Lusk	Moderate: depth to rock, too clayey.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight	Severe: small stones.
MfB Minwells	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
NmB Nimrod	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Oa* Oil-waste land	Variable	Variable	Variable	Variable	Variable	Severe: excess salt.
OcC Owens	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.

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	Lawns and landscaping
OxE*:						
Owens	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope, low strength.	Severe: large stones, slope.
Harpersville	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: large stones, droughty, slope.
PaD Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, low strength.	Severe: depth to rock.
PeE*:						
Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, low strength.	Severe: large stones, depth to rock.
Set	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: large stones, slope.
PoB Patilo	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.
RdB Rowden	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: depth to rock.
SeC Set	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
ThC Throck	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
TrA, TrB Thurber	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
TuB, TuC2 Truce	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
WcA, WcB Wichita	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

* 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," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BaC, BfA, BfB Bastrop	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
BgB, BmB Bluegrove	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey.
BoC Bonti	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey.
BrC*: Bonti	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, thin layer.
Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, large stones.
BxE*: Bonti	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, thin layer.
Exray	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, large stones.
Truce	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
By Bosque	Severe: flooding.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, thin layer.
CaB Chaney	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CeD Chaney	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
ChC Cho	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan, small stones.

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
Cm, Cn Clairemont	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Co Clearfork	Severe: flooding, percs slowly.	Slight	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey.
Fr, Fy Frio	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
Ga Gageby	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HaB Heaton	Slight	Severe: seepage.	Slight	Severe: seepage.	Good.
HeB, HsB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
LeA Leeray	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LeB Leeray	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LnB Lindy	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
LsD Lusk	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, small stones.
MfB Minwells	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
NmB Nimrod	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
Oa* Oil-waste land	Variable	Variable	Severe: excess salt.	Variable	Severe: excess salt.
OcC Owens	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
OxE*: Owens	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, hard to pack.

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
OxE*:					
Harpersville	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
PaD	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, hard to pack, large stones.
PeE*:					
Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, hard to pack, large stones.
Set	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
PoB	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RdB	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
SeC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
ThC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
TrA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
TrB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
TuB, TuC2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
WcA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
WcB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

* 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 other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BaC, BfA, BfB Bastrop	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
BgB, BmB Bluegrove	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BoC Bonti	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BrC*: Bonti	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Exray	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
BxE*: Bonti	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Exray	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Truce	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
By Bosque	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CaB Chaney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CeD Chaney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones.
ChC Cho	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, small stones, area reclaim.
Cm, Cn Clairemont	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Co Clearfork	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Fr, Fy Frio	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ga Gageby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
HaB Heaton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
HeB, HsB Hensley	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
LeA, LeB Leeray	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LnB Lindy	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LsD Lusk	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
MfB Minwells	Good	Probable	Probable	Poor: too clayey.
NmB Nimrod	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Oa* Oil-waste land	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
OcC Owens	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
OxE*: Owens	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, too clayey.
Harpersville	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, slope.
PaD Palopinto	Poor: depth to rock, low strength, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.
PeE*: Palopinto	Poor: depth to rock, low strength, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PeE*: Set	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, slope.
PoB Patilo	Good	Probable	Improbable: too sandy.	Poor: too sandy.
RdB Rowden	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SeC Set	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ThC Throck	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TrA, TrB Thurber	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TuB, TuC2 Truce	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WcA, WcB Wichita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* 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." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
BaC---------- Bastrop	Moderate: seepage.	Moderate: piping.	Fast intake, soil blowing, slope.	Soil blowing-----	Favorable.
BfA, BfB---------- Bastrop	Moderate: seepage.	Moderate: piping.	Soil blowing-----	Erodes easily, soil blowing.	Erodes easily.
BgB---------- Bluegrove	Moderate: depth to rock.	Severe: thin layer.	Soil blowing, depth to rock.	Depth to rock----	Depth to rock.
BmB---------- Bluegrove	Moderate: depth to rock, slope.	Severe: thin layer.	Depth to rock, slope.	Depth to rock----	Depth to rock.
BoC---------- Bonti	Moderate: depth to rock.	Severe: thin layer.	Slope, soil blowing.	Depth to rock, erodes easily, soil blowing.	Erodes easily, depth to rock.
BrC*:					
Bonti----------	Moderate: depth to rock, slope.	Moderate: thin layer.	Depth to rock, slope.	Depth to rock----	Depth to rock.
Exray----------	Severe: depth to rock.	Severe: thin layer.	Depth to rock, slope.	Depth to rock----	Depth to rock.
BxE*:					
Bonti----------	Severe: slope.	Moderate: thin layer.	Depth to rock, slope.	Depth to rock, slope.	Slope, depth to rock.
Exray----------	Severe: depth to rock.	Severe: thin layer.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Truce----------	Severe: slope.	Moderate: hard to pack.	Slope, droughty, percs slowly.	Slope, percs slowly.	Slope, droughty.
By---------- Bosque	Moderate: seepage.	Severe: piping.	Flooding---------	Favorable--------	Favorable.
CaB---------- Chaney	Slight----------	Severe: hard to pack.	Fast intake, soil blowing.	Soil blowing, percs slowly.	Percs slowly.
CeD---------- Chaney	Slight----------	Severe: hard to pack.	Slope, droughty, fast intake.	Large stones, percs slowly.	Large stones, droughty, percs slowly.
ChC---------- Cho	Severe: cemented pan.	Severe: thin layer.	Cemented pan, droughty.	Cemented pan-----	Droughty, cemented pan.
Cm, Cn---------- Clairemont	Moderate: seepage.	Severe: piping.	Erodes easily, flooding.	Erodes easily----	Erodes easily.

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	Irrigation	Terraces and diversions	Grassed waterways
Co Clearfork	Slight	Slight	Flooding	Favorable	Favorable.
Fr, Fy Frio	Slight	Moderate: hard to pack.	Slow intake, flooding.	Favorable	Favorable.
Ga Gageby	Moderate: seepage.	Moderate: piping.	Flooding	Favorable	Favorable.
HaB Heaton	Severe: seepage.	Moderate: piping.	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
HeB Hensley	Severe: depth to rock.	Severe: thin layer.	Percs slowly, depth to rock.	Depth to rock, erodes easily, percs slowly.	Erodes easily, depth to rock, percs slowly.
HsB Hensley	Severe: depth to rock.	Severe: thin layer.	Slope, droughty, percs slowly.	Large stones, depth to rock, erodes easily.	Large stones, erodes easily, droughty.
LeA, LeB Leeray	Slight	Severe: hard to pack.	Slow intake, percs slowly.	Percs slowly	Percs slowly.
LnB Lindy	Moderate: depth to rock.	Severe: thin layer.	Percs slowly	Depth to rock, percs slowly.	Depth to rock, percs slowly.
LsD Lusk	Severe: seepage.	Severe: thin layer.	Slope, droughty, percs slowly.	Depth to rock, percs slowly.	Droughty, depth to rock, percs slowly.
MfB Minwells	Severe: seepage.	Moderate: thin layer, piping.	Soil blowing, percs slowly.	Soil blowing, percs slowly.	Percs slowly.
NmB Nimrod	Severe: seepage.	Moderate: piping, wetness.	Wetness, droughty, fast intake.	Wetness, soil blowing.	Droughty.
Oa* Oil-waste land	Variable	Severe: excess salt.	Slope, excess salt.	Variable	Excess salt.
OcC Owens	Slight	Moderate: hard to pack.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
OxE*: Owens	Slight	Moderate: hard to pack.	Slope, droughty, slow intake.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
Harpersville	Severe: slope.	Moderate: hard to pack, large stones.	Slope, droughty, slow intake.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
PaD Palopinto	Severe: depth to rock.	Severe: large stones.	Large stones, depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
PeE*:					
Palopinto	Severe: depth to rock.	Severe: large stones.	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Set	Slight	Moderate: hard to pack, large stones.	Slow intake, percs slowly, slope.	Slope, large stones, percs slowly.	Large stones, slope, percs slowly.
PoB	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Patilo					
RdB	Moderate: depth to rock.	Severe: thin layer.	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Rowden					
SeC	Slight	Moderate: hard to pack.	Slope, percs slowly.	Percs slowly	Percs slowly.
Set					
ThC	Moderate: slope.	Slight	Slow intake, percs slowly, slope.	Percs slowly	Rooting depth, percs slowly.
Throck					
TrA, TrB	Slight	Severe: hard to pack.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Thurber					
TuB	Slight	Moderate: hard to pack.	Droughty, soil blowing, percs slowly.	Percs slowly, soil blowing, erodes easily.	Percs slowly, droughty, erodes easily.
Truce					
TuC2	Slight	Moderate: hard to pack.	Slope, droughty, soil blowing.	Percs slowly, soil blowing, erodes easily.	Percs slowly, droughty, erodes easily.
Truce					
WcA, WcB	Slight	Slight	Favorable	Favorable	Favorable.
Wichita					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
BaC---------- Bastrop	0-18	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	96-100	96-100	75-95	20-50	<20	NP-4
	18-64	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	96-100	96-100	75-100	40-70	26-40	11-22
	64-80	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0	96-100	75-100	65-100	40-70	26-40	11-22
BfA, BfB---------- Bastrop	0-5	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	96-100	96-100	80-100	40-65	18-25	2-7
	5-66	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	96-100	96-100	75-100	40-70	26-40	11-22
	66-80	Loam, sandy clay loam, clay loam, fine sandy loam, very gravelly sandy clay loam.	CL, SC, GC	A-6, A-2-6	0	55-100	50-100	45-100	30-70	26-40	11-22
BgB---------- Bluegrove	0-5	Loam----------	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	98-100	90-100	45-75	18-30	4-14
	5-27	Clay loam, clay, sandy clay.	CL	A-6, A-7	0-5	95-100	95-100	90-100	51-80	28-50	11-30
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BmB---------- Bluegrove	0-4	Flaggy loam------	SM, ML, SC, CL	A-4, A-6	5-15	80-100	80-100	70-98	45-75	<30	NP-14
	4-21	Sandy clay, clay loam, clay.	CL	A-6, A-7	0-5	95-100	95-100	90-100	51-80	28-50	11-30
	21-48	Weathered bedrock	---	---	---	---	---	---	---	---	---
BoC---------- Bonti	0-10	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-2	90-100	90-100	70-100	25-70	<30	NP-10
	10-27	Clay, clay loam, sandy clay.	CL, SC	A-6, A-7	0-4	80-100	80-100	70-100	41-75	30-45	15-25
	27-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
BrC*:											
Bonti----------	0-8	Stony fine sandy loam.	SM, SM-SC, ML, CL-ML	A-2-4, A-4	5-15	80-100	80-100	70-98	25-70	18-30	2-7
	8-24	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-15	80-100	80-100	75-100	55-75	30-45	18-25
	24-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
Exray----------	0-8	Stony fine sandy loam.	SM-SC, SC	A-2-4, A-4	5-23	85-100	80-100	55-80	30-50	20-30	5-10
	8-16	Clay, sandy clay, clay loam.	CL, SC	A-6, A-7	0-5	85-100	80-100	80-100	48-80	30-45	15-25
	16-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
BxE*:											
Bonti----------	0-5	Stony fine sandy loam.	SM, SM-SC, ML, CL-ML	A-2-4, A-4	5-15	80-100	80-100	70-98	25-70	18-30	2-7
	5-36	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-15	80-100	80-100	75-100	55-75	30-45	18-25
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BxE*:											
Exray	0-5	Stony fine sandy loam.	SM-SC, SC	A-2-4, A-4	5-23	85-100	80-100	55-80	30-50	20-30	5-10
	5-18	Clay, sandy clay, clay loam.	CL, SC	A-6, A-7	0-5	85-100	80-100	80-100	48-80	30-45	15-25
	18-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
Truce	0-4	Stony fine sandy loam.	SC, CL-ML, SM, SM-SC	A-4	5-15	75-100	75-100	70-100	36-70	20-30	3-10
	4-42	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0-5	80-100	75-100	75-100	55-85	35-52	18-32
	42-60	Clay, shale------	CL, CH	A-6, A-7-6	0-5	80-100	75-100	75-100	60-95	30-52	15-32
By	0-22	Clay loam--------	CL, CL-ML	A-4, A-6, A-7-6	0	100	96-100	80-100	56-85	23-45	7-25
Bosque	22-43	Loam, clay loam	CL, CL-ML	A-6, A-7-6, A-4	0	100	95-100	95-100	56-85	23-45	7-25
	43-60	Loam, clay loam, clay.	CL, CL-ML	A-4, A-6, A-7-6	0	98-100	95-100	80-100	65-94	23-49	7-29
CaB	0-9	Loamy fine sand	SM, SP-SM	A-2-4, A-4, A-3	0	80-100	80-100	65-98	7-45	<25	NP-4
Chaney	9-40	Clay, sandy clay	CL, CH, SC	A-6, A-7-6	0	90-100	90-100	90-100	43-85	39-60	24-42
	40-52	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2	0	90-100	90-100	80-100	30-70	25-55	11-40
	52-66	Clay, sandy clay loam, sandy clay.	CL, CH, SC, SM-SC	A-6, A-7-6, A-2, A-4	0	90-100	90-100	80-100	25-85	25-60	6-40
CeD	0-7	Stony loamy fine sand.	SM, SM-SC, SP-SM	A-2-4, A-4, A-3	5-25	80-100	80-100	65-98	7-45	<25	NP-4
Chaney	7-36	Clay, sandy clay	CL, CH	A-7	0-15	90-100	90-100	90-100	51-85	42-60	24-42
	36-52	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2-6, A-2-7	0	90-100	90-100	80-100	30-70	25-55	11-40
	52-60	Clay, sandy clay loam, sandy clay.	CL, CH, SC, SM-SC	A-2-4, A-2-6, A-6, A-7	0	90-100	90-100	80-100	25-85	25-60	6-40
ChC	0-10	Loam----------	CL, CH	A-6, A-7-6	0-3	80-100	80-100	65-96	55-84	35-55	15-30
Cho	10-17	Cemented---------	---	---	---	---	---	---	---	---	---
	17-34	Gravelly loam, gravelly clay loam, very gravelly loam.	SC, GC, GM-GC, SM-SC	A-2, A-4, A-6, A-7-6	0-5	50-85	35-80	20-60	15-60	24-47	5-22
	34-60	Clay, shale------	CL, CH	A-7-6	0-5	90-100	85-100	80-100	65-95	45-60	25-37
Cm, Cn	0-6	Silty clay loam	CL	A-4, A-6	0	100	98-100	95-100	80-95	25-40	8-20
Clairemont	6-65	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	65-95	20-40	4-20
Co	0-28	Silty clay loam	CL	A-6, A-7-6	0	100	100	98-100	85-100	35-50	20-32
Clearfork	28-83	Silty clay loam, silty clay.	CL	A-6, A-7-6	0	100	100	95-100	85-100	35-50	20-32

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
Fr	0-25	Silty clay	CL, CH	A-6, A-7	0-2	90-100	85-100	85-100	69-100	36-59	17-34
Frio	25-52	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0-2	90-100	85-100	85-100	69-100	36-59	17-34
	52-74	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0-5	90-100	90-100	85-100	68-100	36-59	17-34
Fy	0-38	Silty clay	CL, CH	A-6, A-7	0-2	90-100	85-100	85-100	69-100	36-59	17-34
Frio	38-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0-2	90-100	85-100	85-100	69-100	36-59	17-34
	60-70	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0-5	90-100	90-100	85-100	68-100	36-59	17-34
Ga	0-22	Clay loam	CL	A-6	0	100	98-100	90-100	55-85	23-40	11-25
Gageby	22-42	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0	95-100	92-100	90-100	45-80	23-40	11-25
	42-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0	95-100	75-100	70-100	45-85	23-40	11-25
HaB	0-23	Loamy fine sand	SM	A-2-4	0	95-100	95-100	70-90	15-30	<25	NP-3
Heaton	23-42	Sandy clay loam	SC, CL	A-4, A-6	0	98-100	95-100	75-95	36-65	20-35	8-22
	42-80	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	95-100	75-98	36-65	20-35	8-22
HeB	0-4	Loam	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-85	20-35	5-16
Hensley	4-14	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-90	35-55	18-35
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HsB	0-4	Extremely stony loam.	CL, CL-ML	A-4, A-6	30-64	80-100	75-100	70-100	60-90	20-40	5-20
Hensley	4-16	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	65-95	35-55	18-35
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LeA, LeB	0-17	Clay	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	25-40
Leeray	17-74	Clay, silty clay	CH	A-7-6	0-5	95-100	95-100	85-100	75-95	51-70	30-45
	74-80	Clay, silty clay	CH, CL	A-7-6, A-6	0-5	95-100	95-100	85-100	70-95	33-60	19-40
LnB	0-5	Silt loam	CL, CL-ML	A-4, A-6	0-3	95-100	90-100	80-100	65-90	20-40	5-20
Lindy	5-24	Clay loam, clay	CL, CH	A-6, A-7	0-3	95-100	95-100	90-100	65-90	35-60	15-35
	24-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LsD	0-6	Gravelly fine sandy loam.	SC, SM-SC	A-2-4, A-2-6, A-1-b	0-5	65-95	40-70	30-60	15-35	20-33	4-15
Lusk	6-35	Very gravelly clay, extremely gravelly clay loam, very gravelly sandy clay.	GC, GP-GC	A-2-7, A-7-6	0-5	25-60	15-40	15-40	12-40	41-60	20-32
	35-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
MfB---------- Minwells	0-7	Fine sandy loam	CL, CL-ML, SM-SC, SC	A-2, A-4, A-6	0	96-100	90-100	80-98	30-60	<30	NP-15
	7-50	Clay, clay loam, sandy clay.	CL	A-7-6, A-6	0	95-100	90-100	85-98	50-80	32-50	15-32
	50-60	Clay loam, sandy clay loam, gravelly sandy clay loam.	CL, SC	A-6, A-7-6, A-4	0	85-100	80-100	65-98	45-80	23-45	8-26
	60-76	Very gravelly sand, very gravelly sandy loam, gravelly sandy clay loam.	SC, GM, SP-SM, GP-GM	A-1, A-2	0-5	15-75	10-60	5-50	5-30	<44	NP-28
NmB---------- Nimrod	0-22	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	22-56	Sandy clay loam	CL, SC	A-2-6, A-6	0	95-100	95-100	90-100	25-55	22-30	11-16
	56-70	Sandy clay, sandy clay loam.	CL, SC, SM-SC	A-4, A-6, A-2-6, A-2-4, A-7-6	0	95-100	95-100	90-100	15-55	22-42	5-20
Oa*---------- Oil-waste land	0-80	Variable---------	---	---	---	---	---	---	---	---	---
OcC---------- Owens	0-5	Clay----------	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	5-20	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-33
	20-60	Clay, shale------	CL, CH	A-7-6	0-5	90-100	85-100	80-100	65-95	45-60	25-37
OxE*:											
Owens----------	0-5	Very stony clay	CL, CH	A-7-6	15-35	80-100	75-100	70-100	65-95	45-60	22-32
	5-30	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-10	80-100	80-100	80-100	75-95	45-60	22-33
	30-60	Clay, shale------	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	25-37
Harpersville----	0-7	Clay----------	CL, CH	A-7-6	35-50	80-100	75-100	70-100	65-95	45-60	22-32
	7-60	Clay, shale------	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	25-37
PaD---------- Palopinto	0-5	Very flaggy loam, very flaggy clay loam.	CH, CL	A-7-6, A-6	10-25	85-100	85-100	75-100	70-95	39-58	17-31
	5-11	Extremely flaggy clay loam, extremely flaggy silty clay loam, extremely flaggy loam.	CH, CL	A-7-6, A-6	50-85	65-100	65-100	60-100	51-95	39-58	17-31
	11-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
PeE*:											
Palopinto	0-4	Extremely stony loam.	CH, CL	A-7-6, A-6	25-55	85-100	85-100	75-100	70-95	39-58	17-31
	4-12	Extremely stony clay loam, extremely stony silty clay loam, extremely stony loam.	CH, CL	A-7-6, A-6	50-85	65-100	65-100	60-100	51-95	39-58	17-31
	12-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Set	0-12	Extremely stony clay.	CL, CH	A-7-6	40-60	85-100	85-100	80-100	75-95	41-60	20-36
	12-42	Clay, silty clay, clay loam.	CL, CH	A-6, A-7-6	0-5	85-100	85-100	80-100	75-95	36-60	20-40
	42-60	Clay, shale------	CL, CH	A-6, A-7-6	0	85-100	85-100	80-100	75-95	36-60	20-36
PoB	0-3	Fine sand--------	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
Patilo	3-54	Fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
	54-80	Sandy clay loam, fine sandy loam.	SC	A-2, A-4, A-6	0	90-100	90-100	90-100	25-50	---	---
RdB	0-5	Clay loam--------	CL	A-6, A-7-6	0-5	90-100	90-100	80-100	60-90	32-46	12-23
Rowden	5-25	Clay, clay loam	CH, CL	A-7-6	0-5	85-100	80-100	75-100	61-91	41-60	20-35
	25-48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SeC	0-12	Clay loam--------	CL, CH, SC	A-6, A-7-6	0-5	95-100	95-100	80-100	36-60	36-55	20-35
Set	12-45	Clay, silty clay, clay loam.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	75-95	36-60	20-40
	45-60	Clay-------------	CL, CH	A-6, A-7-6	0	90-100	85-100	80-100	75-95	36-60	20-40
ThC	0-6	Clay-------------	CL	A-6, A-7-6	0-2	95-100	95-100	90-100	70-98	35-50	18-31
Throck	6-51	Silty clay, clay loam, clay.	CL	A-6, A-7-6	0-2	80-100	80-100	75-100	70-98	35-50	18-31
	51-76	Clay, silty clay, shale.	CL	A-6, A-7-6	0	95-100	95-100	90-100	70-98	28-50	12-30
TrA, TrB	0-4	Clay loam--------	CL	A-4, A-6	0	98-100	96-100	90-100	60-90	25-40	8-20
Thurber	4-38	Clay, clay loam	CL, CH	A-7-6, A-6	0	98-100	96-100	90-100	70-95	37-65	22-45
	38-62	Clay, clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	85-100	75-100	50-85	35-50	20-35
TuB, TuC2	0-10	Fine sandy loam	CL-ML, SM-SC, SM, SC	A-4	0	95-100	90-100	75-100	40-70	20-30	3-10
Truce	10-44	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	90-100	90-100	75-100	55-85	35-52	18-32
	44-60	Clay, shale------	CL, CH	A-6, A-7-6	0	88-100	85-100	75-100	60-95	30-52	15-32

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
WcA, WcB--------- Wichita	0-8	Clay loam---------	CL	A-6	0	98-100	96-100	90-100	70-90	28-40	11-20
	8-40	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	98-100	96-100	90-100	70-98	36-50	20-30
	40-76	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	96-100	90-100	80-100	65-95	30-50	15-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
BaC	0-18	3-12	1.55-1.65	2.0-6.0	0.07-0.11	5.6-7.8	Very low	0.28	5	2	<1
Bastrop	18-64	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Low	0.32			
	64-80	18-39	1.55-1.70	0.6-2.0	0.12-0.16	6.1-8.4	Low	0.32			
BfA, BfB	0-5	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.8	Low	0.37	5	3	<1
Bastrop	5-66	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Low	0.32			
	66-80	18-39	1.55-1.70	0.6-2.0	0.12-0.16	6.1-8.4	Low	0.32			
BgB	0-5	15-25	1.35-1.45	0.6-2.0	0.14-0.19	5.6-7.3	Low	0.37	2	5	<1
Bluegrove	5-27	35-55	1.40-1.60	0.2-0.6	0.15-0.20	6.1-7.8	Moderate	0.32			
	27-60	---	---	---	---	---	---	---			
BmB	0-4	10-25	1.35-1.45	0.6-2.0	0.12-0.16	5.6-7.3	Low	0.17	2	8	<1
Bluegrove	4-21	35-55	1.40-1.60	0.2-0.6	0.15-0.19	5.6-7.8	Moderate	0.24			
	21-48	---	---	---	---	---	---	---			
BoC	0-10	10-20	1.35-1.55	0.6-2.0	0.11-0.15	5.6-7.3	Low	0.37	2	3	<2
Bonti	10-27	35-50	1.35-1.60	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	0.32			
	27-30	---	---	---	---	---	---	---			
BrC*:											
Bonti	0-8	7-20	1.40-1.60	0.6-2.0	0.08-0.12	5.6-7.3	Low	0.28	2	8	<2
	8-24	35-50	1.40-1.60	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	0.32			
	24-30	---	---	---	---	---	---	---			
Exray	0-8	7-22	1.40-1.60	0.6-2.0	0.08-0.14	6.1-7.3	Low	0.20	1	8	<1
	8-16	35-50	1.40-1.60	0.2-0.6	0.12-0.20	5.6-6.5	Moderate	0.32			
	16-20	---	---	---	---	---	---	---			
BxE*:											
Bonti	0-5	7-20	1.40-1.60	0.6-2.0	0.08-0.12	5.6-7.3	Low	0.28	2	8	<2
	5-36	35-50	1.40-1.60	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	0.32			
	36-40	---	---	---	---	---	---	---			
Exray	0-5	7-22	1.40-1.60	0.6-2.0	0.08-0.14	6.1-7.3	Low	0.20	1	8	<1
	5-18	35-50	1.40-1.60	0.2-0.6	0.12-0.20	5.6-6.5	Moderate	0.32			
	18-20	---	---	---	---	---	---	---			
Truce	0-4	8-20	1.52-1.62	0.6-2.0	0.05-0.10	5.6-7.3	Low	0.20	3	8	<2
	4-42	35-55	1.59-1.69	0.06-0.2	0.07-0.13	6.1-8.4	Moderate	0.32			
	42-60	35-55	1.69-1.80	<0.06	0.05-0.09	6.6-8.4	Moderate	0.28			
By	0-22	27-35	1.20-1.40	0.6-2.0	0.15-0.20	7.9-8.4	Low	0.28	5	4L	1-4
Bosque	22-43	20-35	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	Low	0.28			
	43-60	20-45	1.20-1.40	0.6-2.0	0.11-0.18	7.9-8.4	Low	0.28			
CaB	0-9	5-15	1.78-1.87	2.0-6.0	0.05-0.10	5.6-7.3	Very low	0.20	5	2	<1
Chaney	9-40	35-50	1.42-1.72	0.06-0.2	0.15-0.18	5.6-7.3	Moderate	0.28			
	40-52	20-45	1.54-1.82	0.06-0.2	0.15-0.18	5.6-7.3	Moderate	0.28			
	52-66	20-45	1.68-1.89	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	0.28			
CeD	0-7	5-15	1.50-1.65	2.0-6.0	0.04-0.08	5.6-7.3	Very low	0.15	5	8	<1
Chaney	7-36	35-50	1.45-1.60	0.06-0.2	0.11-0.18	5.6-7.3	Moderate	0.28			
	36-52	20-50	1.50-1.65	0.06-0.2	0.15-0.18	5.6-7.3	Moderate	0.28			
	52-60	20-45	1.65-1.80	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	0.28			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
ChC	0-10	15-27	1.30-1.50	0.6-2.0	0.10-0.15	7.9-8.4	Low	0.28	1	4L	1-2
Cho	10-17	---	---	---	---	---					
	17-34	20-35	1.40-1.60	0.6-2.0	0.05-0.10	7.9-8.4	Low	0.15			
	34-60	40-60	1.60-1.75	<0.06	0.03-0.08	7.9-8.4	High	0.32			
Cm, Cn	0-6	27-35	1.35-1.55	0.6-2.0	0.14-0.20	7.9-8.4	Low	0.43	5	4L	<2
Clairemont	6-65	18-35	1.40-1.65	0.6-2.0	0.16-0.22	7.9-8.4	Low	0.43			
Co	0-28	35-45	1.35-1.55	0.2-0.6	0.14-0.18	7.9-8.4	High	0.32	5	4	1-4
Clearfork	28-83	35-42	1.45-1.65	0.2-0.6	0.14-0.18	7.9-8.4	High	0.32			
Fr	0-25	35-50	1.25-1.45	0.2-0.6	0.11-0.17	7.9-8.4	Moderate	0.32	5	4	1-4
Frio	25-52	35-50	1.30-1.55	0.2-0.6	0.11-0.17	7.9-8.4	Moderate	0.32			
	52-74	35-50	1.40-1.60	0.2-0.6	0.11-0.15	7.9-8.4	Moderate	0.32			
Fy	0-38	35-50	1.25-1.45	0.2-0.6	0.11-0.17	7.9-8.4	Moderate	0.32	5	4	1-4
Frio	38-60	30-50	1.30-1.55	0.2-0.6	0.11-0.17	7.9-8.4	Moderate	0.32			
	60-70	35-50	1.40-1.60	0.2-0.6	0.11-0.15	7.9-8.4	Moderate	0.32			
Ga	0-22	27-35	1.35-1.50	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.28	5	6	1-3
Gageby	22-42	18-35	1.40-1.55	0.6-2.0	0.16-0.20	7.9-8.4	Moderate	0.28			
	42-60	18-35	1.45-1.60	0.6-2.0	0.16-0.20	7.9-8.4	Moderate	0.28			
HaB	0-23	3-12	1.20-1.40	2.0-6.0	0.05-0.11	5.6-7.3	Very low	0.17	5	2	<1
Heaton	23-42	20-35	1.30-1.65	0.6-2.0	0.14-0.16	5.6-7.3	Low	0.24			
	42-80	10-30	1.45-1.70	0.6-2.0	0.10-0.14	5.6-7.8	Low	0.24			
HeB	0-4	15-27	1.30-1.50	0.2-0.6	0.12-0.20	6.1-7.8	Low	0.37	1	6	.5-2
Hensley	4-14	35-55	1.35-1.60	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	0.32			
	14-20	---	---	---	---	---					
HsB	0-4	15-27	1.35-1.55	0.2-0.6	0.08-0.16	6.1-7.8	Low	0.10	1	8	.5-2
Hensley	4-16	35-55	1.40-1.65	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	0.43			
	16-20	---	---	---	---	---					
LeA, LeB	0-17	40-60	1.25-1.40	<0.06	0.12-0.18	7.4-8.4	Very high	0.32	5	4	1-5
Leeray	17-74	40-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	Very high	0.32			
	74-80	40-60	1.35-1.50	<0.06	0.10-0.15	7.9-8.4	High	0.32			
LnB	0-5	20-27	1.35-1.60	0.6-2.0	0.12-0.20	6.1-7.8	Low	0.32	2	4	.5-2
Lindy	5-24	35-60	1.35-1.60	0.06-0.2	0.10-0.20	6.1-7.8	Moderate	0.32			
	24-40	---	---	---	---	---					
LsD	0-6	10-20	1.45-1.60	0.2-2.0	0.08-0.12	6.1-7.8	Low	0.15	2	8	<1
Lusk	6-35	35-50	1.45-1.60	0.06-0.2	0.07-0.12	6.1-8.4	Low	0.10			
	35-60	---	---	---	---	---					
MfB	0-7	10-20	1.40-1.55	2.0-6.0	0.10-0.15	6.1-7.8	Low	0.24	5	3	<1
Minwells	7-50	35-45	1.35-1.60	0.06-0.2	0.11-0.16	6.6-7.8	Moderate	0.32			
	50-60	20-35	1.35-1.60	0.2-0.6	0.10-0.16	6.6-8.4	Moderate	0.32			
	60-76	3-25	1.35-1.60	2.0-6.0	0.01-0.09	6.6-8.4	Low	0.15			
NmB	0-22	3-10	1.20-1.40	6.0-20	0.05-0.11	6.1-7.3	Very low	0.17	5	2	<1
Nimrod	22-56	20-35	1.30-1.65	0.2-0.6	0.12-0.17	6.1-7.3	Low	0.24			
	56-70	20-40	1.40-1.70	0.2-0.6	0.14-0.18	7.4-7.8	Low	0.24			
Oa*	0-80	---	---	---	---	---		---	---	---	---
Oil-waste land											
OcC	0-5	40-60	1.35-1.55	<0.06	0.13-0.17	7.9-8.4	High	0.32	1	4	.5-2
Owens	5-20	35-60	1.45-1.65	<0.06	0.13-0.17	7.9-8.4	High	0.37			
	20-60	40-60	1.60-1.75	<0.06	0.03-0.08	7.9-8.4	High	0.32			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
OxE*:											
Owens	0-5	35-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	Moderate	0.10	1	8	.5-2
	5-30	35-60	1.45-1.65	<0.06	0.13-0.17	7.9-8.4	High	0.32			
	30-60	35-60	1.60-1.75	<0.06	0.03-0.08	7.9-8.4	High	0.37			
Harpersville	0-7	35-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	High	0.10	1	8	.5-2
	7-60	40-60	1.60-1.75	<0.06	0.03-0.08	7.9-8.4	High	0.37			
PaD	0-5	18-35	1.30-1.55	0.6-2.0	0.10-0.15	7.9-8.4	Moderate	0.05	1	8	1-3
Palopinto	5-11	18-35	1.35-1.60	0.6-2.0	0.10-0.15	7.9-8.4	Moderate	0.05			
	11-20	---	---	---	---	---	---	---			
PeE*:											
Palopinto	0-4	18-35	1.30-1.55	0.6-2.0	0.10-0.15	7.4-8.4	Moderate	0.05	1	8	1-3
	4-12	18-35	1.35-1.60	0.6-2.0	0.10-0.15	7.9-8.4	Moderate	0.05			
	12-20	---	---	---	---	---	---	---			
Set	0-12	35-55	1.40-1.50	0.06-0.2	0.12-0.18	7.9-8.4	Moderate	0.10	4	8	1-3
	12-42	35-55	1.40-1.60	0.06-0.2	0.12-0.20	7.9-8.4	Moderate	0.32			
	42-60	40-55	1.40-1.65	<0.06	0.12-0.18	7.9-8.4	Moderate	0.32			
PoB	0-3	2-7	1.50-1.65	6.0-20	0.05-0.08	5.6-7.3	Very low	0.17	5	1	<1
Patilo	3-54	2-12	1.50-1.65	6.0-20	0.05-0.10	5.6-7.3	Low	0.24			
	54-80	27-35	1.50-1.65	0.2-0.6	0.14-0.18	5.1-6.5	Very low	0.17			
RdB	0-5	27-35	1.30-1.45	0.6-2.0	0.14-0.20	6.6-8.4	Moderate	0.32	2	6	1-3
Rowden	5-25	40-60	1.35-1.50	0.06-0.2	0.12-0.20	6.6-8.4	High	0.32			
	25-48	---	---	---	---	---	---	---			
SeC	0-12	30-40	1.40-1.50	0.06-0.2	0.12-0.18	7.9-8.4	Moderate	0.32	4	4	1-3
Set	12-45	35-55	1.40-1.60	0.06-0.2	0.12-0.20	7.9-8.4	Moderate	0.32			
	45-60	40-55	1.40-1.65	<0.06	0.12-0.18	7.9-8.4	Moderate	0.32			
ThC	0-6	40-60	1.45-1.65	0.06-0.2	0.12-0.20	7.9-8.4	High	0.32	3	4	.5-2
Throck	6-51	35-60	1.55-1.70	0.06-0.2	0.12-0.20	7.9-8.4	High	0.32			
	51-76	40-60	1.45-1.90	0.06-0.2	0.10-0.18	7.9-8.4	High	0.32			
TrA, TrB	0-4	20-35	1.40-1.65	0.2-0.6	0.15-0.22	6.1-7.8	Moderate	0.43	5	7	<2
Thurber	4-38	40-55	1.40-1.65	<0.06	0.12-0.18	7.4-8.4	High	0.32			
	38-62	25-45	1.40-1.70	<0.06	0.12-0.18	7.4-8.4	High	0.32			
TuB, TuC2	0-10	8-20	1.45-1.62	0.6-2.0	0.07-0.12	5.6-7.3	Low	0.37	4	3	<2
Truce	10-44	35-55	1.55-1.69	0.06-0.2	0.07-0.13	6.1-8.4	Moderate	0.32			
	44-60	40-55	1.60-1.80	<0.06	0.05-0.09	6.6-8.4	Moderate	0.28			
WcA, WcB	0-8	28-35	1.30-1.45	0.6-2.0	0.15-0.20	6.6-7.8	Moderate	0.32	5	6	<1
Wichita	8-40	35-45	1.30-1.45	0.2-0.6	0.15-0.20	7.4-8.4	Moderate	0.32			
	40-76	35-45	1.35-1.50	0.2-0.6	0.12-0.18	7.9-8.4	Moderate	0.32			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," and "perched" are explained in the text. The symbol < means less than; > means more than)

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			
BaC, BfA, BfB----- Bastrop	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
BgB, BmB----- Bluegrove	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
BoC----- Bonti	C	None	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
BrC*:											
Bonti-----	C	None	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Exray-----	D	None	---	---	>6.0	---	---	14-20	Hard	High-----	Moderate.
BxE*:											
Bonti-----	C	None	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Exray-----	D	None	---	---	>6.0	---	---	14-20	Hard	High-----	Moderate.
Truce-----	C	None	---	---	>6.0	---	---	>60	---	High-----	Low.
By----- Bosque	B	Occasional	Brief-----	Apr-Oct	>6.0	---	---	>60	---	High-----	Low.
CaB, CeD----- Chaney	C	None	---	---	>6.0	---	---	>60	---	High-----	Moderate.
ChC----- Cho	C	None	---	---	>6.0	---	---	>60**	---	High-----	Low.
Cm----- Clairemont	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
Cn----- Clairemont	B	Frequent----	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
Co----- Clearfork	D	Occasional	Brief-----	Apr-Oct	>6.0	---	---	>60	---	High-----	Low.
Fr----- Frio	B	Occasional	Brief-----	Apr-Oct	>6.0	---	---	>60	---	High-----	Low.
Fy----- Frio	B	Frequent----	Brief-----	Apr-Oct	>6.0	---	---	>60	---	High-----	Low.
Ga----- Gageby	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
HaB----- Heaton	A	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
HeB, HsB----- Hensley	D	None	---	---	>6.0	---	---	10-18	Hard	High-----	Low.
LeA, LeB----- Leeray	D	None	---	---	>6.0	---	---	>60	---	High-----	Low.

See footnotes at end of table.

TABLE 15.--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			
LnB---------- Lindy	C	None	---	---	>6.0	---	---	20-40	Hard	High	Low.
LsD---------- Lusk	C	None	---	---	>6.0	---	---	20-40	Soft	High	Moderate.
MfB---------- Minwells	C	None	---	---	>6.0	---	---	>60	---	High	Low.
NmB---------- Nimrod	C	None	---	---	2.0-3.5	Perched	Oct-Nov	>60	---	High	Moderate.
Oa*---------- Oil-waste land	D	None	---	---	>6.0	---	---	---	---	High	Moderate.
OcC---------- Owens	D	None	---	---	>6.0	---	---	>60	---	High	Low.
OxE*:											
Owens----------	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Harpersville-----	D	None	---	---	>6.0	---	---	>60	---	High	Low.
PaD---------- Palopinto	D	None	---	---	>6.0	---	---	6-20	Hard	High	Low.
PeE*:											
Palopinto--------	D	None	---	---	>6.0	---	---	6-20	Hard	High	Low.
Set----------	C	None	---	---	>6.0	---	---	>60	---	High	Low.
PoB---------- Patilo	B	None	---	---	4.0-6.0	Perched	May-Oct	>60	---	High	Moderate.
RdB---------- Rowden	C	None	---	---	>6.0	---	---	20-40	Hard	High	Low.
SeC---------- Set	C	None	---	---	>6.0	---	---	>60	---	High	Low.
ThC---------- Throck	C	None	---	---	>6.0	---	---	>60	---	High	Low.
TrA, TrB---------- Thurber	D	None	---	---	>6.0	---	---	>60	---	High	Low.
TuB, TuC2--------- Truce	C	None	---	---	>6.0	---	---	>60	---	High	Low.
WcA, WcB---------- Wichita	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.
** A cemented layer is at a depth of 7 to 14 inches.

TABLE 16.--PHYSICAL ANALYSIS OF SELECTED SOILS

(Data were determined by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska. Dashes indicate that the material was not detected or a determination was not made. TR means trace)

Soil name and sample number	Horizon	Depth	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Carbonate	COLE	Bulk density: 1/3 bar	Bulk density: Oven-dry	Water content: 1/3 bar	Water content: 15 bar
			In	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	cm/cm	g/cc	g/cc	-Pct(wt)-	
Bluegrove:[1]	A1	0-2	0.6	1.5	2.7	7.4	33.6	45.8	42.7	11.5	---	0.01	1.56	1.60	13.7	5.8
S79TX429-001	A2	2-5	0.8	1.1	2.3	13.6	20.3	38.1	42.1	19.8	---	0.01	1.59	1.64	13.8	7.9
	Bt1	5-8	1.2	1.1	1.9	6.1	25.6	35.9	40.4	23.7	---	0.02	1.50	1.57	16.5	9.3
	Bt2	8-16	1.9	1.0	1.1	3.7	16.8	24.5	22.9	52.6	---	0.05	1.49	1.72	22.4	17.3
	Bt3	16-21	3.0	1.2	1.0	3.6	15.3	24.1	21.9	54.0	---	0.05	1.49	1.74	24.8	18.0
	Bt3	21-24	1.6	1.8	2.3	19.9	19.1	44.7	19.4	35.9	---	---	---	---	---	13.3
	Bt3	24-27	1.6	1.2	1.0	2.3	13.4	19.5	24.7	55.8	---	---	1.50	---	---	20.0
	Cr1	27-44	7.6	8.8	7.0	3.9	9.9	37.2	30.5	32.3	1	---	---	---	---	9.9
	Cr2	44-56	5.4	4.9	3.3	3.2	1.9	18.7	40.1	41.2	1	---	---	---	---	12.2
Clearfork:[1]	A1	0-4	0.1	0.2	0.2	0.7	4.7	5.9	59.4	34.7	TR	0.04	1.45	1.64	21.8	17.0
S83TX429-001	A2	4-17	---	---	---	0.5	5.8	6.3	57.4	36.3	1	0.04	1.49	1.69	20.8	15.1
	A3	17-28	---	---	0.2	1.4	6.6	8.2	56.3	35.5	1	0.05	1.49	1.71	21.7	16.2
	Bw1	28-59	---	---	---	1.5	6.4	7.9	56.1	36.0	3	0.05	1.58	1.82	19.7	13.9
	Bw2	59-76	0.2	---	0.2	5.7	13.5	19.6	51.2	29.2	1	---	1.63	---	16.7	12.2
	Bw3	76-83	---	---	0.2	4.7	15.1	20.0	50.7	29.3	1	0.04	1.61	1.80	18.8	11.9
Hensley:[1]	A	0-4	0.2	0.6	2.2	12.5	11.9	27.4	49.5	23.1	---	0.03	1.28	1.40	25.4	12.3
S84TX429-007	Bt1	4-8	---	0.3	1.8	13.0	12.6	27.7	38.3	34.0	---	0.05	1.43	1.66	22.1	16.2
	Bt2	8-15	0.4	0.3	2.0	12.5	10.2	25.4	35.0	39.6	---	0.07	1.46	1.79	24.3	17.3
Lindy:[1,2]	A1	0-2	0.3	0.6	1.7	8.5	15.2	26.3	55.3	18.4	1	0.06	1.00	1.20	38.4	10.0
S84TX429-004	A2	2-5	0.4	0.5	1.1	7.7	12.4	22.1	52.4	25.5	---	0.02	1.51	1.61	19.3	10.0
	Bt1	5-11	0.6	0.3	0.8	4.8	7.3	13.8	36.3	49.9	---	0.07	1.39	1.71	26.8	18.2
	Bt2	11-19	0.4	0.3	0.9	4.3	6.6	12.5	33.8	53.7	---	0.08	1.45	1.81	28.2	19.7
	Bt3	19-25	0.5	0.4	0.8	4.7	6.6	13.0	35.5	51.5	2	0.08	1.42	1.78	30.0	19.8
Owens:[1]	A	0-5	4.1	3.4	1.8	3.3	6.5	19.1	37.4	43.5	3	0.06	1.42	1.70	25.0	14.4
S84TX429-002	Bw1	5-10	1.4	1.7	1.3	2.0	3.6	10.0	38.1	51.9	3	0.06	1.50	1.78	23.6	15.2
	Bw2	10-16	1.4	1.3	0.7	1.0	2.1	6.5	39.9	53.6	4	0.05	1.54	1.81	22.4	14.6
	Bw3	16-23	1.0	0.8	0.5	0.4	0.9	3.6	43.0	53.4	2	0.06	1.54	1.82	22.0	15.0
	B/C1	23-30	1.5	1.1	0.5	0.4	0.4	3.9	45.0	51.1	1	0.06	1.58	1.87	21.4	15.1
	B/C2	30-40	0.8	0.8	0.7	0.7	0.4	3.4	48.2	48.4	1	0.05	1.65	1.94	21.4	15.8
	C3	40-54	0.9	0.7	0.5	0.5	0.5	3.1	50.0	46.9	1	0.02	1.76	2.13	19.2	15.7
	C4	54-60	0.2	0.1	0.2	0.3	0.3	1.1	50.2	48.7	---	0.06	1.78	2.09	18.7	15.3

See footnotes at end of table.

TABLE 16.--PHYSICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Horizon	Depth	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Carbonate	COLE	Bulk density: 1/3 bar	Bulk density: Oven-dry	Water content: 1/3 bar	Water content: 15 bar
			In	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	cm/cm	g/cc	g/cc	-Pct(wt)-	
Palopinto:[1]	A1	0-2	0.8	1.3	6.8	13.5	9.8	32.2	41.9	25.9	---	0.03	1.41	1.61	21.0	13.4
S84TX429-001	A2	2-5	0.9	1.0	6.9	14.3	9.3	32.4	35.1	32.5	1	0.03	1.27	1.52	26.1	16.5
	A3	5-11	1.4	1.5	6.9	13.0	8.3	31.1	33.2	35.7	1	---	---	---	---	18.9
Rowden:[3]	A1	0-2	---	0.2	1.1	5.9	10.0	17.2	47.8	35.0	---	0.07	1.28	1.55	28.0	15.2
S84TX429-005	A2	2-5	0.2	0.3	1.2	6.0	10.6	18.3	45.0	36.7	---	0.07	1.34	1.66	26.2	15.6
	Bt1	5-10	0.3	0.3	1.0	5.8	8.8	16.2	40.9	42.9	---	0.08	1.38	1.75	29.1	17.6
	Bt2	10-20	0.3	0.3	1.0	5.3	8.6	15.5	38.9	45.6	---	0.08	1.42	1.77	28.3	18.4
	Bt3	20-26	0.9	0.8	1.4	5.2	7.0	15.3	40.9	43.8	2	0.07	1.46	1.77	27.3	18.0
	Btk	26-31	3.4	2.2	2.3	4.8	5.8	18.5	39.6	41.9	3	0.06	1.32	1.61	30.0	17.5
Throck:[1,4]	A1	0-2	0.5	0.8	1.0	2.6	4.2	9.1	45.6	45.3	2	0.08	1.18	1.47	28.0	15.3
S84TX429-006	A2	2-6	1.3	1.0	0.8	1.9	4.1	9.1	39.4	51.5	TR	0.06	1.34	1.65	26.1	18.6
	Bw	6-15	1.4	1.2	1.1	1.8	3.0	8.5	39.3	52.2	1	0.08	1.49	1.89	24.8	16.4
	By	15-29	1.2	1.0	0.8	1.4	3.1	7.5	38.9	53.6	1	0.08	1.54	1.94	23.7	16.4
	Bky1	29-37	0.8	0.9	1.3	1.7	3.3	8.0	39.6	52.4	2	0.07	1.58	1.97	24.0	16.0
	Bky2	37-45	1.1	1.0	0.6	1.1	3.9	7.7	39.1	53.2	1	0.08	1.57	1.98	25.0	16.4
	Bky3	45-51	1.5	0.7	0.3	0.1	1.6	4.2	38.6	57.2	1	0.07	1.56	1.97	24.5	16.6
	C1	51-59	0.4	0.4	0.2	0.2	2.1	3.3	38.6	58.1	2	0.08	1.57	2.00	24.0	15.9
	C2	59-76	---	---	0.1	0.4	2.5	3.0	41.8	55.2	---	0.07	1.74	2.12	18.9	14.7

[1] Location of pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."
[2] This pedon is a taxadjunct to the Lindy series because it has an abrupt textural change between the A2 and Bt1 horizons.
[3] Located from Texas Highway 67 in Ivan, 5.0 miles east on Farm Road 1148, 0.6 mile south on Farm Road 3253, 433 feet west, in an area of rangeland.
[4] This pedon is a taxadjunct to the Throck series because it has less calcium carbonate and a slightly higher shrink-swell potential than is typical.

TABLE 17.--CHEMICAL ANALYSIS OF SELECTED SOILS

(Data were determined by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska. Dashes indicate that the material was not detected or that a determination was not made. TR means trace)

Soil name, report number, horizon, and depth in inches	pH		Extractable cations			Cation-exchange capacity	Exchangeable sodium	SAR	Organic carbon	Calcium carbonate equivalent	Electrical conductivity
	H_2O (1:1)	$CaCl_2$ .01M (1:2)	Mg	K	Na	(NH_4OAc)					
			Meq/100g				Pct		Pct	Pct	mmhos/cm
Bluegrove:[1]											
S79TX429-001											
A1-------- 0-2	6.7	6.1	1.2	0.5	TR	9.0	---	---	0.72	---	---
A2-------- 2-5	6.7	6.1	1.7	0.6	TR	12.0	---	---	0.91	---	---
Bt1------- 5-8	6.8	6.1	2.0	0.6	TR	14.0	---	---	0.88	---	---
Bt2------- 8-16	7.2	6.5	4.5	0.7	0.1	26.0	---	---	0.82	---	---
Bt3------- 16-21	7.5	6.8	5.2	0.6	0.1	27.9	---	---	0.78	---	---
Bt3------- 21-24	8.1	7.6	4.1	0.5	0.1	20.1	---	---	0.91	4	---
Bt3------- 24-27	8.1	7.6	6.4	0.7	0.1	31.3	---	---	1.11	2	---
Cr-------- 27-44	8.5	8.0	4.2	0.2	0.1	16.4	---	---	0.23	27	---
Cr-------- 44-56	8.6	8.0	6.6	0.1	0.4	21.5	---	---	0.07	20	---
Clearfork:[1]											
S83TX429-001											
A1-------- 0-4	7.9	7.5	4.0	1.6	0.2	23.3	---	---	2.18	4	0.9
A2-------- 4-17	8.0	7.5	4.1	1.0	0.2	21.6	---	---	0.95	11	0.5
A3-------- 17-28	8.1	7.6	4.9	0.8	0.1	22.5	---	---	0.84	4	0.5
Bw1------- 28-59	8.2	7.7	5.8	0.5	0.2	20.0	---	---	0.52	12	0.2
Bw2------- 59-76	8.3	7.8	6.4	0.4	0.4	16.0	---	---	0.28	12	0.2
Bw3------- 76-83	8.4	7.8	7.7	0.5	0.6	15.9	---	---	0.24	11	0.5
Hensley:[1]											
S84TX429-007											
A--------- 0-4	6.8	6.5	1.8	0.9	0.1	19.8	---	---	1.98	---	---
Bt1------- 4-8	6.8	6.3	2.1	0.6	TR	23.1	---	---	1.02	---	---
Bt2------- 8-15	7.1	6.5	2.1	0.5	0.1	25.9	---	---	0.75	---	---
Lindy:[1,2]											
S84TX429-004											
A1-------- 0-2	7.6	7.1	1.6	1.2	---	18.2	---	---	3.02	1	---
A2-------- 2-5	7.5	6.9	1.7	1.3	---	14.8	---	---	1.10	---	---
Bt1------- 5-11	7.5	6.9	4.1	1.3	---	13.9	---	---	0.95	---	---
Bt2------- 11-19	7.8	7.1	5.0	0.9	0.1	21.4	---	---	0.80	---	---
Bt3------- 19-25	7.9	7.3	5.6	0.9	0.3	29.6	---	---	0.78	1	---
Owens:[1]											
S84TX429-002											
A--------- 0-5	7.9	7.5	0.8	0.6	0.1	20.8	TR	TR	1.79	12	0.8
Bw1------- 5-10	8.1	7.6	1.4	0.5	0.2	12.4	1	1	1.30	11	0.5
Bw2------- 10-16	8.2	7.6	1.8	0.4	0.7	13.9	4	2	1.08	9	0.7
Bw3------- 16-23	7.9	7.7	2.6	0.3	2.2	19.4	8	6	0.86	5	2.2
B/C1------ 23-30	7.7	7.6	3.1	0.2	4.2	20.5	12	10	0.70	3	4.1
B/C2------ 30-40	7.5	7.5	3.1	0.3	4.1	15.3	11	8	0.54	2	5.9
C3-------- 40-54	7.5	7.5	3.3	0.3	4.0	15.6	11	8	0.46	1	5.9
C4-------- 54-60	7.5	7.4	4.0	0.4	3.6	16.6	12	10	0.35	---	3.7
Palopinto:[1]											
S84TX429-001											
A1-------- 0-2	7.3	6.9	1.6	0.8	TR	26.2	TR	TR	3.06	2	0.6
A2-------- 2-5	7.5	7.1	1.0	0.6	TR	30.3	TR	TR	2.50	3	0.6
A3-------- 5-11	7.7	7.3	0.7	0.6	TR	33.3	TR	TR	2.72	3	0.9

See footnotes at end of table.

TABLE 17.--CHEMICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name, report number, horizon, and depth in inches	pH		Extractable cations			Cation-exchange capacity	Exchangeable sodium	SAR	Organic carbon	Calcium carbonate equivalent	Electrical conductivity
	H_2O (1:1)	$CaCl_2$ .01M (1:2)	Mg	K	Na	(NH_4OAc)					
			Meq/100g				Pct		Pct	Pct	mmhos/cm
Rowden:[3] S84TX429-005											
A1-------- 0-2	7.5	7.0	2.0	1.5	TR	26.5	---	---	2.32	---	---
A2-------- 2-5	7.4	6.9	1.9	1.3	0.1	26.6	---	---	1.81	---	---
Bt1------- 5-10	7.6	7.1	2.3	1.2	TR	28.8	---	---	1.36	TR	---
Bt2------- 10-20	7.7	7.2	2.7	0.9	0.1	31.3	---	---	1.11	TR	---
Bt3------- 20-26	8.1	7.6	3.4	0.7	0.1	29.6	---	---	0.99	4	---
Btk------- 26-31	8.1	7.6	3.4	0.7	0.2	27.0	---	---	0.96	19	---
Throck:[1,4] S84TX429-006											
A1-------- 0-2	7.7	7.3	2.0	0.5	0.6	24.6	TR	TR	1.87	1	1.7
A2-------- 2-6	8.0	7.6	0.6	0.1	0.5	21.3	TR	TR	1.53	3	0.6
Bw-------- 6-15	8.1	7.6	0.4	---	0.9	26.1	1	1	1.05	4	0.5
By-------- 15-29	7.7	7.5	3.4	TR	6.9	24.9	2	2	0.67	4	3.0
Bky1------ 29-37	7.6	7.6	6.4	0.1	15.0	24.1	5	4	0.44	3	3.9
Bky2------ 37-45	7.6	7.6	7.2	0.3	17.0	25.1	6	4	0.43	3	4.0
Bky3------ 45-51	7.6	7.5	8.9	0.2	23.1	27.7	8	5	0.24	2	4.5
C1-------- 51-59	7.9	7.8	7.7	0.2	23.8	27.0	9	6	0.23	3	4.3
C2-------- 59-76	7.7	7.5	2.5	0.1	16.2	22.7	10	8	0.07	1	2.5

[1] Location of pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[2] This pedon is a taxadjunct to the Lindy series because it has an abrupt textural change between the A2 and Bt1 horizons.

[3] Located from Texas Highway 67 in Ivan, 5.0 miles east on Farm Road 1148, 0.6 mile south on Farm Road 3253, 433 feet west, in an area of rangeland.

[4] This pedon is a taxadjunct to the Throck series because it has less calcium carbonate and a slightly higher shrink-swell potential than is typical.

TABLE 18.--CLAY MINERALOGY OF SELECTED SOILS

(Data were determined by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska. Dashes indicate that the material was not detected or that a determination was not made)

Soil name and sample number	Depth	Horizon	Clay minerals[1] X-ray diffraction (<2 microns)					
			Montmorillonite	Mica	Kaolinite	Quartz	Calcite	Vermiculite
	In							
Bluegrove:[2]	8-16	Bt2	2	2	3	---	---	---
S79TX429-001	24-27	Bt3	3	2	3	---	---	---
	27-44	Cr	3	2	3	---	---	---
Clearfork:[2]	17-28	A3	2	4	3	---	1	---
S83TX429-001	76-83	Bw3	3	4	3	---	2	---
Hensley:[2]	8-15	Bt2	3	3	3	---	---	---
S84TX429-007								
Lindy:[2]	5-11	Bt1	2	3	2	---	---	---
S84TX429-004								
Owens:[2]	10-16	Bw2	---	3	3	1	---	3
S84TX429-002	23-30	B/C1	---	3	3	1	---	2
	40-54	C2	---	3	3	1	---	2
Palopinto:[2]	2-5	A2	3	2	2	1	---	---
S84TX429-001								
Throck[2,3]	15-29	By	2	3	4	2	---	---
S84TX429-006	37-45	Bky2	3	3	3	1	---	---
	45-51	Bky3	3	3	3	2	---	---
	59-76	C2	3	3	3	2	---	---

[1] Relative amounts: 5-Dominant; 4-Abundant; 3-Moderate; 2-Small; 1-Trace.
[2] Location of pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."
[3] This pedon is a taxadjunct to the Throck series because it has less calcium carbonate and a higher shrink-swell potential than is typical.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available)

Soil name, report number, horizon, and depth in inches	Classification		Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		g/cc	Pct	Pct	
Bonti:[1,2]														
S82TX429-022														
E---------- 4-10	A-2-4(0)	SM-SC	---	100	99	98	97	32	20	4	2.63	18.0	1.2	1.76
Bt1---------- 10-18	A-6(2)	SC	---	100	98	96	95	40	31	15	2.64	17.0	7.1	1.81
Bt2---------- 18-27	A-6(2)	SC	---	100	98	96	95	41	33	15	2.63	18.0	7.9	1.79
Cho:[3]														
S82TX429-020														
A---------- 0-10	A-7-6(15)	CL	---	---	100	99	96	69	46	23	2.62	19.0	12.3	1.81
Ck1---------- 17-34	A-7-6(9)	CL	93	90	85	80	71	59	41	19	2.70	21.0	9.3	1.73
Clearfork:[4]														
S80TX429-001														
A2---------- 7-18	A-7-6(24)	CL	---	---	---	---	100	98	41	23	2.67	22.0	11.8	1.86
Bw1---------- 18-24	A-7-6(26)	CL	---	---	---	---	100	98	43	25	2.68	16.0	12.8	1.89
Bw2---------- 24-48	A-7-6(28)	CL	---	---	---	---	100	97	44	27	2.68	15.0	35.3	1.89
Leeray:[3]														
S82TX429-021														
Ap---------- 0-6	A-7-6(28)	CH	---	---	100	99	97	86	55	29	2.65	17.0	16.5	1.84
A2---------- 17-54	A-7-6(30)	CH	---	---	---	100	99	92	52	30	2.69	16.0	16.0	1.95
Minwells:[3]														
S82TX429-024														
A---------- 0-7	A-4(0)	CL-ML	---	---	100	99	96	50	23	7	2.63	18.0	2.9	1.79
Bt1---------- 7-14	A-6(9)	CL	---	100	99	99	95	63	36	18	2.65	13.0	11.1	1.91
Bt2---------- 14-32	A-6(10)	CL	100	99	98	95	91	62	39	21	2.63	15.0	12.4	1.94
Bt3---------- 32-50	A-6(7)	CL	---	100	99	99	97	61	32	16	2.64	18.0	7.5	1.84
BCk---------- 50-60	A-4(1)	SC	96	89	84	82	78	41	24	10	2.67	16.0	4.8	1.87
Ck---------- 60-76	A-2-4(0)	SC	95	89	60	48	38	20	24	8	2.70	17.0	4.0	1.83
Owens:[5]														
S82TX429-025														
A---------- 0-4	A-7-6(17)	CL	100	99	98	95	91	73	45	25	2.65	16.0	13.7	1.91
Bw---------- 4-12	A-7-6(26)	CH	---	100	98	96	94	80	51	32	2.68	15.0	16.3	1.94

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		g/cc	Pct	Pct	
Rowden:[3] S82TX429-026														
A---------- 0-5	A-7-6(19)	CL	---	---	---	---	100	85	46	21	2.58	21.0	11.3	1.72
Bt1---------- 5-15	A-7-6(24)	CL	---	---	---	100	99	86	46	27	2.66	10.0	16.2	2.00
Bt2---------- 15-25	A-7-6(25)	CH	---	---	---	100	99	83	52	28	2.66	16.0	15.9	1.90
Thurber:[6] A82TX429-023														
A---------- 0-6	A-6(9)	CL	---	---	---	100	99	70	33	15	2.66	19.0	7.4	1.76
Bt2---------- 16-32	A-7-6(21)	CL	---	---	100	99	97	77	48	28	2.69	15.0	14.9	1.91

[1] Located from U.S. 183 in Breckenridge, 2.5 miles east on U.S. 180, 7.3 miles northeast on U.S. 67, 4.1 miles north on Farm Road 701, 1.2 miles east, 300 feet south, in an area of rangeland.

[2] This pedon is a taxadjunct to the Bonti series because the subsoil is less clayey than is typical.

[3] Location of pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[4] Located from U.S. 180 in Breckenridge, 12.9 miles northwest on U.S. 183, 4.6 miles west on county road, 0.8 mile north on ranch trail, 16 feet west, in an area of rangeland.

[5] Located from U.S. 180 in Breckenridge, 1.47 miles north on U.S. 183, 1.5 miles west, 225 feet north, in an area of rangeland.

[6] Located from U.S. 183 in Breckenridge, 11.3 miles west on U.S. 180, 3.8 miles south, 0.5 mile west, 820 feet north, in an area of rangeland.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
*Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Bluegrove	Fine, mixed, thermic Typic Haplustalfs
Bonti	Fine, mixed, thermic Ultic Paleustalfs
Bosque	Fine-loamy, mixed, thermic Cumulic Haplustolls
Chaney	Fine, mixed, thermic Aquic Paleustalfs
Cho	Loamy, carbonatic, thermic, shallow Petrocalcic Calciustolls
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Clearfork	Fine, mixed, thermic Cumulic Haplustolls
Exray	Clayey, mixed, thermic Lithic Rhodustalfs
Frio	Fine, montmorillonitic, thermic Cumulic Haplustolls
Gageby	Fine-loamy, mixed, thermic Cumulic Haplustolls
Harpersville	Clayey, mixed (calcareous), thermic Ustic Torriorthents
Heaton	Loamy, siliceous, thermic Arenic Paleustalfs
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Leeray	Fine, montmorillonitic, thermic Typic Chromusterts
*Lindy	Fine, mixed, thermic Udic Haplustalfs
Lusk	Clayey-skeletal, mixed, thermic Typic Paleustalfs
*Minwells	Fine, mixed, thermic Udic Paleustalfs
Nimrod	Loamy, siliceous, thermic Aquic Arenic Paleustalfs
Owens	Fine, mixed, thermic Typic Ustochrepts
Palopinto	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Patilo	Loamy, siliceous, thermic Grossarenic Paleustalfs
Rowden	Fine, mixed, thermic Typic Argiustolls
Set	Fine-silty, carbonatic, thermic Typic Calciustolls
*Throck	Fine, mixed, thermic Typic Ustochrepts
Thurber	Fine, montmorillonitic, thermic Typic Haplustalfs
*Truce	Fine, mixed, thermic Udic Paleustalfs
Wichita	Fine, mixed, thermic Typic Paleustalfs

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