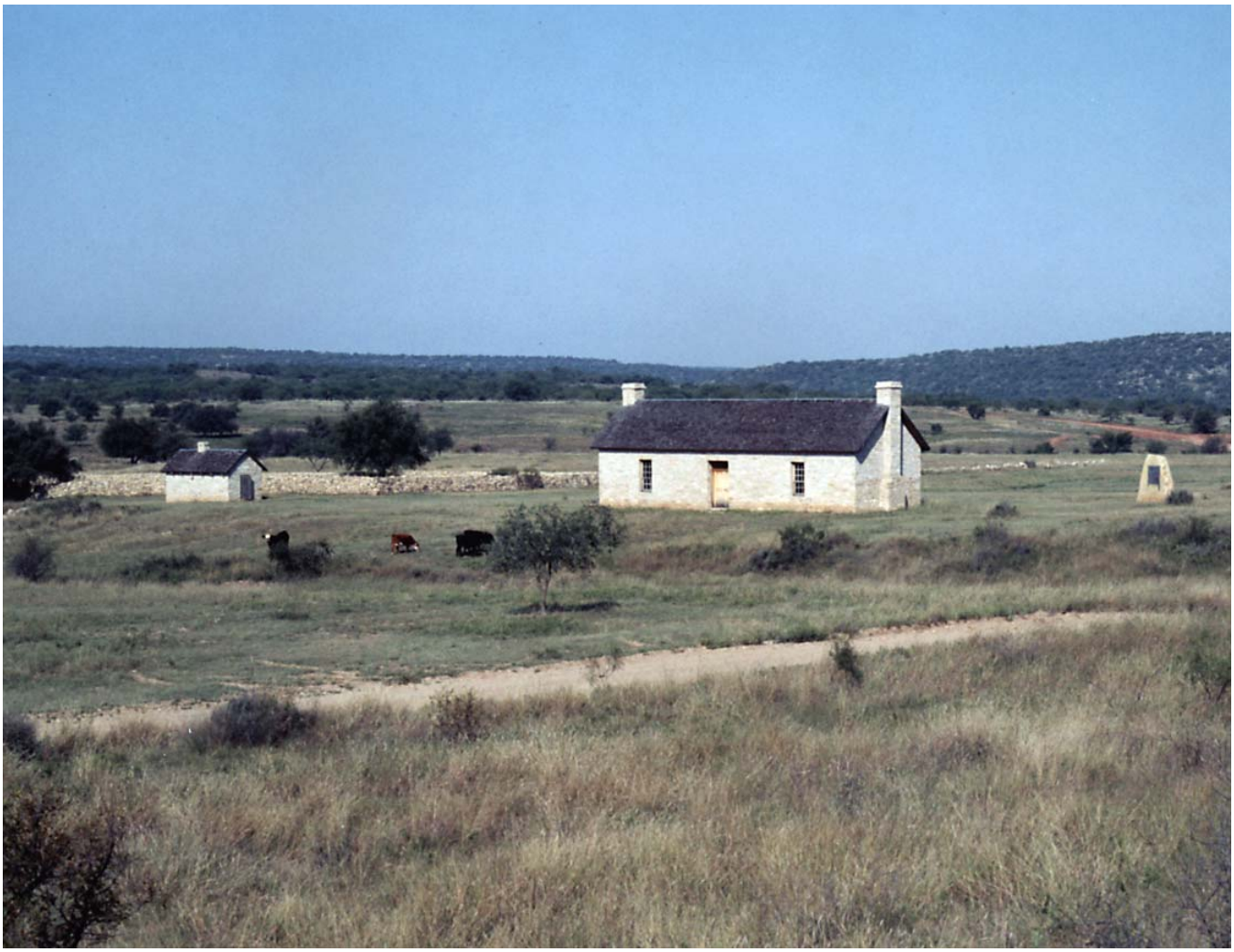
United States Department of Agriculture

Natural Resources Conservation Service
In cooperation with Texas Agricultural Experiment Station

Soil Survey of Throckmorton County, Texas



How to Use This Soil Survey

General Soil Map

The general soil map, which is a color map, 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.

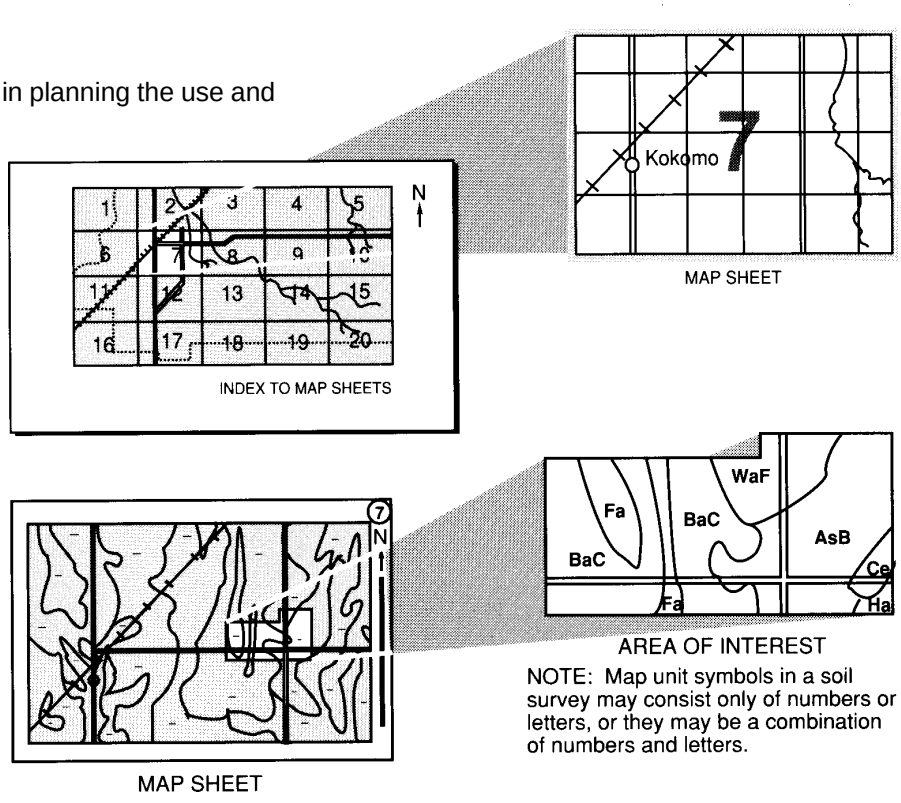
Detailed Soil Maps

The detailed soil maps 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**. 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 **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

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



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.

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 Natural Resources Conservation Service (formerly 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 1991. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1991. This survey was made cooperatively by the Natural Resources Conservation Service and the Texas Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Throckmorton Soil and Water Conservation District.

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

Cover: Stone Ranch, a historical site in Throckmorton County, was the last house on the western edge of the Texas frontier when it was built in 1856.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

Issued 2004

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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

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

Larry D. Butler
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Throckmorton County Texas

By Thomas E. Cyprian, Natural Resources Conservation Service

Fieldwork by Thomas E. Cyprian, A.C Lowther, Stephen S. Park, and Colletus A. Rogers, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
Texas Agricultural Experiment Station

THROCKMORTON COUNTY is in west-central Texas (fig. 1). It is bordered on the north by Baylor County, on the east by Young County, on the south by Shackelford and Stephens Counties, and on the west by Haskell County. Throckmorton is the county seat and largest town in the county. It has a population of 1,174. It is near the center of the county and is about 60 miles southwest of Wichita Falls and 70 miles northeast of Abilene. The county has a population of 2,200. Elevation ranges from about 1,100 to 1,730 feet above sea level.

Throckmorton County has a land area of 583,782 acres, a water area of 1,920 acres, and a total area of 585,702 acres.

The county is in the Central Rolling Red Plains and Texas North Central Prairies MLRA's *(6)*. A number of diverse and contrasting geological formations, mainly of Permian age, are exposed in the county. Most of the county is gently undulating to rolling, but a few large areas are nearly level and a few areas are steep. Most of the county is used as rangeland. A small percentage of the land, about 80,000 acres, is cultivated. The main crops are grain sorghum, cotton, and small grain. A small acreage is used for pasture and hay. Encroaching mesquite brush has been cleared from many pastures.

General Nature of the Survey Area

In this section the environmental and cultural factors that affect the use and management of the soils in Throckmorton County are described. These factors are history, natural resources, and climate.

History

The Spanish explorer Pedro Vial is considered to be the earliest European to travel through what is now known as Throckmorton County. Vial passed between the Clear Fork and Main Forks of the Brazos River in 1786 while searching for a direct route between San Antonio and Santa Fe. No other major activity is recorded in the county until 1849, when Captain Randolph B. Marcy, commander of a U.S. military escort expedition led by Lieutenant J.E. Johnson, passed through the county. The Captain John Pope expedition passed through the county in 1854.

In 1854, Captain Marcy returned to the county in search of suitable locations for a reservation for Texas Indians. During this visit he surveyed and established the tract of land that was to become known as the Comanche Indian Reservation, which is adjacent to the Clear Fork of the Brazos River in Throckmorton County.

The reservation consisted of approximately 25,000 acres of land extending well out from both sides of the river. The location was ideal for the Indians because it provided plenty of running water and good opportunities for hunting. Marcy also met with Sanaco and the famous Tecumseh leaders of the southern band of Comanche Indians in an attempt to persuade them to move to the reservation, which they began doing in 1855. Early in 1856, Colonel Albert Sidney Johnston established Camp Cooper on the banks of the Clear Fork of the Brazos River to protect reservation Indians. Captain Robert E. Lee, later

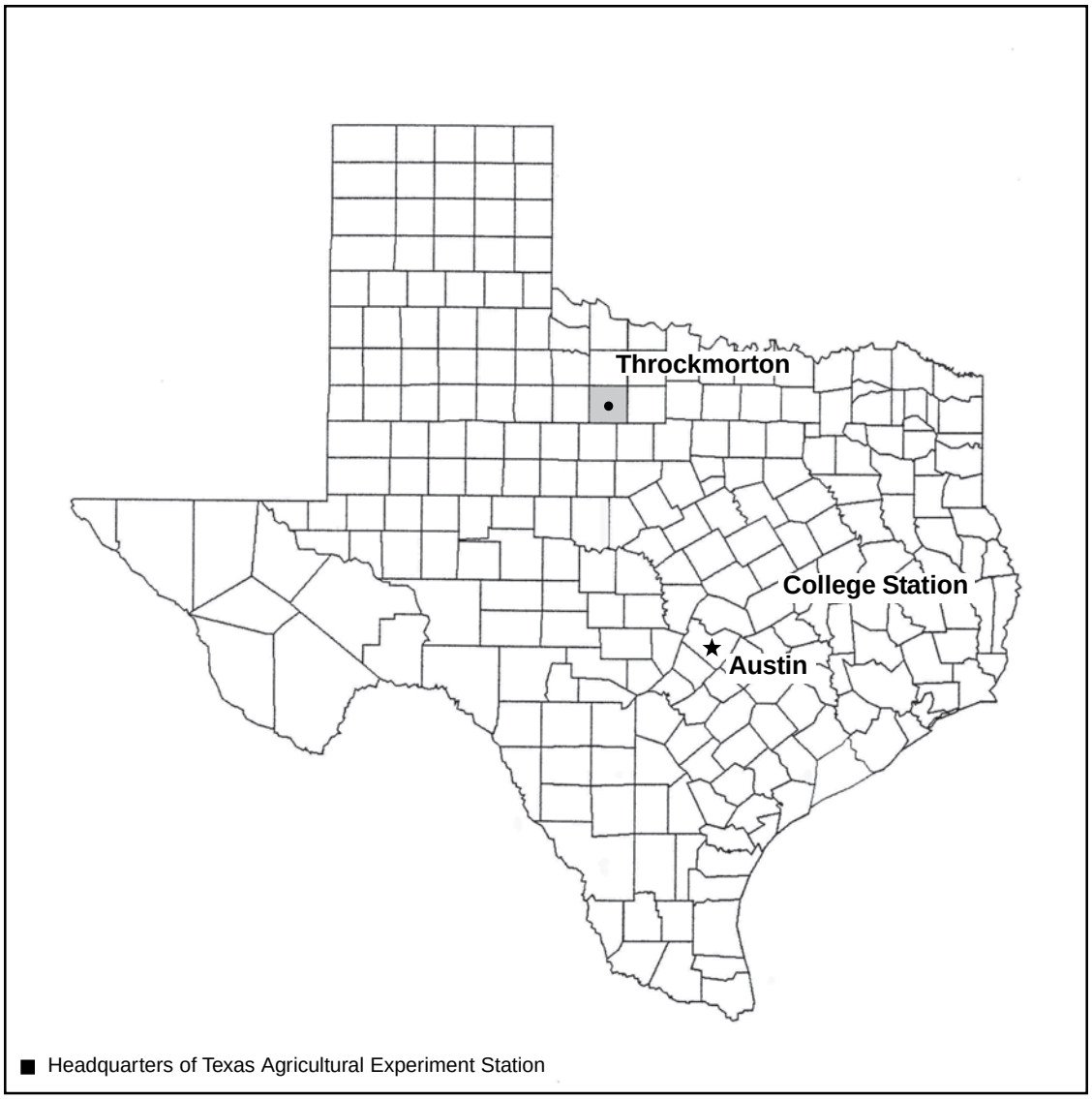


Figure 1.—Location of Throckmorton County in Texas.

general of Confederate forces, served as commander of Camp Cooper from April 9, 1856, to July 22, 1857.

In 1837, the Republic of Texas established Fannin County, which included the area now known as Throckmorton County. In 1858, Throckmorton County was officially established. Williamsburg was designated as county seat. The county was named in honor of Dr. William E. Throckmorton, an early north Texas pioneer and the father of James W. Throckmorton, who later became Governor of Texas. Organization of the county was delayed until 1879, when Throckmorton was named the county seat.

In 1858, the Butterfield Overland Mail stage line began operating with two relay stations in Throckmorton County. One, called the Franz Station, was in an area along the Clear Fork of the Brazos River in southwestern Throckmorton County. In 1859, Indians living on the Comanche Indian Reservation were uprooted and moved to the Oklahoma Indian Territory. In 1861, a few months prior to the start of the Civil War, Camp Cooper was abandoned by Federal troops in the face of building political tension between the North and South.

From 1847 until the start of the Civil War, several settlers moved into the county, living mostly in the vicinity of Camp Cooper. When the camp was abandoned in 1861, most of the settlers moved east into a line of forts that offered protection from the Northern Comanche Indians.

One of the early settlements was known as the Old

Stone Ranch House. It was built in 1856 near the present Throckmorton-Haskell County line. For several years it was the last house seen by immigrants traveling west between the Texas frontier and settlements in New Mexico.

In 1867, following the Civil War, Fort Griffin was established in an area along the Clear Fork of the Brazos River directly south of the Throckmorton-Shackelford County line. With Federal troops in the area, most of the old settlers returned to the county and many new ones arrived.

The first settlements were in areas along the Clear Fork of the Brazos River, where the natural environment was best. Wildlife was abundant in these areas. Vast herds of buffalo roamed in the areas. Buffalo hunters headquartered at Fort Griffin. The first settlers were cattleman who used the open range at will. Later, farmers moved into the survey area and homesteaded on small tracts of land.

In 1871, Colonel Ranald S. Mackenzie began a campaign to remove disenchanted Indians from north Texas. He used the old Camp Cooper site as his base of operation.

In 1881, Federal troops abandoned Fort Griffin, which had served as a protection post, a shipping point and supply center for buffalo hunters, and a trail head for the Dodge Cattle Trail. This event signaled the end of the frontier era of the region.

In 1890, the population of Throckmorton County was 124. It grew to a maximum of 4,275 by 1940 but declined to 2,053 by 1990.

The economy of the county depends primarily on oil and agriculture-related businesses. The majority of the agricultural income is derived from the sale of cattle.

Natural Resources

Soil is an important natural resource in Throckmorton County. Most of the people in the county earn their living by raising cattle and horses or producing forage for livestock or food and fiber for the market or for home consumption.

Oil production is the largest nonagricultural industry in the county. Oil and gas are produced from numerous wells in the county. They provide a major source of income for some landowners and provide a solid tax base from which public services can be funded. Oil wells produce about 6,000 barrels each day.

Water is another natural resource. The Clear Fork of the Brazos River, which flows through the southern part of the county, and the Salt Fork of the Brazos River, which flows through the northeast corner, provide water for livestock, wildlife, and recreation. A rural water system furnishes water to many areas of the county.

The wildlife on the farms and ranches in the county provide opportunities for recreation and are a source of income for many residents. Deer, turkey, and quail are plentiful throughout most of the county.

Other natural resources are gravel and limestone, which are used mainly for road construction.

Climate

Winter weather in Throckmorton County is alternately mild and very cool. Cold fronts repeatedly sweep over the county, causing sharp drops in temperature, but the cold air behind these fronts moderates quickly. Winter precipitation, often snowfall, is light. The total annual precipitation is usually adequate for wheat, sorghum, and range grasses. Summers are hot. The growing season is about 220 days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Throckmorton in the period 1951 to 1988. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 44 degrees F and the average daily minimum temperature is 31 degrees. The lowest temperature on record, which occurred on February 2, 1985, is 5 degrees. In summer, the average temperature is 83 degrees and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred on June 27, 1972, is 113 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 25.40 inches. Of this, nearly 17 inches, or about 65 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 6.5 inches on August 4, 1978. Thunderstorms occur on about 50 days each year.

The average seasonal snowfall is about 5.5 inches. The greatest snow depth at any one time during the period of record was 6 inches. On the average, 3 days of the year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is

about 50 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 75 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 15 miles per hour, in spring.

Duststorms occur occasionally in spring, when strong dry winds blow over unprotected soils. Tornadoes and severe thunderstorms, some of which are accompanied by hail, occur occasionally. These storms are local in extent and of short duration and cause damage in scattered spots.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 in 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 and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area 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-vegetation-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 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. Soil taxonomy, 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 generally are 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 and 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 predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area,

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

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

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 or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map 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 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.

Soil Descriptions

1. Lueders-Throck-Owens

Very shallow to deep, gently undulating or undulating, loamy and clayey soils; on uplands

Lueders soils are very shallow or shallow, cobbly, and loamy. They are on ridgetops and sloping hillsides. Throck soils are moderately deep or deep. They are on hillsides. They formed in material weathered from shale. Owens soils are shallow or moderately deep and are thinly developed over clay and shale. They are on hilly erosional uplands below escarpments.

This map unit makes up about 52 percent of Throckmorton County. It is about 27 percent Lueders soils, 19 percent Throck soils, 11 percent Owens soils, and 43 percent other soils and Oil-waste land (fig. 2).

Typically, the surface layer of the Lueders soils is dark brown cobbly loam about 6 inches thick. The subsoil is dark brown very cobbly loam about 6 inches thick. The underlying material is hard, coarsely fractured limestone bedrock. The soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Throck soils is dark grayish brown silty clay loam about 8 inches thick. The upper part of the subsoil, from 8 to 16 inches, is dark yellowish brown silty clay. The next part, from 16 to 39 inches, is yellowish brown silty clay. The lower part, from 39 to 62 inches, is very pale brown clay loam and light gray loam. The soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Owens soils is light yellowish brown very stony clay about 7 inches thick. The subsoil, from 7 to 17 inches, is light olive gray clay. The underlying material, from 17 to 26 inches, is light gray shale that has clay texture. The soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Abilene, Anson, Aspermont, Clearfork, Knoco, Leeray, Lusk, Nukrum, Nuvalde, Palopinto, Pitzer, Rochelle, Rowden, Rowena, Speck, Springcreek, Swenson, Tillman, and Vernon soils. Abilene, Clearfork, Nukrum, Rowena, and Tillman soils are very deep and loamy. They generally are on alluvial plains or in gently sloping filled valleys, but Clearfork soils are on flood plains. Anson and Nuvalde soils are very deep and loamy. Anson soils formed in eolian deposits on stream terraces. Nuvalde soils are on alluvial plains and in filled valleys. Aspermont soils are very deep and loamy. They formed in calcareous, loamy alluvial material overlying silty and clayey red beds. They are on side slopes below broad, flat plains; on low ridges; and on divides. Knoco and Speck soils are very shallow or shallow. Knoco soils are clayey and formed in red bed shales. Speck soils are loamy and formed in material weathered from hard limestone. They are on uplands. Leeray soils are very deep and clayey. Lusk, Rowden, Swenson, and Vernon soils are moderately deep. Lusk and Rochelle soils are loamy and formed in gravelly stream terrace deposits. Rowden and Swenson soils are loamy and formed in material weathered from limestone. They are on the summits of ridges in the uplands and Vernon soils are clayey and moderately deep to red bed shale.

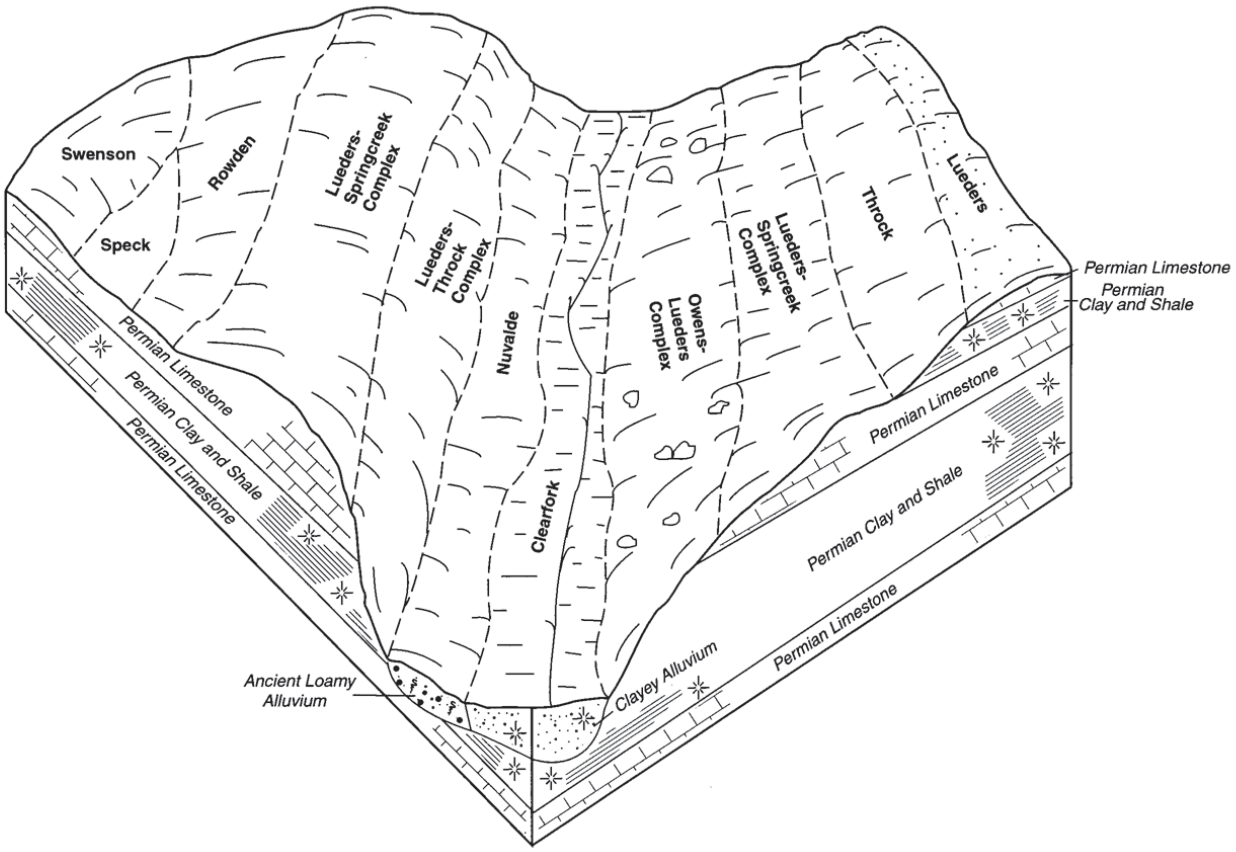


Figure 2.—Typical pattern of soils and underlying material in the Lueders-Throck-Owens general soil map unit

Palopinto and Pitzer soils are very shallow and loamy. Palopinto soils formed in material weathered from limestone on ridges. Pitzer soils formed in gravelly material deposited over limestone and shale on terraces. Springcreek soils are moderately deep and loamy. They formed in loamy material deposited over hard limestone. Oil-waste land is in areas where oil and the accompanying saltwater brine have been deposited on the surface as a result of overflows and spills during oil exploration and production.

The soils in this map unit are used mainly for rangeland and wildlife habitat. Some areas of the Throck soils are used as cropland or pasture. Wheat and forage sorghum are grown in some areas of the more gently sloping Throck soils.

Deer, quail, dove, and small mammals are the main kinds of wildlife. Deer are more numerous where woody vegetation is available for cover. These soils provide nesting areas for doves and songbirds.

The main limitations on sites for roads, dwellings, and other structures are the shrink-swell potential and the danger of soil slippage in areas of the Throck and Owens soils, the cobbles in the Lueders soils, and corrosivity to uncoated steel. The foundations of buildings and roads should be designed and constructed so that they can withstand shrinking and swelling of the soils. In the steeper areas, however, the potential for soil slippage must be considered. Corrosion of underground steel utility lines is rapid unless the lines are protected. Special design and proper installation are needed if septic tank absorption fields are to function properly.

Landscaping and gardening are difficult because of stones or the clay texture of the soils. Because of these limitations and the slope, the soils are poorly suited to recreational uses.

2. Leeray-Sagerton-Rowena

Very deep, nearly level or very gently sloping, clayey and loamy soils; on uplands

These soils are on alluvial plains. They formed in calcareous, clayey, and loamy alluvial sediments.

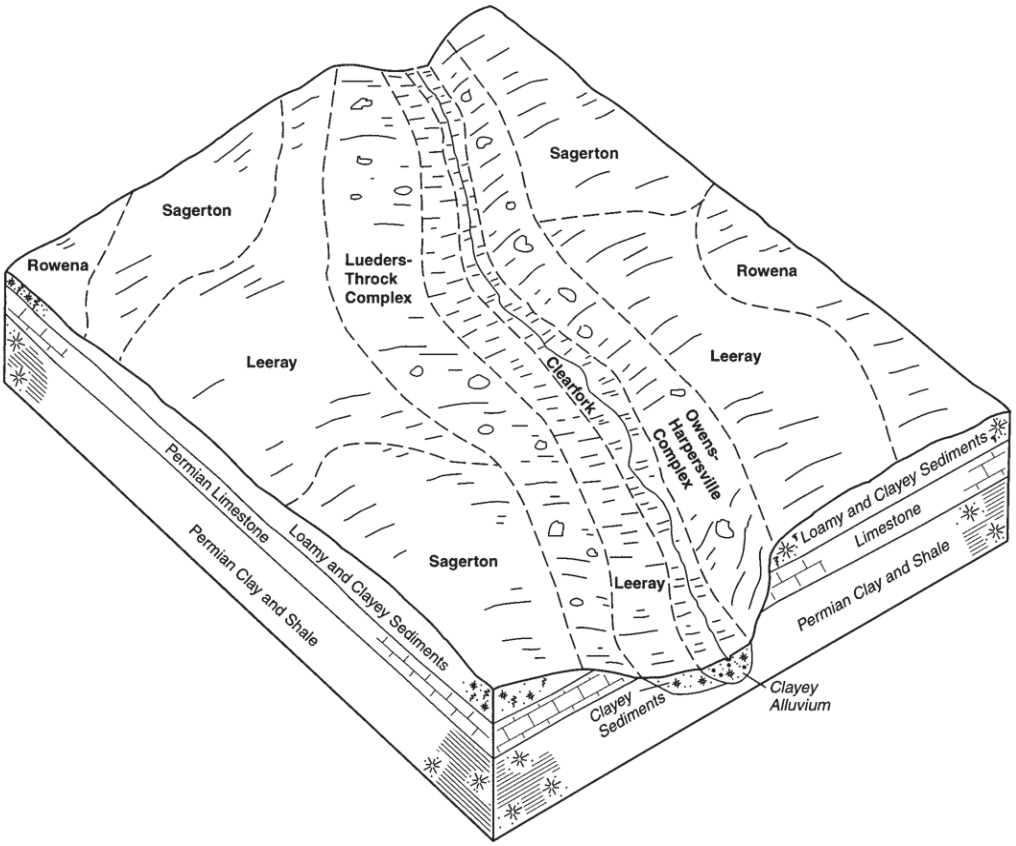


Figure 3.—Typical pattern of soils and underlying material in the Leeray-Sagerton-Rowena general soil map unit

Leeray soils are clayey, and Sagerton and Rowena soils are loamy.

This map unit makes up about 25 percent of Throckmorton County. It is about 34 percent Leeray soils, 20 percent Sagerton soils, 13 percent Rowena soils, and 33 percent other soils (fig. 3).

Typically, the surface layer of the Leeray soils is dark grayish brown and very dark grayish brown silty clay and clay about 19 inches thick. From 19 to 37 inches, the subsoil is dark grayish brown clay. From 37 to 54 inches, it is yellowish brown silty clay. From 54 to 73 inches, it is strong brown silty clay. From 73 to 80 inches, it is strong brown silty clay with an estimated 10 percent, by volume, gypsum crystals. The soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Sagerton soils is reddish brown clay loam about 6 inches thick. The upper part of the subsoil, from 6 to 22 inches, is reddish brown clay loam. The next part, from 22 to 34 inches, is yellowish red clay loam. The lower part, from 34 to 80 inches, is reddish yellow clay and clay loam with about 35 percent calcium carbonate. The soils are slightly alkaline.

Typically, the surface layer of the Rowena soils is dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil, from 7 to 38 inches, is dark grayish brown clay. The lower part, from 38 to 65 inches, is brown and reddish yellow clay loam to silty clay loam with 20 to about 40 percent calcium carbonate. The soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Abilene, Aspermont, Bluegrove, Clearfork, Gageby, Harpersville, Jolly, Lueders, Nukrum, Nuvalde, Owens, Rowden, Speck, Springcreek, Swenson, Throck, Tillman, Vernon, and Witchita soils. Abilene, Aspermont, Clearfork, Gageby, Nuvalde, Tillman, and Wichita soils are very deep and loamy. They generally are on upland plains and terraces near the major streams, but Clearfork and Gageby soils are on flood plains. Bluegrove, Rowden, Springcreek, and

Swenson soils are moderately deep and loamy. Bluegrove soils formed on side slopes underlain by sandstone. Rowden and Swenson soils are on upland plains underlain by limestone. Harpersville and Owens soils are shallow or moderately deep, thinly developed, clayey soils formed in material weathered from shale. Jolly, Lueders, and Speck soils are shallow and loamy. Jolly soils are on hilltops underlain by sandstone and commonly have rock outcrops. Lueders soils are cobbly and are on ridgetops underlain by limestone and on sloping hillsides above limestone outcrops. Speck soils are on uplands and are underlain by limestone. Nukrum soils are very deep and loamy. They are on upland alluvial plains and in gently sloping filled valleys. Throck and Vernon soils are moderately deep or deep. They are on hillsides and formed in clay and weathered shale. Throck soils are loamy, and Vernon soils are clayey.

The soils in this map unit are used mainly as cropland and rangeland. A few areas are used as pasture or for recreational or urban development. The main crops are wheat and cotton. Some forage sorghum and grain sorghum also is grown. The improved pasture grasses are mainly kleingrass and yellow bluestem species.

Dove and quail are the main kinds of wildlife. These soils furnish nesting areas for doves and songbirds.

Buildings and roads can be constructed on these soils, but they should be designed and constructed so that they can withstand shrinking and swelling of the soils. Unprotected areas are muddy following rains. As a result, foot and vehicle traffic is difficult. Corrosion of underground steel utility lines is rapid unless the lines are protected. Special design and proper installation are needed if septic tank absorption fields are to function properly in the soils that have a clayey subsoil.

3. Bluegrove-Thurber-Jolly

Shallow, moderately deep, and very deep, nearly level to gently sloping, loamy soils, some of which are stony; on uplands

Bluegrove soils are moderately deep and are gently sloping or undulating. They are on side slopes. Jolly soils are shallow and are gently sloping or undulating. They are on ridgetops. Both of these soils are underlain by sandstone. Thurber soils are very deep and nearly level. They are on valley side slopes and at heads of streams. They formed in calcareous, clayey alluvial sediments.

This map unit makes up about 9 percent of Throckmorton County. It is about 30 percent Bluegrove soils, 22 percent Thurber soils, 18 percent Jolly soils, and 30 percent other soils (fig. 4).

Typically, the surface layer of the Bluegrove soils is brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from 7 to 12 inches, is reddish brown sandy clay. The lower part, from 12 to 29 inches, is yellowish red clay. It is underlain by reddish yellow sandstone. The soils are slightly alkaline or neutral.

Typically, the surface layer of the Thurber soils is grayish brown clay loam about 4 inches thick. From 4 to 22 inches, the subsoil is dark grayish brown clay. From 22 to 50 inches, it is brown clay that has concretions of calcium carbonate below a depth of 36 inches. From 50 to 62 inches, it is light yellowish brown clay with concretions of calcium carbonate. From 62 to 80 inches, it is light yellowish brown clay loam with masses of calcium carbonate. The soils are slightly alkaline to moderately alkaline.

Typically, the surface layer of the Jolly soils is brown fine sandy loam about 4 inches thick. The subsoil, from 4 to 17 inches, is reddish brown sandy clay. The underlying material is pale yellow, weakly cemented sandstone. Sandstone outcrops in the form of flush surface exposures and occasional boulders are intermingled throughout some areas of this unit. The soils are slightly acid or neutral.

Of minor extent in this map unit are Gageby, Harpersville, Leeray, Newcastle, Owens, Rochelle, Throck, Truce, and Witchita soils. Gageby soils are very deep and loamy. They are on flood plains. Harpersville and Owens soils are shallow to moderately deep, thinly developed clayey soils weathered from shale. They are on ridges and hillsides. Leeray soils are very deep and clayey. They are on upland plains. Newcastle soils are moderately deep and loamy and are underlain by sandstone. Rochelle soils are moderately deep or deep and are loamy. They are on high river terrace remnants and are underlain by gravelly alluvium. Throck soils are deep and loamy. They are on side slopes in the uplands. They formed in clayey material and shale. Truce soils are deep and loamy. They are on upland plains. They formed in material weathered from shale. Wichita soils are very deep and loamy. They are on old river terraces.

The soils in this map unit are used mainly for rangeland, cropland, pasture, and wildlife habitat. A few areas of the Thurber soils are used as cropland. The main crops are oats, wheat, forage sorghum, and grain sorghum. The main pasture grasses are improved bermudagrass, kleingrass, and yellow bluestem species.

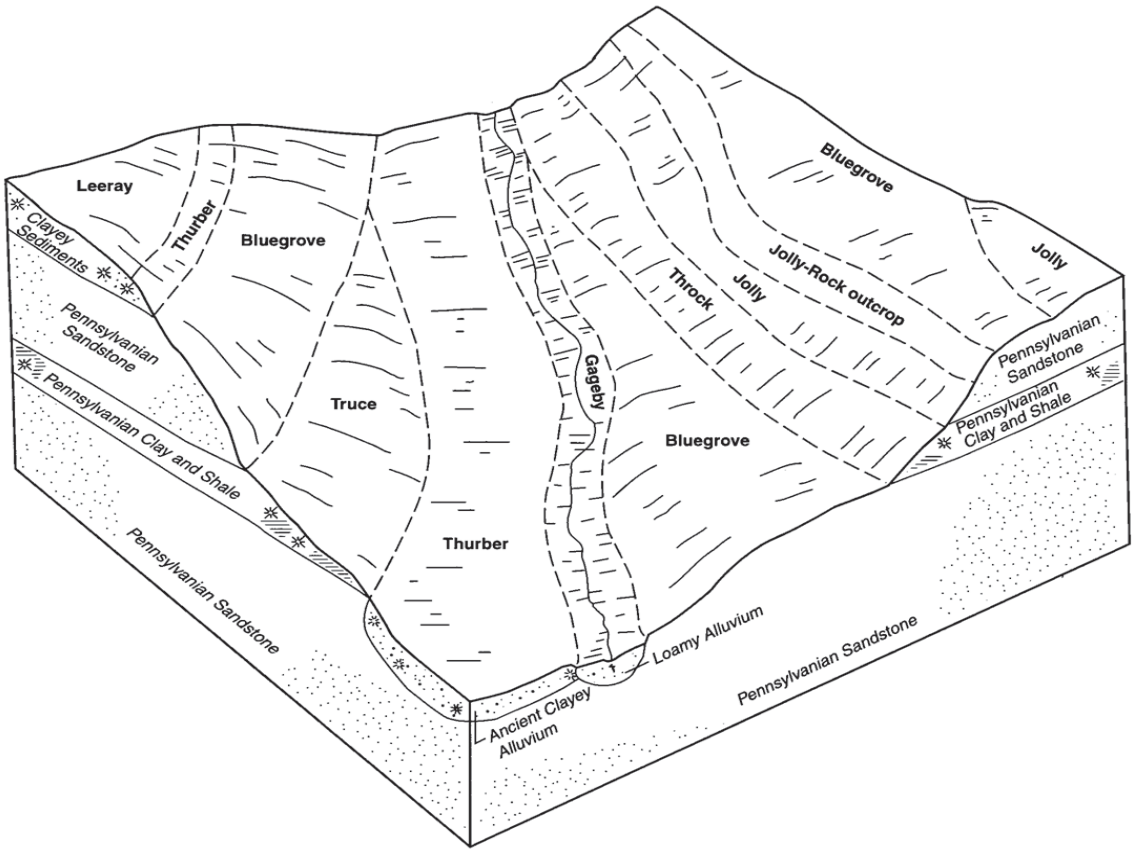


Figure 4.—Typical pattern of soils and underlying material in the Bluegrove-Thurber-Jolly general soil map unit

Deer, turkey, quail, and dove are the main kinds of wildlife. Some areas are managed by ranchers for hunting. Nesting areas for doves, turkeys, and songbirds are plentiful in areas that support trees and tall grasses.

The main limitations on sites for roads, dwellings, and other structures are the depth to bedrock, large stones, and corrosivity to uncoated steel. The shrink-swell potential of the Thurber soils also is a limitation. The foundations of buildings and roads should be designed and constructed so that they can withstand shrinking and swelling of the soils. Foundations can be constructed on solid bedrock in areas of the Bluegrove and Jolly soils, but excavations are difficult because of the bedrock. Corrosion of underground steel utility lines is rapid unless the lines are protected. Special design and proper installation are needed if septic tank absorption fields are to function properly. Pollutants should be kept from passing through the bedrock and contaminating the ground water.

Landscaping and gardening are difficult because of stones and the shallow depth to bedrock in areas of the Jolly soils.

4. Clearfork-Gageby

Very deep, nearly level or very gently sloping, loamy soils; on flood plains

These soils are in flood plains along streams in all parts of the county, including those along the Clear Fork of the Brazos River and the Brazos River. They formed in loamy sediments derived from nearby sources.

This map unit makes up about 8 percent of Throckmorton County. It is about 65 percent Clearfork soils, 17 percent Gageby soils, and 18 percent other soils.

Typically, the surface layer of the Clearfork soils is dark grayish brown silty clay loam and clay loam about 24 inches thick. The upper part of the subsoil, from 24 to 34 inches, is dark grayish brown clay loam.

The lower part, from 34 to 62 inches, is yellowish. brown clay loam and silty clay. The soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Gageby soils is dark brown loam about 22 inches thick. The upper part of the subsoil, from 22 to 58 inches, is brown loam and clay loam with films and threads of calcium carbonate. The lower part, from 58 to 80 inches, is yellowish brown loam.

Of minor extent in this map unit are Bluegrove, Lueders, and Throck soils. Bluegrove soils are moderately deep and loamy. They are on side slopes and ridges underlain by sandstone. Lueders soils are very shallow, cobbly, and loamy. They are on limestone ledges and bluffs along the river. Throck soils are deep and loamy. They are on uplands underlain by shale.

The soils in this map unit are used mainly for cropland, rangeland, pasture, recreational development, and wildlife habitat. They are near the river channel and are occasionally flooded. The flooding occurs once or twice every other year. The floodwater can cover the soils from 2 to 48 hours. The main crop is wheat. Some forage sorghum, grain sorghum, and cotton also is grown.

Deer, turkey, quail, dove, and squirrel are the main kinds of wildlife. Some areas are managed by ranchers for hunting. These soils furnish nesting areas for doves and songbirds.

The Clear Fork of the Brazos River, the Brazos River, and areas alongside the river are scenic and provide opportunities for fishing, swimming, boating, hiking, and other recreational activities.

Flooding is a hazard on these soils and must be considered when playgrounds, camp areas, houses, and roads are planned, designed, and built. Unprotected areas are muddy following rains. As a result, foot and vehicle traffic is difficult. The main limitation on sites for roads, dwellings, and other structures is low strength. Corrosion of underground steel utility lines is rapid unless the lines are protected. Special design and proper installation are needed if septic tank absorption fields are to function properly. Pollutants should be kept from passing through the soils and contaminating the ground water.

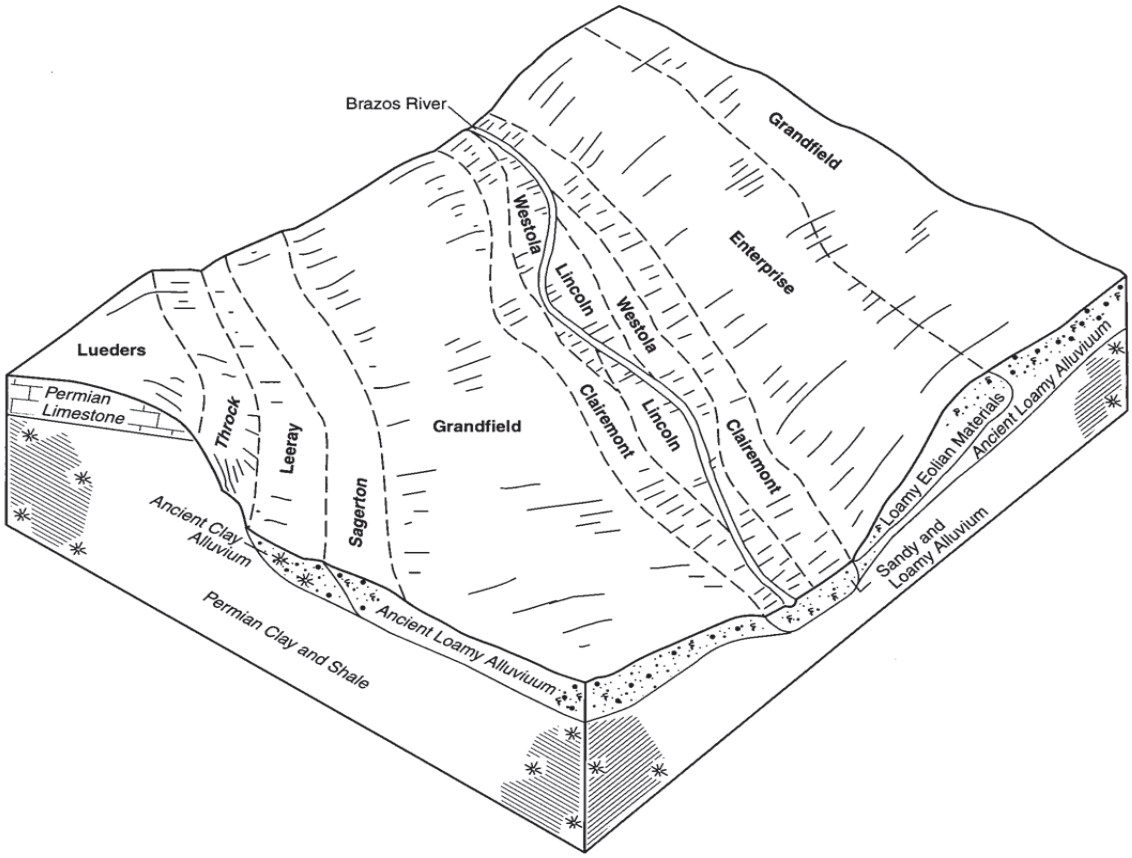


Figure 5.—Typical pattern of soils and underlying material in the Grandfield-Enterprise general soil map unit

5. Grandfield-Enterprise

Very deep, nearly level or very gently sloping, loamy soils; on terraces

These soils are on terraces above the flood plains along the Clear Fork of the Brazos River and the Brazos River. Enterprise soils formed in eolian material, and Grandfield soils formed in alluvial material.

This map unit makes up about 6 percent of Throckmorton County. It is about 26 percent Grandfield soils, 6 percent Enterprise soils, and 68 percent other soils (fig. 5).

Typically, the surface layer of the Grandfield soils is dark brown fine sandy loam about 7 inches thick. From 7 to 24 inches, the subsoil is yellowish red sandy clay loam. From 24 to 38 inches, it is red sandy clay loam. From 38 to 58 inches, it is light red sandy clay loam. From 58 to 80 inches, it is light red fine sandy loam. The soils are slightly acid to moderately alkaline throughout.

Typically, the surface layer of the Enterprise soils is reddish brown very fine sandy loam about 24 inches thick. The subsoil, from 24 to 65 inches, is yellowish red and reddish brown loam. The soils are moderately alkaline throughout.

Of minor extent in this map unit are Bluegrove, Clairemont, Gageby, Jolly, Leeray, Lincoln, Lueders, Sagerton, Throck, Westola, and Wheatwood soils. The moderately deep, loamy Bluegrove soils formed in material weathered from sandstone and shale. The very deep, loamy Clairemont, Gageby, Westola, and Wheatwood soils and the very deep, sandy Lincoln soils are on flood plains. The shallow, loamy Jolly soils are on ridgetops underlain by sandstone. The Leeray and Throck soils are clayey. The Lueders soils are shallow over limestone. Sagerton soils are loamy and on upland plains.

The soils in this map unit are used mainly for cropland, rangeland, pasture, and wildlife habitat. The main crops are small grain, forage sorghum, and grain sorghum. The main pasture grasses are improved bermudagrass, yellow bluestem species, kleingrass, and weeping lovegrass.

Deer, quail, and dove, are the main kinds of wildlife. Some areas are managed by ranchers for hunting. These soils furnish nesting areas for doves and songbirds.

The main limitations on sites for roads, dwellings, and other structures are low strength and corrosivity to uncoated steel. Properly designing and constructing the foundations of buildings and roads can compensate for low strength. Good design and proper installation are needed if septic tank absorption fields are to function properly. Pollutants should be kept from passing through the soils and contaminating the ground water.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some “included” areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, 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, slope, stoniness, salinity, 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, Bluegrove loam, 1 to 8 percent slopes, stony, is a phase of the Bluegrove series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Knoco-Vernon complex, 3 to 12 percent slopes, very bouldery, is an example.

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.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see “Contents”) 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 or miscellaneous areas.

Soil Descriptions

AbA—Abilene clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is on short side slopes and in small depressional areas on uplands. The surface is slightly concave. Slopes average about 0.5 percent. The mapped areas are narrow and elongated and range from 15 to 45 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. From 7 to 15 inches, the subsoil is dark grayish brown clay loam; from 15 to 40 inches, it is dark brown and brown clay; from 40 to 70 inches, it is reddish yellow silty clay loam; and from 70 to 80 inches, it is yellowish red clay. The subsoil is calcareous below a depth of 15 inches.

This soil is well drained. Surface runoff is negligible. Permeability is moderately slow, and 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 slight.

Small areas of noncontrasting Tillman and Sagerton soils are included in this map unit.

Approximately 50 percent of this map unit is rangeland. The remaining 50 percent is cropland.

The natural climax range vegetation consists of short and mid prairie grasses. This soil responds well to brush control and reseeding. The quality of desirable forage can be improved and the quantity increased by proper stocking rates and planned grazing with adequate deferments.

The best adapted range grasses include sideoats grama, johnsongrass, kleingrass, indiangrass, Lehmann lovegrass, blue panicum, and most bluestem species. Brush and weed control, controlled grazing, and timely applications of fertilizer improve yields and forage quality.

When cropped, this soil is best suited to cool-season small grain. Droughtiness is a problem in most years, especially during the summer months. A surface crust tends to form after heavy rains if the surface is bare. This crust reduces the rate of water infiltration, increases the hazards of runoff and erosion, and impedes the emergence of germinating seedlings. Crop residue management, minimum tillage, crop rotation, terraces, and contour farming help to control erosion and conserve soil moisture. Proper management of crop residue helps to maintain productivity and tilth and minimizes surface crusting. Timely applications of fertilizer increase yields in most years.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush control in strips or patterns improves the habitat.

Restricted permeability, a high content of clay, a moderate shrink-swell potential, low strength, and corrosivity to uncoated steel adversely affect most urban uses of this soil. Adequate planning and proper design and construction can minimize the effects of most of these limitations.

This soil is in capability subclass IIc and is in the Clay Loam ecological site.

AnB—Anson fine sand, 0 to 3 percent slopes. This very deep, nearly level or very gently sloping soil is on uplands. Slopes average about 1.5 percent. The surface is convex. The mapped areas are oblong or irregularly shaped and range from 10 to several hundred acres in size. This soil formed as the result of geological wind deposition and shifting.

Typically, the surface layer is light yellowish brown fine sand about 6 inches thick. The subsurface layer, from 6 to 28 inches, is very pale brown loamy fine sand. The subsoil, from 28 to 80 inches, is light gray and very pale brown sandy clay loam with mottles in shades of yellow and brown.

This soil is moderately well drained. Surface runoff is negligible. Permeability is rapid in the sandy surface layer and moderately slow in the subsoil. Available water capacity is low. The root zone is deep. The hazards of water erosion and wind erosion are moderate.

Included in this map unit are Grandfield soils, which make up about 15 percent of any one mapped area. Also included are soils that are closely similar to the Anson soil but have a subsoil at a depth of less than 20 inches or have a subsoil that extends to a depth of 40 to 60 inches. The closely similar soils make up about 15 percent of any one mapped area.

Most areas of the Anson soil are used as rangeland.

This soil is poorly suited to nonirrigated cultivated crops. It is well suited to orchard and truck crops. Crop residue should be maintained on the fine sand surface at all times to prevent excessive wind erosion. Sand

has accumulated in the fence rows around most fields.

This soil is poorly suited to native range plants. An inadequate supply of soil moisture, the low available water capacity, and low fertility are the most limiting factors. The native forage plants are mostly mid and short grasses. Most areas of rangeland support sand lovegrass, little bluestem, purpletop, annuals, shinnery oak, and post oak.

The potential for wildlife habitat is medium. Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is well suited to most urban uses. Restricted permeability, however, limits the use of this soil for septic tank absorption fields.

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

This soil is in capability subclass IIIe and is in the Sandy ecological site.

AsC—Aspermont silty clay loam, 3 to 5 percent slopes. This very deep, gently sloping soil is uplands. It is on convex shoulder slopes and side slopes below broad, flat plains and on low ridges and divides. The surface is convex. Slopes average 3.5 percent. The mapped areas range from 10 to 50 acres in size. The original surface layer has been thinned in most areas by water erosion. In a few areas, all of the topsoil has been eroded away and concretions normally found in the subsoil are exposed on the surface, forming a partial gravel pavement.

Typically, the surface layer is reddish brown, calcareous silty clay loam about 10 inches thick. The upper part of the subsoil, from 10 to 38 inches, is red, calcareous silty clay loam and silt loam. The lower part, from 38 to 65 inches, is red silt loam mixed with partially weathered clay and shale.

This soil is well drained. Surface runoff is low. Permeability and available water capacity are moderate. The root zone is deep. The hazard of water erosion is slight, and the hazard of wind erosion is severe.

Contrasting Knoco and Vernon soils on strongly sloping shoulder slopes and short, steep escarpments of exposed shale and clay parent material make up about 5 percent of this map unit. Small areas of noncontrasting Tillman and Sagerton soils also are part of this unit.

The Aspermont soil is used mostly as rangeland. The normal climax vegetation includes short and mid grasses. The quantity of desirable forage can be increased and the quality improved by proper stocking rates, controlled grazing with adequate deferments, and brush control.

A few small areas of this soil have been seeded to improved pasture grasses. Adapted plant species include sideoats grama, johnsongrass, kleingrass, indiangrass, Lehmann lovegrass, blue panicum, and several bluestem species. Such management practices as brush and weed control, controlled grazing, and timely applications of fertilizer can improve the quality and increase the quantity of desirable forage.

When this soil is cropped, failure to maintain a continuous cover of vegetation or crop residue results in rapid depletion of the surface layer by water erosion. For this reason, small grain is the best suited crop. Droughty conditions occur in most years, especially during the summer months. A surface crust forms easily after rains if the surface is left unprotected. Seedling germination and emergence are adversely affected by such a crust. Practices that help to control erosion and conserve soil moisture include terraces, contour farming, timely but limited tillage, and a protective cover of crop residue. Crop residue management helps to maintain productivity and tilth. Timely applications of fertilizer increase yields in most years.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock and brush control in strips or patterns also can improve the habitat.

This soil is moderately well suited to most urban uses. The content of clay, low strength as it affects streets and roads, and moderate shrinking and swelling with changes in moisture content are the main limitations.

This soil is moderately well suited to recreational uses. The slope in a limitation on sites for playgrounds. Paths and trails are easily eroded.

This soil is in capability subclass IVe and is in the Clay Loam ecological site.

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

Typically, the surface layer is brown fine sandy loam

about 7 inches thick. The upper part of the subsoil, from 7 to 12 inches, is reddish brown sandy clay. The lower part, from 12 to 29 inches, is yellowish red clay. The underlying material, from 29 to 32 inches, is yellow, weakly cemented or strongly cemented sandstone.

This soil is well drained. Surface runoff is very low. Permeability is moderately slow, and available water capacity is low. The root zone is moderately deep. The sandstone that underlies this soil limits the depth to which plant roots can penetrate. Tilth is poor, and a hard crust forms on the surface 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 small areas of Jolly, Owens, Thurber, and Truce soils and small areas of Bluegrove soils that have sandstone fragments on the surface. Included soils make up as much as 20 percent of the map unit.

Most areas of the Bluegrove soil are used as rangeland. Some areas are used as cropland (fig. 6). Small grain and grain sorghum are the main crops. Some areas are managed for wildlife.

Areas of this map unit are inhabited by dove, quail, turkey, and deer. Where woody vegetation is more prevalent, deer and turkey numbers are higher. Forbs and browse provide much of the food for wildlife. Planting small grain winter food plots can improve the habitat for wildlife. Grazing management and range seeding with food- and cover-producing grasses, forbs, and legumes also can improve the habitat.

This soil is well suited to cultivated crops. The depth to sandstone bedrock and the available water capacity are the most limiting factors. Crop residue management helps to control water erosion and wind erosion and conserves soil moisture. Contour farming and terraces are needed to conserve soil moisture and reduce the hazard of water erosion.

This soil is well suited to native range plants. The climax plant community is a mixture of mid and short grasses with scattered live oak and post oak. Most areas of rangeland support Texas wintergrass, vine mesquite, tall dropseed, threeawns, mesquite, pricklypear, and annuals.

This soil is poorly suited to most urban uses. The depth to bedrock is the most limiting factor. Low strength is an additional limitation on sites for local roads and streets.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Tight Sandy Loam ecological site.

BeD—Bluegrove loam, 1 to 8 percent slopes, stony. This moderately deep, gently sloping to moderately sloping soil is on uplands. The surface is convex. Slopes are complex. They average about 4 percent but range from 1 to 8 percent. The mapped areas are irregular in shape and range from 15 to more than 50 acres in size.

Typically, the surface layer is dark brown loam about 2 inches thick. About 1 to 5 percent of the surface is covered with sandstone fragments. The subsoil, from 2 to 22 inches, is reddish brown clay. The underlying material, from 22 to 30 inches, is yellow, weakly cemented or strongly cemented sandstone.

This soil is well drained. Surface runoff is very low to medium. Permeability is moderately slow, and available water capacity is low. The root zone is moderately deep. The hazards of water erosion and wind erosion are slight because of the stones on the surface.

Some areas of this map unit have inclusions of Jolly and Truce soils. Also included are small areas of Bluegrove soils that have only a few sandstone fragments and a soil that is closely similar to the Bluegrove soil but has more than 35 percent sandstone fragments in the surface layer. Included soils make up less than 25 percent of any one mapped area.

Stoniness precludes the use of the Bluegrove soil as cropland.

This soil is used exclusively as rangeland. It is well suited to this use. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses with scattered live oak and post oak. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite trees, post oak, catclaw acacia, and annuals.

The potential for wildlife habitat is medium. Areas of this map unit are inhabited by deer, turkey, quail, and dove. Woody species provide good cover for these species of wildlife. Continuous overgrazing has caused oaks and elms to increase in abundance and grasses and forbs to decrease. Patterned brush management and grazing management can improve the habitat for wildlife. Establishing winter food plots on the deeper nearby soils can improve the habitat for deer.

This soil is poorly suited to most urban uses. The depth to bedrock is the most limiting factor.

This soil is moderately well suited to recreational uses. Playgrounds are affected by large stones on the surface and by the slope.

This soil is in capability subclass VIs and is in the Sandstone Hill ecological site.

Cm—Clairemont silt loam, occasionally flooded. This very deep, nearly level soil is on the flood plains

Figure 6.—An area of Bluegrove fine sandy loam, 1 to 3 percent slopes, used as cropland.

along the Clear Fork of the Brazos River. Slopes generally are less than 1 percent but are undulating in places. The mapped areas are long and narrow and range from 80 to several hundred acres in size. The soil is flooded once every 3 to 7 years.

Typically, the surface layer is reddish brown silt loam about 5 inches thick. The underlying material, from 5 to 65 inches, consists of alternating strata of reddish brown silty clay loam, silt loam, and clay loam.

This soil is well drained. Surface runoff is negligible. Permeability is moderate, and available water capacity is high. The root zone is deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are slight.

Included in this map unit are some areas of Clearfork and Westola soils. Also included are small areas adjacent to sloughs where slopes are more than 1 percent and areas where the surface layer is silt loam. Included soils make up less than 10 percent of any one mapped area.

The Clairemont soil is used mainly as cropland. Small grain, cotton, and grain sorghum are the main crops. The potential for cultivated crops is high. Keeping crop residue on or near the surface increases the rate of water infiltration, conserves soil moisture, and helps to control wind erosion. Contour farming and terraces are needed to conserve soil moisture.

Areas of this map unit are inhabited by deer, turkey, squirrel, dove, quail, furbearers, and numerous reptiles and amphibians. Turkeys commonly use the larger trees for roosting. Many choice plants provide resting and escape cover for deer and turkey. The tall grasses provide ideal nesting sites. Grazing management improves the habitat for wildlife. Small grain plots provide food for deer and turkey.

This soil is poorly suited to most urban uses. Flooding is the most restrictive factor.

Flooding restricts the use of this soil for recreational development.

This soil is in capability subclass IIw and is in the Loamy Bottomland ecological site.

Co—Clearfork silty clay loam, occasionally flooded. This very deep, nearly level soil is on the flood plains along the Brazos River and other major streams. Slopes are 0 to 1 percent. The mapped areas are long and narrow and range from 10 to 200 acres in size. This soil is flooded about once every 3 to 20 years.

Typically, the surface layer is dark grayish brown silty clay loam and clay loam about 24 inches thick.

The upper part of the subsoil, from 24 to 34 inches, is dark yellowish brown clay loam. The lower part, from 34 to 62 inches, is yellowish brown clay loam and silty clay.

This soil is well drained. Surface runoff is negligible. Permeability is moderately slow, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Included in this map unit are small areas of Clairemont soils near stream channels and soils that are similar to Clairemont soils but have a lighter colored surface layer or have less than 35 percent clay. Included soils make up less than 15 percent of any one mapped area.

The clearfork soil is used mainly as cropland, small grain, grain sorghum, and cotton are the main crops. The potential for cultivated crops is high. Keeping crop residue on or near the surface conserves soil moisture and helps to control runoff.

The major hazard in areas of cropland is flooding (fig. 7). Grain sorghum, forage sorghum, and small grain are the major crops. Keeping crop residue on the surface conserves soil moisture and helps to control runoff.

This soil is well suited to pasture. Improved Haskell sideoats grama, bluestem species, and kleingrass are adapted pasture plants.

Areas of this map unit are inhabited by deer, turkey, squirrel, dove, quail, furbearers, and numerous reptiles and amphibians. Turkeys commonly use the larger trees for roosting. Many choice plants provide resting and escape cover for deer and turkey. The tall grasses provide ideal nesting sites. Grazing management improves the habitat for wildlife. Small grain plots provide food for deer and turkey.

This soil is poorly suited to urban uses because of flooding.

This soil is moderately suited to most recreational uses. Flooding is the most limiting feature.

This soil is in capability subclass IIw and is in the Loamy Bottomland ecological site.

EnB—Enterprise very fine sandy loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is on uplands. The surface is convex. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 15 to more than 50 acres in size.

Typically, the surface layer is reddish brown very fine sandy loam about 24 inches thick. The subsoil, from 24 to 65 inches, is yellowish red and reddish brown loam.

This soil is well drained. Surface runoff is negligible. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are moderate.

Included with this soil in mapping are areas of Grandfield and Clairemont soils. These soils are in areas that are 1 to 5 acres in size. They make up less 15 percent of any one mapped area. Also included, mainly on escarpments along the Brazos River, are areas where slopes are as much as 8 percent.

The Enterprise soil is used mainly as cropland. Small grain, forage sorghum, and grain sorghum are the main crops. Keeping crop residue on the surface conserves soil moisture and helps to control runoff.

This soil is well suited to native range plants. The climax vegetation is mostly mid and tall grasses.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is well suited to pasture. Improved sideoats grama, bluestem species, and kleingrass are adapted pasture plants.

This soil is moderately well suited to urban and recreational uses.

This soil is in capability subclass IIe and is in the Sandy Loam ecological site.

Ga—Gageby loam, occasionally flooded. This very deep, nearly level or very gently sloping soil is on the flood plains along local streams. Slopes average 0.5 percent but range from 0 to 2 percent. The mapped areas are long and narrow and are parallel to stream channels. They range from 10 to about 200 acres in size. Flooding occurs about once every 5 to 12 years unless the soil is protected.

Typically, the surface layer is dark brown loam about 22 inches thick. The upper part of the subsoil, from 22 to 58 inches, is calcareous, brown loam and clay loam with films and threads of calcium carbonate. The lower part, from 58 to 80 inches, is calcareous, yellowish brown loam.

This soil is well drained. Surface runoff is negligible or very low. Permeability is moderate, and available water capacity is high. The root zone is deep, and plant roots can penetrate the soil easily. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are Nukrum and Clearfork soils, which have a surface layer of loam or sandy clay loam. Also included are soils that are

Figure 7.—An area of Clearfork silty clay loam, occasionally flooded, used as cropland. The major limitation is flooding for brief periods.

similar to the Gageby soil but are noncalcareous to a depth of 40 inches. Included soils make up as much as 20 percent of most mapped areas.

The Gageby soil is used as both cropland and rangeland. A few areas are used for native pecan trees. The main crops are small grain, grain sorghum, and forage sorghum.

This soil is well suited to nonirrigated and irrigated small grain, grain sorghum, and forage sorghum. An inadequate supply of soil moisture is the most limiting factor. Keeping crop residue on the surface conserves soil moisture.

This soil is well suited to native range plants, but flooding can be hazardous to livestock and can limit the use of equipment. The climax plant community is a mixture of tall and mid grasses. Most areas of rangeland support Texas wintergrass, silver bluestem, Canada wildrye, bermudagrass, and mesquite, post oak, hackberry, pecan, and elm trees. The main management needs are proper stocking rates, controlled grazing, and brush management.

Areas of this map unit are inhabited by dove, quail, deer, turkey, and squirrel. Deer, turkey, and squirrel are more abundant where woody vegetation provides feeding and escape cover. Other species of small mammals and birds feed, rest, and raise their young in these areas. Forbs, browse, mast, and some seed-producing grasses provide food for the wildlife. Grazing management and brush management can improve the habitat for wildlife.

This soil is poorly suited to most urban uses. Flooding is a severe hazard that is very difficult to overcome.

This soil is moderately suited to most recreational uses. Flooding restricts the use of this soil for playgrounds and camp areas.

This soil is in capability subclass IIw and is in the Draw ecological site.

GdB—Grandfield loamy fine sand, 0 to 3 percent slopes. This very deep, nearly level or very gently sloping soil is on high terraces along the Brazos River. Slopes average about 1.5 percent. The mapped

areas are irregular in shape and range from 15 to several hundred acres in size.

Typically, the surface layer is light brown loamy fine sand about 6 inches thick. The upper part of the subsoil, from 6 to 18 inches, is reddish brown sandy clay loam. The next part, from 18 to 28 inches, is reddish yellow sandy clay loam. The lower part, from 28 to 80 inches, is reddish yellow fine sandy loam.

This soil is well drained. Surface runoff is negligible or very low. Permeability and available water capacity are moderate. The root zone is deep. The hazards of water erosion and wind erosion are moderate.

Some areas of this map unit have inclusions of Wichita soils or Grandfield soils with slopes of 0 to more than 5 percent. These included soils make up less than 15 percent of any one mapped area. Also included are soils that have dark brown layers and soils that have a subsoil of fine sandy loam.

The Grandfield soil is used mostly as rangeland, but some areas are used as cropland. The main crops are small grain and grain sorghum.

This soil is well suited to nonirrigated and irrigated small grain and grain sorghum. An inadequate supply of soil moisture is the most limiting factor in nonirrigated areas. Keeping crop residue on the surface conserves soil moisture and helps to control water erosion and wind erosion. If the soil is irrigated in dry years, a properly designed irrigation system and proper applications of water and fertilizer are needed.

This soil is moderately suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The climax plant community is a tall grass prairie dominated by big bluestem, little bluestem, switchgrass, indiangrass, scattered plots of oaks, and an abundance of forbs. Because of past grazing history, many areas have dense stands of post oak, blackjack oak, greenbriar, and mesquite and grasses consist of threeawns, sand dropseed, sand paspalum, and gummy lovegrass. Proper grazing use, deferred grazing, and brush management are needed to improve the plant community.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is moderately suited to most urban uses. Restricted permeability and seepage are the most limiting factors.

This soil is well suited to most recreational uses.

This soil is in capability subclass IIIe and is in the Loamy Sand ecological site.

GfB—Grandfield fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level or very gently sloping soil is on high terraces along the Brazos River. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 15 to several hundred acres in size.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from 7 to 58 inches, is yellowish red, red, and light red sandy clay loam. The lower part, from 58 to 80 inches, is light red fine sandy loam.

This soil is well drained. Surface runoff is negligible or very low. Permeability and available water capacity are moderate. The root zone is deep. The hazards of wind erosion and water erosion are moderate.

Some areas of this map unit have inclusions of Wichita soils or Grandfield soils with slopes of 0 to more than 5 percent. These included soils make up less than 15 percent of any one mapped area. Also included are soils that are closely similar to the Grandfield soil but have dark brown layers and soils that have a subsoil of loamy fine sand.

The Grandfield soil is used mostly as rangeland, but some areas are used as cropland. The main crops are small grain and grain sorghum.

This soil is well suited to nonirrigated and irrigated small grain and grain sorghum. An inadequate supply of soil moisture is the most limiting factor in nonirrigated areas. Keeping crop residue on the surface conserves soil moisture and helps to control water erosion and wind erosion. In dry years tillage is needed to control wind erosion when crop residue does not furnish adequate protection. If the soil is irrigated, a properly designed irrigation system and proper applications of water and fertilizer are needed.

This soil is moderately suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses with scattered live oak and post oak. Most areas of rangeland support silver bluestem, sideoats grama, purpletop, Texas grama, threeawns, mesquite trees, and annuals.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is moderately suited to most urban uses. Restricted permeability and seepage are the most limiting factors.

This soil is well suited to most recreational uses.

This soil is in capability subclass IIe and is in the Sandy Loam ecological site.

JoC—Jolly fine sandy loam, 2 to 5 percent slopes. This shallow, gently sloping soil is on uplands. Slopes average about 3.5 percent. The surface is convex. The mapped areas are elongated or rounded and range from 5 to 100 acres in size. Wind erosion and water erosion have thinned the topsoil on many ridgetops and summits. In places, the topsoil has been completely removed and the subsoil is exposed. Small gullies, 2 to 4 feet wide and 1 to 3 feet deep, are on the steeper shoulder slopes and extend to the lower side slopes in about 10 percent of the areas.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil, from 4 to 17 inches, is reddish brown sandy clay loam. The underlying material, from 17 to 23 inches, is pale yellow, weakly cemented sandstone.

This soil is well drained. Surface runoff is very low or low. Permeability is moderate, and available water capacity is low because of the shallow depth to bedrock. The root zone is shallow. The hazard of water erosion is moderate or severe, depending on the slope and the percent of rock cover. The hazard of wind erosion is moderate.

Included in this map unit are Newcastle and Bluegrove soils in the higher areas on ridgetops. These soils are similar to the Jolly soil. They make up about 20 percent of the map unit. Also included are the contrasting Owens and Vernon soils directly below the sandstone outcrops on side slopes and foot slopes and soils that are very shallow over sandstone bedrock. The contrasting soils make up about 10 percent of the map unit.

The Jolly soil is used mainly as rangeland. A few small areas are used improved pasture. Some areas have been cropped in the past, but most of these areas are being converted back to grassland because of rapid erosion and exposure of bedrock.

The climax native plant community is a mid grass prairie with some tall grasses on shoulder slopes. North-facing slopes have a better potential for plant growth than south-facing slopes because they receive less direct sunlight. Runoff from areas of exposed rock supplements rainfall in soil areas and increases yields. Surface crusting occurs if the surface is allowed to become devoid of a vegetative cover. The crust hinders seed germination and accelerates erosion. Brush control, reseeding, proper stocking rates, and planned grazing improve the quality and increase the quantity of desirable forage. The improved vegetative cover, in turn, reduces soil and water losses.

Adapted improved pasture grasses include Haskell sideoats grama, kleingrass, Caucasian bluestem, King Ranch bluestem, plains bluestem, and old world bluestem. Good management includes brush and weed control, controlled grazing, and timely applications of fertilizer. These practices improve forage quality and increase yields in most years.

Areas of this map unit are inhabited by dove, quail, turkey, and deer. Where woody vegetation is more prevalent, deer and turkey numbers are higher. Forbs and browse provide much of the food for wildlife. Planting small grain winter food plots can improve the habitat for wildlife. Grazing management and range seeding with food- and cover-producing grasses, forbs, and legumes also can improve the habitat.

The slope and the shallow depth to bedrock restrict the use of this soil for most kinds of urban and recreational development. Many areas are adjacent to and overlooking flood plains. As a result, they are especially desirable as homesites. Thoughtful planning and proper design can minimize the effects of most soil-related restrictions.

This soil is in capability subclass IVe and is in the Tight Sandy Loam ecological site.

JrD—Jolly-Rock outcrop complex, 1 to 8 percent slopes, very stony. This shallow, gently sloping or moderately sloping complex is on uplands. Slopes average about 4 percent. The surface is convex. The mapped areas are elongated or rounded and range from 30 to more than 50 acres in size. Wind erosion and water erosion have thinned the topsoil on many ridgetops and summits. In places, the topsoil has been completely removed and the subsoil is exposed. Small gullies, 2 to 4 feet wide and 1 to 3 feet deep, are on the steeper side slopes and extend to the lower side slopes in about 15 percent of the areas.

A typical area of this map unit is 60 percent Jolly soil, 20 percent Rock outcrop, and 20 percent included soils and Oil-waste land. Sandstone fragments averaging 8 inches across typically cover about 5 percent of the surface.

The Jolly soil and sandstone rock outcrops in the form of flush surface exposures are intermingled throughout this map unit and cannot be separated at the map scale used. Additional rock outcrops in the form of stones and boulders protruding through the soil surface form narrow rock outcrop contours on shoulder slopes in about 40 percent of the areas. These stones and boulders range from 2 to 8 feet across and cover 8 to 35 percent of the surface. Flush sandstone outcrops on summits range from 2 to 12 feet across and cover 1 to 5 percent of the surface. Flagstones and a few isolated boulders cover as much

as 3 percent of the surface on side slopes below the rock outcrop contours.

Typically, the surface layer of the Jolly soil is brown fine sandy loam about 3 inches thick. The subsoil, from 3 to 15 inches, is reddish brown and brown sandy clay loam. The underlying material, from 15 to 18 inches, is light yellowish brown sandstone that is weakly cemented in the upper part and strongly cemented in the lower part.

The Jolly soil is well drained. Surface runoff is very low to medium. Permeability is moderate, and available water capacity is low because of the shallow depth to bedrock. The root zone is shallow. The hazard of water erosion is moderate or severe, depending on the slope and the percent of rock cover. The hazard of wind erosion is slight.

Contrasting Owens, Harpersville, and Throck soils on the upper side slopes directly below rock outcrop contours, short, steep escarpments with extremely bouldery surfaces, and small spots of Oil-waste land make up about 20 percent of this map unit. Small areas of the noncontrasting Bluegrove soils also are part of this unit.

This complex is used mainly as rangeland. The climax native plant community is a mid grass prairie with some tall grasses on shoulder slopes. North-facing slopes have a better potential for plant growth than south-facing slopes because they receive less direct sunlight. Runoff from areas of exposed rock supplements rainfall in soil areas and increases yields. Surface crusting occurs if the surface is allowed to become devoid of a vegetative cover. The crust hinders seed germination and accelerates erosion. Brush control, reseeding, proper stocking rates, and planned grazing improve the quality and increase the quantity of desirable forage. The improved vegetative cover, in turn, reduces soil and water losses.

Adapted improved pasture grasses include Haskell sideoats grama, kleingrass, Caucasian bluestem, King Ranch bluestem, plains bluestem, and old world bluestem. Good management includes brush and weed control, controlled grazing, and timely applications of fertilizer. These practices improve forage quality and increase yields in most years.

Areas of this map unit are inhabited by deer, turkey, quail, and dove. Woody species provide good cover for these species of wildlife. Continuous overgrazing has caused oaks and elms to increase in abundance and grasses and forbs to decrease. Patterned brush management and grazing management can improve the habitat for wildlife. Establishing winter food plots on the deeper nearby soils can improve the habitat for deer.

The shallow depth to bedrock and the slope restrict the use of this map unit for most kinds of urban and recreational development. Many areas are adjacent to and overlooking flood plains. As a result, they are especially desirable as homesites. Thoughtful planning and proper design can minimize the effects of most soil-related restrictions.

The Jolly soil is in capability subclass VIs and in the Sandstone Hill ecological site. The Rock outcrop is in capability subclass VIIIs and is not assigned to a ecological site.

KrE—Knoco-Vernon complex, 3 to 12 percent slopes, very bouldery. The shallow or moderately deep soils in this complex are on gently sloping, elongated side slopes and in strongly sloping headcut areas, most of which are breaks or transition areas from uplands to flood plains or drainageways. Short, steep escarpments generally occur at the point of contact of this map unit with deeper upland soils. Geologic erosion is active, and numerous small drainageways and gullies dissect the unit. Slopes are mainly convex and are 3 to 12 percent. The mapped areas are long and narrow adjacent to drainageways and irregularly shaped in headcut areas. They range from 20 to about 500 acres in size.

A typical area of this complex is 42 percent Knoco soil, 33 percent Vernon soil, 15 percent badland, and 10 percent included soils. The Knoco soil is on severely eroded knolls and the steeper side slopes. The Vernon soil is on the more stable foot slopes. Badland is on severely eroded knolls; on short, steep escarpments; and in narrow interfluve areas. Geologic erosion has removed much, if not all, of the topsoil. Concentrations of concretionary gravel, originally in the subsoil, cover 25 to 50 percent of the surface. The soils in this map unit are so intricately mixed or are in areas are so small that it was not practical to map them separately at the map scale used.

Typically, the surface layer of Knoco soil is reddish brown, calcareous clay about 11 inches thick. The underlying material, from 11 to 32 inches, is reddish brown, calcareous shale with clay texture. Masses and concretions of calcium carbonate are common in the topsoil.

The Knoco soil is well drained. Surface runoff is high or very high. Permeability is very slow, and 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.

Typically, the surface layer of the Vernon soil is reddish brown, calcareous clay about 5 inches thick. The subsoil, from 5 to 26 inches, is reddish brown,

calcareous clay. The underlying material, from 26 to 65 inches, is shale with clay texture. It is mottled in shades of red and gray.

The Vernon soil is well drained. Surface runoff is high or very high. Permeability is very slow, and available water capacity is low or moderate. The root zone is moderately deep. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Closely similar soils and rock outcrops are on gently sloping ridgetops and shoulder slopes. Clairemont soils are on very narrow flood plains along watercourses, and there are also small areas of Oil-waste land. Included soils make up about 15 percent of this map unit.

This complex is used as rangeland. It is not suited to cropland or improved pasture. The annual production of adapted short and mid range grasses varies, depending on soil depth and annual rainfall. Surface crusting and scalding become severe when vegetation is removed. Brush control and planned grazing with adequate deferments improve the quality and increase the quantity of desirable forage. Poor growth or absence of a vegetative cover results in an inadequate availability of food and cover for wildlife.

Areas of this map unit are inhabited by dove and quail. Deer and turkey may feed on forbs in these areas and use cover on the adjacent soils. Grazing management and patterned brush management can improve the habitat for wildlife. Small patchwork plantings of woody species that provide food and cover can increase the diversity of wildlife species.

A high shrink-swell potential, a high content of clay, the slope, low strength, restricted permeability, corrosivity to uncoated steel, the severe hazard of water erosion, and the droughty nature of these soils severely limit the use of this complex for urban and recreational development.

The Knoco soil is in capability subclass VIIs and is in the Very Shallow Clay ecological site. The Vernon soil is in capability subclass VIe and is in the Shallow Clay ecological site.

LeA—Leeray silty clay, 0 to 2 percent slopes. This very deep, nearly level soil is on uplands. Slopes average about 1 percent. The mapped areas are irregularly shaped and range from 15 to several hundred acres in size. Undisturbed areas have gilgai microrelief. Microknolls are 4 to 12 inches higher than microdepressions. Cycles of knolls and depressions are repeated every 10 to 30 feet.

Typically, the surface layer is dark grayish brown and very dark grayish brown silty clay and clay about 19 inches thick. The upper part of the subsoil, from 19 to 37 inches, is dark grayish brown clay. The next part, from 37 to 73 inches, is yellowish brown and strong brown silty clay. The lower part, from 73 to 80 inches, is strong brown silty clay with an estimated 10 percent gypsum crystals.

This soil is well drained. Surface runoff is low or medium. Water penetrates the surface rapidly when the soil is dry and cracked and very slowly when the soil is moist. Permeability is very slow, and available water capacity is moderate. The root zone is deep. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Included in this map unit are some small areas of Nuvalde and Nukrum soils. Also included are small areas with slopes of more than 2 percent and soils that are closely similar to the Leeray soil but are underlain by limestone bedrock at a depth of 20 to 40 inches. Included soils make up less than 20 percent of any one mapped area.

The Leeray soil is used as rangeland and cropland (fig. 8). The main crops are cotton, small grain, and grain sorghum.

The potential for cotton, small grain, and grain sorghum is medium. Keeping crop residue on or near the surface helps to control water erosion and wind erosion and conserves soil moisture.

The potential for native range plants is high. An inadequate supply of soil moisture is the most limiting factor. Yields of short and mid grasses are good during favorable years.

The potential for wildlife habitat is medium. Areas of this map unit are inhabited by dove, quail, and small mammals. Plants supply adequate food and provide cover for the wildlife. Scattered small plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock and brush management in strips or patterns also can improve the habitat.

The potential for most urban uses is poor. A very high shrink-swell potential, low strength, and corrosivity to uncoated steel are the most restrictive features. They can be overcome by good design and careful installation procedures.

The potential for recreational uses is moderate. The clayey texture and restricted permeability are limitations.

This soil is in capability subclass IIe and is in the Clayey Upland ecological site.

Ln—Lincoln sandy loam, occasionally flooded. This very deep, nearly level or gently undulating soil is on the flood plains along local streams. Slopes average about 1.5 percent but range from 0 to 3 percent. The soil is flooded for short periods about once every 4 years. In low areas water ponds for 3 to 6 days following periods of flooding. The mapped

Figure 8.—An area of Leeray silty clay, 0 to 2 percent slopes, used as rangeland. The ecological site is Clayey Upland.

areas occur as long and narrow, meandering basins and ridges and range from 10 to several hundred acres in size.

Typically, the surface layer is yellowish red sandy loam about 7 inches thick. The subsoil, from 7 to 80 inches, is reddish yellow loamy fine sand, fine sand, and coarse sand and gravel.

This soil is somewhat excessively drained. Surface runoff is negligible. Permeability is rapid, and available water capacity is low. The root zone is deep. The hazard of water erosion is slight, and the hazard of wind erosion is severe.

Included in this map unit are Westola, Clairemont, and closely similar soils to Lincoln which make up about 15 percent of any one mapped area. Also included are areas on ridges where the surface layer is loamy fine sand to fine sand and low areas where the surface layer is silty clay loam to silty clay and is 5 to 8 inches thick. These inclusions make up 20 to 40 percent of some areas.

The Lincoln soil is used mostly as rangeland. A few areas are used as improved pasture, which supports mainly coastal bermudagrass and weeping lovegrass.

This soil is poorly suited to nonirrigated cultivated crops because of droughtiness and wind erosion. A cover of crop residue helps to prevent excessive wind erosion. Sand has accumulated in the fence rows around most fields.

This soil is poorly suited to native range plants. An inadequate supply of soil moisture, the low available water capacity, and low fertility are the most limiting

factors. The native forage plants are mostly mid and short grasses. Most areas of rangeland support sand lovegrass, little bluestem, purpletop, and annuals.

Areas of this map unit provide fair habitat for dove and quail. They are inhabited by deer, turkey, squirrel, dove, quail, and furbearers. Turkeys commonly use the larger trees for roosting. Many choice plants provide resting and nesting sites and escape cover for deer and turkey. Grazing management improves the habitat for wildlife. Small grain plots provide food for deer and turkey.

This soil is poorly suited to most urban and recreational uses because of flooding.

This soil is in capability subclass IVs and is in the Sandy Bottomland ecological site.

LrC—Lueders cobbly loam, 1 to 5 percent slopes. This shallow, gently sloping or undulating soil is on uplands. Slopes average about 3 percent. The mapped areas are irregularly shaped and range from 25 to several hundred acres in size.

Typically, the surface layer is dark brown cobbly loam about 6 inches thick. The subsoil, from 6 to 12 inches, is dark brown very cobbly loam. The underlying material, from 12 to 24 inches, is coarsely fractured limestone bedrock.

This soil is well drained. Surface runoff is very low or low. Permeability is moderate, and available water capacity is very low. The root zone is very shallow. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are some small areas of Pitzer and Springcreek soils. Also included are small areas of rock outcrop. Inclusions make up less than 20 percent of any one mapped area.

The Lueders soil is used mostly as rangeland. A few areas are quarried for limestone. The potential for native range plants is medium. An inadequate supply of soil moisture, the very shallow root zone, and the very low available water capacity are the most limiting factors.

The potential for wildlife habitat is poor. Quail, dove, and small mammals inhabit areas of this map unit. Deer and turkey inhabit areas where adequate woody cover is available. Forbs and many seed-producing grasses provide food for the wildlife. Grazing management and brush management can improve the habitat for wildlife.

The potential for most urban uses is low. Stones and the depth to bedrock are the most restrictive features.

This soil is poorly suited to recreational uses. The depth to bedrock is a severe limitation on sites for camping areas, picnic areas, and playgrounds.

This soil is in capability subclass VIIs and is in the Very Shallow ecological site.

LsD—Lueders-Springcreek complex, 1 to 8 percent slopes, very stony. The very shallow or moderately deep soils in this complex are on uplands. Slopes are convex and average about 4 percent. These soils are underlain by limestone bedrock. The very shallow, loamy Lueders soil formed in material weathered from hard limestone. It has a few cobbles, stones, and boulders on the surface in addition to the gravel and flagstones in the soil. The moderately deep, loamy Springcreek soil formed in material weathered from limestone. It has a few cobbles and stones on the surface. The mapped areas are irregular in shape and range from about 25 to several hundred acres in size.

The Lueders soil makes up about 50 percent of the map unit, ranging from 40 to 75 percent of each mapped area; the Springcreek soil makes up about 30 percent of the unit, ranging from 20 to 40 percent of each mapped area; and other soils and rock outcrop make about 20 percent of the unit. The areas of this unit are large, and the composition varies. The soils in the unit have similar use and management requirements, and mapping has been controlled for the foreseeable uses of the soils.

The Lueders soil is on gently undulating ridgetops and gently sloping or moderately sloping hillsides. Typically, the surface layer is dark brown very stony clay loam about 6 inches thick. The subsoil, from 6 to 12 inches, is dark brown very cobbly loam. The underlying material, from 12 to 30 inches, is fractured, layered limestone bedrock. The soil is moderately alkaline and calcareous throughout.

The Springcreek soil is on gently undulating, convex ridgetops. Typically, the surface layer is calcareous, dark brown clay loam about 8 inches thick. The upper part of the subsoil, from 8 to 18 inches, is yellowish brown gravelly clay loam with 10 percent limestone gravel and about 50 to 60 percent calcium carbonate. The lower part, from 18 to 26 inches, is light yellowish brown very gravelly loam. The underlying material, from 26 to 30 inches, is fractured, layered limestone bedrock. The soil is moderately alkaline and calcareous throughout.

The Lueders and Springcreek soils are well drained. Surface runoff is very low to medium. Permeability is moderate. Available water capacity is very low in the Lueders soil and moderate in the Springcreek soil. The root zone is very shallow in the Lueders soil and moderately deep in the Springcreek soil. The hazard of water erosion is severe on both soils, and the hazard of wind erosion is slight.

Included in this map unit are areas of Owens and Throck soils. About 3 percent of some map units consists of a soil that is closely similar to the Throck

soil but has a calcium carbonate equivalent of more than 40 percent, and about 15 percent of some map units consists of another soil that is closely similar to the Throck soil but has limestone bedrock at a depth of 30 to 60 inches. Included with the Lueders soil are areas where the surface layer is gravelly clay loam, extremely flaggy clay loam, or flaggy clay loam and fine-earth textures are silty clay loam, silt loam, or loam. Rock outcrop makes up about 10 percent of the unit. It consists mainly of limestone bedrock ledges that are 3 to 20 feet thick.

Stoniness and bedrock prevent the use of the Lueders and Springcreek soils as cropland.

These soils are used for rangeland and wildlife habitat. They are moderately suited to native plants. Large stones limit overland travel by car or truck. An inadequate supply of soil moisture and excessive runoff limit yields. The climax plant community is mostly tall and mid grasses and mesquite trees. Most areas of rangeland support Texas wintergrass, sideoats grama, tall dropseed, vine mesquite, silver bluestem, catclaw, and mesquite trees.

Quail, dove, and small mammals inhabit areas of this map unit. Deer and turkey inhabit areas where adequate woody cover is available. Forbs and many seed-producing grasses provide food for the wildlife. Grazing management and brush management can improve the habitat for wildlife.

These soils are poorly suited to most urban uses. Large limestone fragments, the depth to bedrock, and the slope are the most restrictive features.

These soils are poorly suited to recreational uses. The most restrictive features are large stones, the slope, and the depth to bedrock.

The Lueders soil is in capability subclass VIIs and is in the Very Shallow ecological site. The Springcreek soil is in capability subclass IVe and is in the Clay Loam ecological site.

LtD—Lueders-Throck complex, 1 to 8 percent, extremely stony. The very shallow or deep soils in this complex are on broad ridges in the uplands. Slopes are convex and average about 4 percent. These soils are underlain by alternating layers of shale and limestone bedrock. Limestone ledges crop out with changing relief at vertical intervals of 10 to 50 feet. The very shallow, loamy Lueders soil formed in material weathered from hard limestone. It has a few stones and boulders on the surface in addition to the gravel and flagstones in the soil. The deep, clayey Throck soil formed in material weathered from shale. It has a few floating stones and boulders on the surface. The mapped areas are irregular in shape and range from about 100 to several hundred acres in size.

The Lueders soil makes up about 57 percent of the map unit, ranging from 40 to 75 percent of each mapped area; the Throck soil makes about 33 percent of the unit, ranging from 20 to 40 percent of each mapped area; and other soils and rock outcrop make up about 10 percent of the unit. The areas of this unit are large, and the composition varies. The soils in the unit have similar use and management requirements, and mapping has been controlled for the foreseeable uses of the soils.

The Lueders soil is on gently undulating ridgetops and gently sloping or moderately sloping hillsides. Typically, the surface layer is dark brown extremely stony clay loam about 5 inches thick. The subsoil, from 5 to 14 inches, is brown extremely cobbly loam. The underlying material, from 14 to 30 inches, is fractured, layered limestone bedrock. The soil is moderately alkaline and calcareous throughout.

The Throck soil is on gently undulating ridgetops and sloping hillsides. Typically, the surface layer is calcareous, brown stony clay loam about 7 inches thick. The subsoil, from 7 to 17 inches, is yellowish brown silty clay with 5 to 10 percent limestone gravel. The underlying material, from 17 to 50 inches, is grayish brown to light olive gray silty clay. The soil is moderately alkaline and calcareous throughout.

The Lueders and Throck soils are well drained. Surface runoff is very low to high. Permeability is moderate in the Lueders soil and slow in the Throck soil. Available water capacity is low in the Lueders soil and moderate in the Throck soil. The root zone is very shallow in the Lueders soil and deep in the Throck soil. The hazards of water erosion and wind erosion are slight on both soils because of stones on the surface.

Included in this map unit are areas of Owens and Palopinto soils. About 3 percent of some map units consists of a soil that is closely similar to the Throck soil but has a calcium carbonate equivalent of more than 40 percent, and about 15 percent of some map units consists of another soil that is closely similar to the Throck soil but has limestone bedrock at a depth of 30 to 60 inches. Included with the Lueders soil are areas where the surface layer is extremely flaggy clay loam or flaggy clay loam and fine-earth textures are silty clay loam, silt loam, or loam. Rock outcrop makes up about 10 percent of the unit. It consists is mainly of limestone bedrock ledges that are 3 to 20 feet thick. It is coarsely fractured and massive and tilts about 10 degrees to the west. It is white and yellowish brown and has a hardness of 3 or more on the Mohs scale. Some formations have many worm fossils.

Stoniness and bedrock prevent the use of the Lueders and Throck soils as cropland.

These soils are used for rangeland and wildlife habitat (fig. 9). They are moderately suited to native plants. Large stones limit overland travel by car or truck. An inadequate supply of soil moisture and excessive runoff limit yields. The climax plant community is mostly tall and mid grasses and mesquite trees. Most areas of rangeland support Texas wintergrass, sideoats grama, tall dropseed, vine mesquite, silver bluestem, catclaw, and mesquite trees.

The potential for wildlife habitat is fair. Areas of this map unit provide good habitat for quail but do not provide shrubs and forbs for deer and turkey. Nesting areas for quail, dove, and songbirds are plentiful.

These soils are poorly suited to most urban uses. Large limestone fragments, the depth to bedrock, and the slope are the most restrictive features.

These soils are poorly suited to recreational uses. The most restrictive features are large stones and the slope.

The Lueders soil is in capability subclass VIIs and is in the Very Shallow ecological site. The Throck soil is in capability subclass VIs and is in the Clay Slopes ecological site.

LuC—Lusk very gravelly sandy loam, 1 to 5 percent slopes. This moderately deep, gently undulating soil is on uplands. Slopes average about 2 percent on ridgetops and 5 percent on side slopes. The surface is slightly convex on broad terraces. The mapped areas are somewhat oval and range from 25 to 100 acres in size.

Typically, the surface layer is brown very gravelly sandy loam about 7 inches thick. The upper part of the subsoil, from 7 to 16 inches, is reddish brown extremely gravelly clay loam. The lower part, from 16 to 36 inches, is reddish brown very gravelly clay that has about 55 percent quartz gravel. The underlying material, from 36 to 52 inches, is yellowish red extremely gravelly coarse sand, which calcium carbonate and silica have cemented, forming a conglomerate. In places the underlying material is not cemented.

This soil is well drained. Surface runoff is medium. Permeability is slow, and available water capacity is low. The root zone is moderately deep. The hazards of water erosion and wind erosion are slight.

Some areas of this map unit have inclusions of Rochelle soils. These soils make up less than 20 percent of any one mapped area.

The Lusk soil is used almost entirely for rangeland and wildlife habitat. It is moderately suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, tall dropseed, and buffalograss with an overstory of mesquite, live oak, hackberry, elm, pricklypear, tasajillo, and bumelia.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is poorly suited to most urban uses. The slope, the depth to bedrock, and the content of clay are the most limiting factors. Gravel is mined from areas of this soil and used as a source of construction material.

This soil is poorly suited to recreational uses because of small stones.

This soil is in capability subclass VIs and is in the Sandy Loam ecological site.

NeB—Newcastle fine sandy loam, 1 to 3 percent slopes. This moderately deep, very gently sloping soil is on ridgetops and side slopes in the uplands. The surface is convex. Slopes average 1.5 percent. The mapped areas range from 15 to 300 acres in size.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The upper part of the subsoil, from 4 to 24 inches, is reddish brown clay loam. The lower part, from 24 to 33 inches, is yellowish red sandy clay loam. The underlying material, from 33 to 50 inches, is reddish brown, weakly cemented, thin-bedded sandstone.

This soil is well drained. Surface runoff is very low. Permeability is moderate, and available water capacity is low. The root zone is moderately deep. The hazards of water erosion and wind erosion are moderate.

Included in this map unit are contrasting Jolly soils and zones of rock outcrop on shoulder slopes, Vernon soils on mid slopes and foot slopes below sandstone outcrops, and small spots of Oil-waste land. These inclusions make up about 20 percent of the map unit. Also included are small areas of noncontrasting Grandfield soils.

About 80 percent of this map unit is rangeland. The remaining 20 percent is cropland, except for a few small areas that have been seeded to improved pasture.

The climax native plant community is a mid grass prairie with a sprinkling of forbs and low-growing woody plants. Proper stocking rates with adequate deferments and brush control improve the quality and increase the quantity of desirable forage.

Sideoats grama, sand bluestem, King Ranch bluestem, plains bluestem, old world bluestem, Caucasian bluestem, indiangrass, johnsongrass,

Figure 9.—An area of Lueders-Throck complex, 1 to 8 percent slopes, extremely stony, in the foreground. The range is in poor condition.

weeping lovegrass, Lehmann lovegrass, blue panicum, and switchgrass are adapted improved pasture grasses. Brush and weed control, controlled grazing, and timely applications of fertilizer increase yields and help to maintain high production levels of good-quality forage in most years.

This soil is suited to cool-season and warm-season cultivated crops. Droughtiness is a problem in some years, especially during the summer months. A surface crust tends to form after heavy rains. It can hinder the emergence of germinating seed. Keeping crop residue on or near the surface helps to prevent crusting, conserves soil moisture, helps to control wind erosion and water erosion, and helps to maintain productivity and tilth. Contour farming and terraces are needed in most areas to control water erosion. Stripcropping and field windbreaks help to control wind erosion.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is poorly suited to most urban uses. The depth to bedrock is the most limiting factor. When cuts or excavations exceed 20 inches, there is a hazard of cutting into the sandstone bedrock.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Sandy Loam ecological site.

NuB—Nukrum clay loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is in narrow valleys surrounded by limestone hills. Slopes average about 1.5 percent. The mapped areas are irregularly shaped and range from 15 to 300 acres in size. This soil may be flooded for short periods every 15 or more years.

Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper part of the subsoil, from 6 to 36 inches, is dark brown clay. The lower part, from 36 to 52 inches, is brown clay that has accumulated calcium carbonates below a depth of 48 inches. The subsoil has pressure faces on peds. The underlying material, from 52 to 66 inches, is very pale brown silty clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium. Permeability is slow, and available water capacity is high. The root zone is deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are moderate.

Included with this soil in mapping are some small areas of Leeray and Throck soils. These soils make up less than 20 percent of any one mapped area.

The Nukrum soil is used mainly as rangeland, but a few areas are used for cultivated crops, mainly small grain and forage sorghum.

This soil is well suited to small grain and forage sorghum. Keeping crop residue on or near the surface helps to control water erosion and wind erosion and conserves soil moisture. Contour farming, terraces, and grassed waterways are needed to conserve soil moisture and control erosion.

This soil is well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. Yields of short and mid grasses are good during favorable years.

Areas of this map unit provide fair habitat for quail and dove. They are inhabited by dove, quail, and small mammals. Plants supply adequate food and provide cover. Scattered small plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock and brush management in strips or patterns also can improve the habitat.

The suitability for most urban uses is poor. Low strength, the shrink-swell potential, restricted permeability, and corrosivity to uncoated steel are the most restrictive features. They can be partially overcome by good design and careful installation procedures.

This soil is well suited to recreational uses.

This soil is in capability subclass IIe and is in the Clay Loam ecological site.

NvA—Nuvalde clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is on uplands. The surface is plane or slightly convex. Slopes average about 0.5 percent. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 8 inches thick. The subsurface layer, from 8 to 13 inches, is dark brown clay loam. From 13 to 23 inches, the subsoil is brown clay loam; from 23 to 37 inches, it is pink clay loam with about 25 percent masses and concretions of calcium carbonate; from 37 to 47 inches, it is reddish yellow clay loam with about 35 percent masses and concretions of calcium carbonate; and from 47 to 80 inches, it is reddish yellow silty clay loam with about 25 percent masses of calcium carbonate. The soil is calcareous throughout.

This soil is well drained. Surface runoff is negligible. Permeability is moderate, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Some areas of this map unit have inclusions of Springcreek, Rowena, Leeray, Throck, and Palopinto soils. Also included are small areas of gently sloping Nuvalde soils and soils that are closely similar to the Nuvalde soil but have limestone bedrock below a depth of 50 inches. Inclusions make up less than 20 percent of any one mapped area.

The Nuvalde soil is used as cropland and rangeland. The main crops are small grain, cotton, and forage sorghum.

This soil is well suited to nonirrigated and irrigated crops. An inadequate supply of soil moisture is the most limiting factor in nonirrigated areas. Keeping crop residue on the surface conserves soil moisture.

This soil is well suited to native range plants. An inadequate supply of soil moisture is a limiting factor. The native range plants are mostly tall and mid grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annuals, and mesquite trees.

Areas of this map unit provide good habitat for dove and quail. They are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is moderately suited to most urban uses. Low strength on sites for streets and roads, shrinking

and swelling with changes in moisture content, and the content of clay are the most limiting factors.

This soil is well suited to recreational uses.

This soil is in capability subclass IIc and is in the Clay Loam ecological site.

NvB—Nuvalde clay loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is on uplands. The surface is plane or slightly convex. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is calcareous, dark brown clay loam about 11 inches thick. From 11 to 24 inches, the subsoil is calcareous, light yellowish brown clay loam; from 24 to 40 inches, it is yellowish brown clay loam with 10 to 15 percent concretions and masses of calcium carbonate; from 40 to 66 inches, it is light brown clay loam with 5 to 10 percent concretions and masses of calcium carbonate; and from 66 to 80 inches, it is reddish yellow clay loam with 10 to 15 percent concretions and soft masses of calcium carbonate.

This soil is well drained. Surface runoff is very low. Permeability is moderate, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Included in this map unit are some areas of Springcreek, Rowena, Leeray, Throck, and Sagerton soils and small areas of nearly level Nuvalde soils. These included soils make up less than 15 percent of any one mapped area. Also included are soils that are closely similar to the Nuvalde soil but have limestone bedrock at a depth of 40 to 60 inches. These soils make up about 30 percent of the unit.

The Nuvalde soil is used as cropland and rangeland. The main crops are small grain and forage sorghum.

This soil is well suited to nonirrigated and irrigated crops. An inadequate supply of soil moisture is the most limiting factor. Keeping crop residue on the surface conserves soil moisture. Terraces may be needed to control water erosion.

This soil is well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly tall and mid grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annuals, and mesquite trees.

The potential for wildlife habitat is medium. Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is moderately suited to most urban uses. Low strength as it affects streets and roads, shrinking and swelling with changes in moisture content, and the content of clay are the most limiting factors.

This soil is well suited to recreational uses.

This soil is in capability subclass IIe and is in the Clay Loam ecological site.

Od—Oil-waste land. This map unit is in areas where liquid oil and the accompanying saltwater brine waste have been deposited on the surface as a result of overflows and spills during oil exploration and production. These spills are in areas that are 0.5 acre to more than 25 acres in size, but only those from 5 to more than 25 acres are delineated on the maps. They occur on any soil on which oil exploration and production have been active. The surface texture varies. Most slopes are 0 to 3 percent, but some are as much as 12 percent.

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

This map unit is in capability subclass VIIIs and is not assigned to a ecological site.

OnD—Owens clay, 3 to 8 percent slopes. This gently sloping or moderately sloping soil is on uplands. It is moderately deep to dense, weathered shale. The surface is slightly convex. Slopes average about 4 percent. The mapped areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is light yellowish brown clay about 5 inches thick. The upper part of the subsoil, from 5 to 16 inches, is light olive brown clay. The lower part, from 16 to 27 inches, is pale yellow clay. The underlying material, from 27 to 40 inches, is light gray, weathered shale that has clay texture.

This soil is well drained. Surface runoff is high or very high. Permeability is very slow, and 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 some small areas of Throck, Harpersville, Knoco, and Vernon soils with stones and boulders on the surface. Inclusions make up less than 20 percent of any one mapped area.

The Owens soil is used mainly as rangeland, but a few areas are used for cultivated crops, mainly small grain and forage sorghum.

The suitability for small grain and forage sorghum is poor. Keeping crop residue on or near the surface helps to control water erosion and wind erosion and conserves soil moisture.

The suitability for native range plants is fair. An inadequate supply of soil moisture and droughtiness are the most limiting factors. Yields of short and mid grasses are good during favorable years.

Areas of this map unit are inhabited by dove and quail. Deer and turkey may feed on forbs in these areas and use cover on the adjacent soils. Grazing management and patterned brush management can improve the habitat for wildlife.

The suitability for most urban uses is poor. The shrink-swell potential, low strength, and corrosivity to uncoated steel are the most restrictive features. They can be partially overcome by good design and careful installation procedures.

The suitability for recreational uses is moderate. Restricted permeability, the clayey texture, and the slope are limitations.

This soil is in capability subclass VIe and is in the Shallow Clay ecological site.

OrE—Owens-Harpersville complex, 8 to 30 percent slopes, extremely bouldery. These moderately deep, very shallow or shallow, strongly sloping to steep soils are on hillsides. There are a few escarpments. Slopes are mostly simple and range from about 8 to 30 percent. These soils formed in material weathered from soft shale with alternating thin layers of limestone or sandstone. More than 15 percent of the surface is covered with flattened stones and boulders. The Owens soil is on the mid and lower hillside slopes. The Harpersville soil is on the sloping upper side slopes. The mapped areas are long and narrow and range from 50 to more than 200 acres in size.

This complex is made up of about 50 percent Owens soil, 30 percent Harpersville soil, and 20 percent other soils and rock outcrop. The areas of this unit are large, and the composition varies. The detail of mapping is adequate for the foreseeable uses of the soils.

Typically, the surface layer of the Owens soil is light yellowish brown extremely bouldery clay about 7 inches thick. The subsoil, from 7 to 17 inches, is light olive gray clay. The underlying material, from 17 to 26 inches, is gray shale with clay texture. The soil is moderately alkaline and calcareous throughout.

The Owens soil is well drained. Surface runoff is very high. Permeability is very slow, and available water capacity is very low. The root zone cannot be easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Typically, the surface layer of the Harpersville soil is grayish brown extremely bouldery clay about 9 inches thick. The underlying material, from 9 to 22 inches, is light olive gray and olive gray clay. The soil is moderately alkaline and calcareous throughout, but some of the underlying shale is noncalcareous.

The Harpersville soil is well drained. Surface runoff is very high. Permeability is very slow, and available water capacity is very low. The root zone is very shallow. The hazard of water erosion is severe, and the hazard of wind erosion is slight. Rapid geological erosion is evident on this soil.

Included in this complex are areas of Lueders soils on convex ridgetops and breaks of erosional uplands, Palopinto soils on the summits of limestone hills and ridges, Bluegrove and Jolly soils on the summits of sandstone hills and ridges, the extremely stony Throck soils on the lower side slopes, and rock outcrop along ledges.

The Owens and Harpersville soils are used as rangeland. They are moderately suited to this use. They support a sparse cover of short and mid grasses, mainly sideoats grama and threeawns and a few scrubby mesquite trees. Careful management is needed to prevent overuse. Effective management practices are proper stocking rates and controlled grazing.

This complex is unsuited to use as cropland because of the slope and stoniness.

Areas of this map unit are inhabited by dove and quail. Deer and turkey may feed on forbs in these areas and use cover on the adjacent soils. Grazing management and patterned brush management can improve the habitat for wildlife.

These soils are poorly suited to urban and recreational uses. The slope, stones, restricted permeability, and a high shrink-swell potential are limitations that are difficult to overcome.

This map unit is in capability subclass VIIs. The Owens soil is in the Rocky Hill ecological site, and the Harpersville soil is in the Shaly Hill ecological site.

OsE—Owens-Lueders complex, 5 to 30 percent slopes, extremely bouldery. These moderately sloping to steep soils are on uplands, mainly on hillsides and escarpments. Slopes range from 5 to 30 percent. These soils are underlain by alternating layers of weakly consolidated shale and limestone bedrock at vertical intervals of 10 to about 50 feet. The Owens soil formed in material weathered from shale, and the Lueders soil formed in material weathered from hard limestone. Both the clayey Owens soil and

the loamy Lueders soil have floating limestone boulders and stones on and below the surface. Rock outcrops are along scarps and ledges. The mapped areas are mostly long and narrow and range from about 50 to several hundred acres in size.

The Owens and closely similar soils make up about 45 percent of each mapped area, the Lueders soil about 35 percent, and other soils and rock outcrop about 20 percent. The areas of this unit are large, and the composition varies. The soils in the unit have similar use and management requirements, and mapping has been controlled sufficiently for the foreseeable uses of the soils.

The Owens soil is on strongly sloping to steep hillsides. Typically, the surface layer is grayish brown extremely bouldery clay about 8 inches thick. The subsoil, from 8 to 30 inches, is light olive brown clay. The underlying material, from 30 to 36 inches, is olive shale that has clay texture. About 20 percent of the surface is covered with floating and embedded limestone flagstones, stones, and boulders. The soil is moderately alkaline and calcareous throughout.

The Lueders soil is on moderately sloping ridges and benches on the hillsides. Typically, the surface layer is dark grayish brown cobbly clay loam about 7 inches thick. The subsoil, from 7 to 15 inches, is brown extremely cobbly clay loam. The underlying material, from 15 to 20 inches, is coarsely fractured, hard limestone bedrock. About 40 percent of the surface is covered with pebbles and cobbles and with scattered stones and boulders.

The Owens and Lueders soils are well drained. Surface runoff is medium to very high. Permeability is very slow in the Owens soil and moderate in the Lueders soil. Available water capacity is low in the Owens soil and very low in the Lueders soil. The root zone is shallow or moderately deep in the Owens soil and very shallow in the Lueders soil. The hazard of water erosion is severe on both soils, and the hazard of wind erosion is slight.

Included in this map unit are areas of Harpersville and Throck soils, which make up about 10 percent of the unit. Included with the Lueders soil are areas where the surface layer is extremely cobbly clay loam, stony clay loam, silty clay loam, or silt loam. Rock outcrop makes up about 10 percent of the unit. It is mainly limestone bedrock 3 to 20 feet thick. It is coarsely fractured and massive and tilts about 10 degrees to the west. It is gray, white, or yellowish brown and has a hardness of 3 or more on the Mohs scale.

Stoniness, bedrock, and steep slopes prevent the use of the Owens and Lueders soils as cropland.

These soils are used for rangeland and wildlife habitat. They are moderately suited to native plants. Large stones limit overland travel by car or truck. An inadequate supply of soil moisture and excessive runoff limit yields. Most areas of rangeland support Texas wintergrass, sideoats grama, tall dropseed, vine mesquite, and mesquite trees. Hackberry, bumelia, and greenbriar grow near and on rock ledges.

Areas of this map unit are inhabited by dove, quail, and small mammals. The rough terrain attracts rattlesnakes. A scarcity of food and cover limits the habitat for deer. Excessive grazing by livestock reduces the amount of food and cover for wildlife. Proper grazing management improves the habitat for wildlife.

These soils are poorly suited to most urban uses. Large limestone fragments, the depth to bedrock, and the slope are the most restrictive features.

These soils are poorly suited to recreational uses. The most restrictive features are large stones and the slope.

This map unit is in capability subclass VIIs and is in the Rocky Hill ecological site.

PaC—Palopinto loam, 2 to 5 percent slopes, very stony. This very shallow or shallow, gently sloping soil is on uplands. It is mainly on narrow ridges. Slopes are complex. They average about 3 percent but range from 2 to 5 percent. The mapped areas are irregular in shape and range from 10 to more than 50 acres in size.

Typically, the surface layer is calcareous, dark brown very stony loam about 8 inches thick. Hard, coarsely fractured limestone bedrock is at a depth of 8 to 14 inches. About 20 percent of the surface is covered with limestone cobbles, stones, and scattered boulders.

This soil is well drained. Surface runoff is very low or low. Permeability is moderate, and available water capacity is very low. The root zone is very shallow or shallow. The hazards of water erosion and wind erosion are slight.

Some areas of this map unit have inclusions of Pitzer, Springcreek, and Lueders soils and rock outcrop. These inclusions make up less than 25 percent of any one mapped area.

Stoniness and the very shallow or shallow depth prevent the use of the Palopinto soil as cropland.

This soil is used for rangeland and wildlife habitat. It is moderately suited to native range plants. An inadequate supply of soil moisture and the shallow or very shallow depth are the most limiting factors. The native range plants are mostly tall and mid grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite trees, and annuals.

Areas of this map unit are inhabited by quail, dove, and small mammals. The rough terrain attracts rattlesnakes. Deer and turkey may inhabit areas along watercourses that support woody vegetation, such as live oak, hackberry, and elm. Proper grazing management improves the habitat for wildlife.

This soil is poorly suited to most urban uses. The depth to bedrock and stoniness are the most limiting factors.

This soil is poorly suited to recreational uses because of the depth to bedrock and large stones.

This soil is in capability subclass VIs and is in the Low Stony Hill ecological site.

PtC—Pitzer gravelly clay loam, 1 to 5 percent slopes. This gently undulating soil is on uplands. It is very shallow or shallow to a petrocalcic horizon. The surface is convex. Slopes average about 3.5 percent but range from 1 to 5 percent. Limestone gravel is on and below the surface. Beds of limestone and quartz gravel underlie a platy caliche layer. The mapped areas are irregular in shape and range from 30 to more than 300 acres in size.

Typically, the surface layer is calcareous, reddish brown gravelly clay loam about 10 inches thick. The upper part of the subsoil, from 10 to 16 inches, is white, indurated, platy caliche. The lower part, from 16 to 50 inches, is pink very gravelly loam in which pebbles are coated with calcium carbonate. The underlying material, from 50 to 65 inches, is light yellowish brown clay with seams of gray shale.

This soil is well drained. Surface runoff is very low or low. Permeability generally is moderate but is slow in the cemented layer. Available water capacity is very low. The root zone is very shallow or shallow. The hazards of water erosion and wind erosion are slight.

Some areas of this map unit have inclusions of Springcreek and Nuvalde soils. These soils make up less than 15 percent of any one mapped area.

The very shallow or shallow depth to a petrocalcic horizon prevents the use of the Pitzer soil as cropland. This soil is used for rangeland and wildlife habitat. A few areas are mined for road gravel.

This soil is moderately suited to native range plants. The shallow or very shallow root zone, the very low available water capacity, and an inadequate supply of soil moisture limit the amount of forage produced. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, mesquite trees, and annuals.

Quail, dove, and small mammals inhabit areas of this map unit. Deer and turkey inhabit areas where adequate woody cover is available. Forbs and many seeding grasses provide food for wildlife. Grazing management and brush management can improve the habitat for wildlife.

This soil is poorly suited to most urban uses. The depth to a cemented pan is the most limiting factor.

This soil is poorly suited to recreational uses because of the cemented pan and the gravelly surface layer.

This soil is in capability subclass VIs and is in the Very Shallow ecological site.

RcB—Rochelle fine sandy loam, 1 to 3 percent slopes. This moderately deep or deep, very gently sloping soil is on high river terraces. The surface is convex. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 15 to more than 100 acres in size.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from 7 to 12 inches, is yellowish red sandy clay loam. The lower part, from 12 to 53 inches, is red gravelly sandy clay loam with common siliceous pebbles. The underlying material, from 53 to 65 inches, is red extremely gravelly sandy loam.

This soil is well drained. Surface runoff is very low. Permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep or deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are moderate.

Some areas of this map unit have inclusions of Bluegrove, Lusk, Truce, and Wichita soils. Also included are a few nearly level areas and some areas where the surface layer is loam or sandy loam. Inclusions make up less than 20 percent of any one mapped area.

The Rochelle soil is used mostly for rangeland and wildlife habitat. Gravel from the lower horizons is mined as a source of construction material in a few areas.

This soil is moderately well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annuals, and mesquite and post oak trees.

Areas of this map unit are inhabited by deer, dove, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas can improve the habitat for deer and other wildlife. Grazing management and patterned brush management also can improve the habitat.

This soil is moderately well suited to most urban uses. Seepage is the most limiting factor.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Sandy Loam ecological site.

RdA—Rowden clay loam, 0 to 2 percent slopes. This moderately deep, nearly level or very gently sloping soil is on ridges in the uplands. Slopes average about 1.2 percent. The mapped areas are irregularly shaped or rounded and range from 15 to 200 acres in size.

Typically, the surface layer is dark reddish gray clay loam about 12 inches thick. The subsoil, from 12 to 31 inches, is reddish brown clay. The underlying material, from 31 to 39 inches, is coarsely fractured limestone bedrock.

This soil is well drained. Surface runoff is low or medium. Permeability is slow, and available water capacity is moderate. The root zone is moderately deep, and the clayey lower layers restrict 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 Pitzer, Speck, Springcreek, Palopinto, and Lueders soils and some small areas where the surface layer is stony. These included soils are in areas that are less than 10 acres in size and together make up less than 15 percent of any one mapped area. Speck soils are in positions similar to those of the Rowden soil. Lueders and Springcreek soils are in slightly elevated areas. Palopinto soils are near slope breaks. Pitzer soils are on low hills and knobs. About 20 percent of this map unit consists of a soil that is closely similar to the Rowden soil but has a light brown surface layer.

The Rowden soil is used mainly as rangeland, for which it is well suited. The climax plant community is mainly big and little bluestem, indiangrass, sideoats grama, forbs, and scattered live oak.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush control in strips or patterns improves the habitat.

The suitability for small grain and forage sorghum is moderate. Terraces and contour farming help to control erosion. Keeping crop residue on the surface conserves soil moisture, helps to control runoff, and helps to maintain productivity.

This soil is well suited to pasture. Kleingrass and King Ranch bluestem are adapted pasture plants.

The suitability for urban uses is poor. The depth to bedrock and the shrink-swell potential are the most limiting factors.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Clay Loam ecological site.

ReA—Rowena clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is on broad upland plains. The surface is plane or slightly convex. Slopes average about 0.5 percent. The mapped areas are long and narrow and range from 15 to several hundred acres in size.

Typically, the surface layer is calcareous, dark grayish brown clay loam about 7 inches thick. From 7 to 21 inches, the subsoil is calcareous, dark grayish brown clay; from 21 to 38 inches, it is grayish brown clay; from 38 to 46 inches, it is brown clay; and from 46 to 65 inches, it is reddish yellow silty clay loam that has 20 to about 40 percent calcium carbonate.

This soil is well drained. Surface runoff is negligible. Permeability is moderately slow, and available water capacity is moderate. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are some small areas of Leeray, Throck, and Springcreek soils. Also included are small areas of gently sloping Rowena soils. Included soils make up less than 20 percent of any one mapped area.

The Rowena soil is used mainly as cropland, but a few areas are used as rangeland. Cotton and grain sorghum are the main crops.

The potential for wheat, cotton, and grain sorghum is high. Keeping crop residue on the surface conserves soil moisture.

The potential for native range plants is high. An inadequate supply of soil moisture is the most limiting factor. Yields of short and mid grasses are good during favorable years.

Areas of this map unit are inhabited by deer, quail, dove, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

The potential for most urban uses is low. Restricted permeability, a high shrink-swell potential, low strength, and corrosivity to uncoated steel are the most restrictive features. They can be overcome by good design and careful installation procedures.

The potential for recreational uses is high.

This soil is in capability subclass IIc and is in the Clay Loam ecological site.

ReB—Rowena clay loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is on broad upland plains. The surface is plane or slightly convex. Slopes average about 2 percent. The mapped areas are long and narrow and range from 15 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil, from 7 to 25 inches, is dark grayish brown clay. The next part, from 25 to 32 inches, is dark brown clay. The lower part, from 32 to 62 inches, is reddish yellow clay loam that has 15 to about 50 percent calcium carbonate. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is very low. Permeability is moderately slow, and available water capacity is moderate. 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 some small areas of Leeray and Springcreek soils. Also included are small areas of nearly level Rowena soils. Included soils make up less than 20 percent of any one mapped area.

The Rowena soil is used mainly as cropland, but a few areas are used as rangeland. Cotton and grain sorghum are the main crops.

The suitability for wheat, cotton, and grain sorghum is good. Keeping crop residue the surface helps to control water erosion and conserves soil moisture. Contour farming, terraces, and grassed waterways also help to control water erosion.

The suitability for native range plants is good. An inadequate supply of soil moisture is the most limiting factor. Yields of short and mid grasses are good during favorable years.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

The suitability for most urban uses is poor. Restricted permeability, a high shrink-swell potential, low strength, and corrosivity to uncoated steel are the most restrictive features. They can be overcome by good design and careful installation procedures.

This soil is well suited to recreational uses .

This soil is in capability subclass IIe and is in the Clay Loam ecological site.

SaA—Sagerton clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is on upland plains. The surface is plane or slightly convex. Slopes average about 0.5 percent. The mapped areas are irregular in shape and range from 25 to more than 300 acres in size.

Typically, the surface layer is reddish brown clay loam about 6 inches thick. The upper part of the subsoil, from 6 to 22 inches, also is reddish brown clay loam. The next part, from 22 to 34 inches, is yellowish red clay loam. The lower part, from 34 to 80 inches, is reddish yellow clay and clay loam with about 35 percent calcium carbonate.

This soil is well drained. Surface runoff is negligible. Permeability is moderately slow, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are small areas of Leeray, Abilene, Thurber, and Tillman soils. Also included are soils that are similar to the Sagerton soil but are underlain by limestone bedrock below a depth of 50 inches. Included soils make up 15 percent of the map unit.

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

This soil is well suited to nonirrigated and irrigated crops. Keeping crop residue on the surface conserves soil moisture and helps to control runoff. In irrigated areas a well designed irrigation system and a proper rate of water application are essential. Also, fertilizer is needed. A sprinkler or surface irrigation system can be used. Diversions may be needed to control water from the steeper slopes.

This soil is well suited to rangeland. An inadequate supply of soil moisture during dry periods is the most limiting factor. The climax vegetation is mostly mid and short grasses. Most areas of rangeland support sideoats grama, Texas wintergrass, white tridens, threeawns, mesquite trees, and pricklypear.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is moderately well suited to most urban uses. Low strength as it affects roads and streets, moderate shrinking and swelling with changes in moisture content, a moderate potential for corrosion

on uncoated steel, and the content of clay are the most limiting factors. They can be overcome by good design and careful installation procedures.

This soil is well suited to recreational uses.

This soil is in capability subclass IIc and is in the Clay Loam ecological site.

SaB—Sagerton clay loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is on upland plains. The surface is plane or slightly convex. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark brown clay loam about 9 inches thick. The upper part of the subsoil, from 9 to 38 inches, is reddish brown clay. The lower part, from 38 to 60 inches, is calcareous, pink clay loam.

This soil is well drained. Surface runoff is very low. Permeability is moderately slow, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are small areas of Leeray, Abilene, Thurber, and Tillman soils. Also included are soils that are similar to the Sagerton soil but are underlain by limestone bedrock below a depth of 50 inches. Included soils make up less than 15 percent of any one mapped area.

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

This soil is well suited to nonirrigated and irrigated crops. Keeping crop residue on the surface conserves soil moisture and helps to control runoff. Terraces and grassed waterways help to control water erosion. Plowing when the soil is wet causes a compacted plowpan a few inches thick to form at the base of the plowed layer.

This soil is well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annuals, and mesquite trees.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is moderately well suited to most urban uses. Low strength as it affects streets and roads, moderate shrinking and swelling with changes in moisture content, and a moderate potential for corrosion on uncoated steel are the most limiting factors.

This soil is well suited to recreational uses.

This soil is in capability subclass IIe and is in the Clay Loam ecological site.

SpB—Speck silty clay loam, 0 to 2 percent slopes. This shallow, nearly level or very gently sloping soil is on ridges in the uplands. The surface is convex. Slopes average about 1.2 percent. The mapped areas are irregularly shaped or rounded and range from 15 to 100 acres in size.

Typically, the surface layer is dark brown silty clay loam about 5 inches thick. The subsoil, from 5 to 12 inches, is reddish brown silty clay. Limestone bedrock is at a depth of 12 to 20 inches.

This soil is well drained. Surface runoff is low or medium. Permeability is slow, and available water capacity is moderate. The root zone is shallow, and the clayey 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 Rowden, Springcreek, and Lueders soils and some small areas where the surface layer is stony. These included soils are in areas that are less than 10 acres in size and together make up less than 15 percent of any one mapped area. Rowden soils are in positions similar to those of the Speck soil. Springcreek and Lueders soils are in slightly elevated areas. About 20 percent of the unit consists of a soil that is closely similar to the Speck soil but has a light brown surface layer.

The Speck soil is used mainly as rangeland. The climax plant community is mainly little bluestem, sideoats grama, forbs, and scattered live oak.

The suitability for small grain and forage sorghum is fair. Terraces and contour farming help to control erosion. Keeping crop residue on the surface conserves soil moisture, helps to control runoff, and helps to maintain productivity. Kleingrass and King Ranch bluestem are adapted pasture grasses.

Areas of this map unit are inhabited by dove and quail. Forbs and grasses provide seed for dove and quail. The rough terrain attracts rattlesnakes. Forbs, mast, and browse provide food for deer, which feed in areas of this unit but move back into areas that provide more suitable cover. Grazing management and patterned brush management improve the habitat for wildlife.

The suitability for urban uses is poor. The depth to bedrock and the shrink-swell potential are the most limiting factors.

This soil is moderately suited to recreational uses. The depth to bedrock is the most limiting factor.

This soil is in capability subclass IVs and is in the Redland ecological site.

SsB—Speck silty clay loam, 1 to 3 percent slopes, stony. This shallow, very gently sloping soil is on uplands. The surface is plane or slightly convex. Slopes average about 2 percent but range from 1 to 3 percent. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size. Limestone gravel, cobbles, and stones are on the surface.

Typically, the surface layer is dark brown stony silty clay loam about 7 inches thick. The subsoil, from 7 to 15 inches, is dark brown silty clay. The underlying material, from 15 to 20 inches, is coarsely fractured, hard limestone bedrock. The soil is slightly alkaline throughout.

This soil is well drained. Surface runoff is low or medium. Permeability is slow, and available water capacity is moderate. The root zone is shallow. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

Some areas of this map unit have inclusions of Rowden and Palopinto soils. These inclusions make up less than 15 percent of any one mapped area. Also included are soils that are closely similar to the Speck soil but have a reddish brown surface layer and subsoil.

Stoniness prevents the use of the Speck soil as cropland.

This soil is suited to native range plants. The moderate available water capacity is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, sideoats grama, curlymesquite, and mesquite, live oak, and post oak trees.

Areas of this map unit are inhabited by dove and quail. Forbs and grasses provide seed for dove and quail. The rough terrain attracts rattlesnakes. Forbs, mast, and browse provide food for deer, which feed in areas of this unit but move back into areas that provide more suitable cover. Grazing management and patterned brush management improve the habitat for wildlife.

This soil is poorly suited to most urban uses. The depth to limestone bedrock is the most limiting factor.

This soil is poorly suited to recreational uses because of surface stoniness and the depth to bedrock.

This soil is in capability subclass VIs and is in the Redland ecological site.

StB—Springcreek clay loam, 1 to 3 percent slopes. This moderately deep, very gently sloping soil is on uplands. The surface is plane or convex. Slopes average about 2 percent. The mapped areas range from 10 to 50 acres in size.

Typically, the surface layer is dark brown clay loam about 9 inches thick. The subsoil, from 9 to 30 inches, is light yellowish brown gravelly clay loam. The underlying material, from 30 to 40 inches, is coarsely fractured limestone bedrock.

This soil is well drained. Surface runoff is very low. Permeability and available water capacity are moderate. 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 small areas of Lueders, Nuvalde, Owens, Speck, Swenson, and Throck soils. Also included are soils that are closely similar to the Springcreek soil but are deeper to limestone bedrock. Included soils make up less than 20 percent of any one mapped area.

The Springcreek soil is used mainly as rangeland. Some areas are used for small grain or sorghum.

This soil is moderately suited to nonirrigated crops. An inadequate supply of soil moisture is the most limiting factor in nonirrigated areas. Keeping crop residue on the surface conserves soil moisture.

This soil is well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Arizona cottontop, Texas wintergrass, Texas grama, silver bluestem, little bluestem, sideoats grama, lotebush, and mesquite trees.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is poorly suited to most urban uses. The depth to bedrock is the most limiting factor.

This soil is only moderately well suited to recreational uses because of small stones.

This soil is in capability subclass IIIe and is in the Clay Loam ecological site.

SwA—Swenson clay loam, 0 to 2 percent slopes. This moderately deep, nearly level or very gently sloping soil is on ridges in the uplands. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 15 to 75 acres in size.

Typically, the surface layer is very dark grayish

brown clay loam about 4 inches thick. The upper part of the subsoil, from 4 to 10 inches, is dark brown clay. The next part, from 10 to 25 inches, is reddish brown clay. The lower part, from 25 to 32 inches, is reddish yellow gravelly silt loam. The underlying material, from 32 to 36 inches, is coarsely fractured limestone bedrock.

This soil is well drained. Surface runoff is low or medium. Permeability is moderately slow, and available water capacity is moderate. 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 small areas of Leeray, Lueders, Nukrum, Nuvalde, Speck, Springcreek, and Rowden soils. Also included are soils that are closely similar to the Swenson soil but are not mollic. Included soils make up less than 20 percent of any one mapped area.

The Swenson soil is used mainly as rangeland. Some areas are used for small grain, cotton, or sorghum.

This soil is well suited to nonirrigated and irrigated crops. An inadequate supply of soil moisture is the most limiting factor in nonirrigated areas. Keeping crop residue on the surface conserves soil moisture.

This soil is well suited to native range plants. An inadequate supply of soil moisture is a limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, Texas grama, silver bluestem, little bluestem, sideoats grama, forbs, and mesquite trees.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is poorly suited to most urban uses. The depth to bedrock and the shrink-swell potential are the most limiting factors.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Clay Loam ecological site.

ThC—Throck silty clay loam, 1 to 5 percent slopes. This gently sloping soil is on uplands (fig. 10). It is moderately deep or deep to dense, weathered shale. The surface is convex. Slopes average about 3.5 percent. The mapped areas are irregular in shape and range from 10 to more than 300 acres in size.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The upper part of the subsoil, from 8 to 16 inches, is dark yellowish brown silty clay. The next part, from 16 to 39 inches, is yellowish brown silty clay. The lower part, from 39 to 49 inches, is very pale brown clay loam. The underlying material, from 49 to 62 inches, is light gray loam.

This soil is well drained. Surface runoff is medium. Permeability is slow, and available water capacity is low. The root zone is moderately deep. The hazards of water erosion and wind erosion are moderate.

Some areas of this map unit have inclusions of Nukrum, Nuvalde, and Owens soils. Also included are small areas of more sloping Throck soils. Inclusions make up less than 15 percent of any one mapped area.

The Throck soil is used mostly 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. An inadequate supply of soil moisture, the low available water capacity, and the slope are the most limiting factors. Keeping crop residue on the surface conserves soil moisture. Diversion terraces may be needed to control water from the higher slopes. Terraces and grassed waterways are needed to control erosion.

This soil is well suited to native range plants. An inadequate supply of soil moisture is the most limiting factor. The native range plants are mostly tall and mid grasses. Most areas of rangeland support Texas wintergrass, sideoats grama, sand dropseed, Texas grama, curlymesquite, mesquite trees, and annuals.

Areas of this map unit are inhabited by deer, quail, dove, and small mammals. The woody plants, forbs, and grasses in these areas provide cover, browse, and seeds for wildlife. Deer are more numerous where woody vegetation is available for escape and resting cover. Small grain, such as wheat and rye, is recommended for wildlife food plots. Proper grazing by livestock is needed to maintain habitat quality.

This soil is moderately suited to most urban uses. Low strength as it affects streets and roads, shrinking and swelling with changes in moisture content, and the content of clay are the most limiting factors.

This soil is only moderately well suited to recreational uses because of the slope and small stones.

This soil is in capability subclass IVe and is in the Clay Slopes ecological site.

TrA—Thurber clay loam, 0 to 2 percent. This very deep, nearly level or very gently sloping soil is on

Figure 10.—A typical area of Throck silty clay loam, 1 to 5 percent slopes, in the foreground and an area of Owens-Lueders complex, 5 to 30 percent slopes, extremely bouldery, on the hillslopes. The Throck soil can be used for cropland but is best suited to rangeland. The Owens-Lueders complex is used only as rangeland or as wildlife habitat.

uplands. The surface is plane or slightly concave. Slopes average about 1 percent. The mapped areas are irregularly shaped or oval and range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown clay loam about 4 inches thick. The upper part of the subsoil, from 4 to 22 inches, is dark grayish brown clay. The next part, from 22 to 50 inches, is brown clay that has concretions of calcium carbonate below a depth of 36 inches. The lower part, from 50 to 80 inches, is light yellowish brown clay loam with masses of calcium carbonate.

This soil is moderately well drained. Surface runoff is low or medium. Permeability is very slow, and available water capacity is high. The root zone is moderately deep or deep, but the clayey 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 severe, and the hazard of wind erosion is slight.

Some areas of this map unit have inclusions of Leeray, Truce, Throck, and Bluegrove soils. Also included are 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 bedrock below a depth of 42 inches. Included soils make up less than 15 percent of any one mapped area.

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

This soil is moderately well suited to nonirrigated and irrigated small grain and forage sorghum. An inadequate supply of soil moisture limits some yields. Keeping crop residue on the surface helps to control runoff, conserves soil moisture, and improves tilth and productivity. The soil can be easily worked only within a very narrow range of moisture content. Diversions may be needed in some fields to control runoff from the higher slopes.

This soil is moderately well suited to native range plants. When the soil is dry, the massive surface layer and restricted permeability limit water infiltration. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, sand dropseed, Texas grama, curlymesquite, annuals, and mesquite trees.

Areas of this map unit are inhabited by dove, quail, and rabbit. A good selection of forbs is available for deer forage, but little cover is provided for escape and resting. Numerous annuals as well as perennial plants offer food and cover for birds. Woody plantings, seeding, and grazing management improve the habitat for wildlife. Small grain provides winter food for deer.

This soil is poorly suited to most urban uses. Shrinking and swelling with changes in moisture content, low strength, and the content of clay are the most limiting factors. Foundations for roads, structures, and utilities should be designed and installed with these factors in mind.

This soil is only moderately well suited to recreational uses because of restricted permeability.

This soil is in capability subclass IIIe and is in the Claypan Prairie ecological site.

TtA—Tillman clay loam, 0 to 2 percent slopes. This very deep, nearly level or very gently sloping soil is on upland plains. The surface is plane or slightly convex. Slopes average about 1.5 percent. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper part of the subsoil, from 6 to 12 inches, is reddish brown clay. The next part, from 12 to 24 inches, is moderately alkaline, reddish brown clay. The lower part, from 24 to 80 inches, is yellowish red and red clay that has about 5 to 10 percent calcium carbonate. In some areas the soil is underlain by partially weathered, weak red shale at a depth of 74 to 80 inches.

This soil is well drained. Surface runoff is negligible or very low. Permeability is slow, and available water capacity is high. The root zone is deep. The hazards of water erosion and wind erosion are slight.

Some areas of this map unit have inclusions of Leeray, Abilene, and Thurber soils and Tillman soils that are gently sloping and have a surface layer of loam. Also included are a few areas of soils that are closely similar to the Tillman soil but are underlain by limestone bedrock below a depth of 50 inches. Included soils make up less than 15 percent of any one mapped area.

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

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

This soil is well suited to rangeland. An inadequate supply of soil moisture during dry periods is the most limiting factor. The climax vegetation is mostly mid and short grasses. Most areas of rangeland support sideoats grama, Texas wintergrass, white tridens, threeawns, mesquite trees, and pricklypear.

The potential for wildlife habitat is medium. Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

This soil is poorly suited to most urban uses. Low strength as it affects streets and roads, shrinking and swelling with changes in moisture content, a high potential for corrosion on uncoated steel, and restricted permeability are the most limiting factors. They can be overcome by good design and careful installation procedures.

This soil is well suited to recreational uses.

This soil is in capability subclass IIIe and is in the Clay Loam ecological site.

TuB—Truce fine sandy loam, 2 to 5 percent slopes. This gently sloping soil is on uplands. It is

deep to weathered shale. The surface is convex. Slopes average about 2 percent. The mapped areas are irregular in shape and range from 15 to more than 100 acres in size.

Typically, the surface layer is yellowish brown fine sandy loam about 5 inches thick. The upper part of the subsoil, from 5 to 20 inches, is reddish brown clay. The next part, from 20 to 34 inches, is yellowish red clay. The lower part, from 34 to 42 inches, is strong brown clay. The underlying material, from 42 to 60 inches, is light yellowish brown clay and weakly consolidated or strongly consolidated shale.

This soil is well drained. Surface runoff is medium. Permeability is slow, and available water capacity is low. The root zone is deep, but plant roots cannot easily penetrate the clayey subsoil. The hazards of water erosion and wind erosion are moderate.

Some areas of this map unit have inclusions of Bluegrove, Jolly, Owens, Thurber, and Throck soils. Also included are a few areas of severely eroded Truce soils and areas where 10 to 15 percent of the surface is covered with sandstone fragments. Inclusions make up less than 15 percent of any one mapped area.

The Truce soil is used mainly as rangeland. The better managed areas have a mixture of short and mid grasses, forbs, and a few scattered post oak trees.

This soil is moderately suited to small grain, forage sorghum, and cool-season legumes. Terraces and contour farming are needed to control water erosion. Keeping crop residue on or near the surface slows runoff, conserves soil moisture, reduces the hazard of wind erosion, and lowers the soil temperature.

This soil is moderately suited to native range plants. Droughtiness is the most limiting factor. The native range plants are mostly mid and short grasses. Most areas of rangeland support Texas wintergrass, vine mesquite, tall dropseed, curlymesquite, annuals, and mesquite trees. Once native plants have been removed from the plant community, reestablishing them is difficult.

Areas of this map unit are inhabited by dove, quail, turkey, and deer. Where woody vegetation is more prevalent, deer and turkey numbers are higher. Forbs and browse provide much of the food for wildlife. Planting small grain winter food plots can improve the habitat for wildlife. Grazing management and range seeding with food- and cover-producing grasses, forbs, and legumes also can improve the habitat.

This soil is moderately suited to most urban and recreational uses. Restricted permeability, shrinking and swelling with changes in moisture content, low strength, corrosivity to uncoated steel, and the moderate erosion hazard are limitations that are difficult to overcome. The clayey subsoil is a limitation on sites for septic tank absorption fields. The slope limits some recreational uses.

This soil is in capability subclass IVe and is in the Tight Sandy Loam ecological site.

VnC—Vernon clay, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on side slopes, in headcut areas that are transitional areas between uplands and flood plains, and on knolls and low ridges in the uplands. The mapped areas are narrow and elongated on the side slopes and oblong or rounded on the knolls and ridges. The surface layer has been thinned in many places by water erosion and in some areas is almost completely removed. In areas where erosion is active, concretionary gravel originally in the surface layer and subsoil covers 5 to 20 percent of the surface. Slopes average about 2.5 percent. The mapped areas range from 15 to about 200 acres in size.

Typically, the surface layer is reddish brown clay about 6 inches thick. The subsoil, from 6 to 28 inches, also is reddish brown clay. The underlying material, from 28 to 65 inches, is reddish brown clay and shale that has clay texture. This soil is calcareous throughout. Masses and concretions of calcium carbonate are common in the surface layer and in the upper part of the subsoil.

This soil is well drained. Surface runoff is low. Permeability is very slow, and available water capacity low or moderate. The root zone is moderately deep, but plant roots cannot easily penetrate the clayey subsoil. The hazard of water erosion is severe, and the hazard of wind erosion is slight.

Contrasting Knoco and Vernon soils and areas of rock outcrop on shoulder slopes and small spots of Oil-waste land make up about 10 percent of this map unit. Small areas of Aspermont and Tillman soils and Vernon soils that have a surface layer of clay loam also are part of this unit.

The Vernon soil is used mainly as rangeland. A few small areas are cropped, but erosion rapidly depletes the surface layer unless a protective cover is maintained.

The native range vegetation includes short and mid grasses and scattered brush. This soil responds well to brush control and reseeding. When the surface is left bare, scalding and crusting can occur, resulting in poor germination of grasses and increased erosion. Proper stocking rates and controlled grazing can improve the quality and increase the quantity of desirable forage.

This soil responds well to reseeding of improved pasture grasses. Brush and weed control, controlled grazing, and timely applications of fertilizer improve

the production and quality of adapted grasses. Adapted grasses include sideoats grama, sand bluestem, big bluestem, indiangrass, Caucasian bluestem, kleingrass, King Ranch bluestem, johnsongrass, blue panicum, plains bluestem, and old world bluestem.

Cool-season small grains are the only cultivated crops adapted to this soil. Droughty conditions occur most of the time. Scalding and crusting of bare soil can reduce the rate of permeability, increase the hazard of erosion, and restrict seed germination and seedling emergence. A protective cover of crop residue, limited tillage, terraces, and contour farming help to control erosion and conserve soil moisture. The crop residue also helps to maintain productivity and tilth and helps to prevent crusting. Timely applications of fertilizer according to the results of soil tests increase yields in most years.

Areas of this map unit are inhabited by dove and quail. Deer and turkey may feed on forbs in these areas and use cover on the adjacent soils. Grazing management and patterned brush management can improve the habitat for wildlife. Small patchwork plantings of woody species that provide food and cover can increase the diversity of wildlife species.

Low strength, a high shrink-swell potential, restricted permeability, the severe hazard of water erosion, a high content of clay, and corrosivity to uncoated steel limit the use of this soil for urban and recreational development. Thoughtful planning and good design, however, can minimize the effects of these restrictive factors.

This soil is in capability subclass IVe and is in the Shallow Clay ecological site.

We—Westola fine sandy loam, occasionally flooded. This very deep, nearly level soil is on the flood plains along the Brazos River. Slopes are less than 1 percent in most areas but are undulating in some areas. The mapped areas are long and narrow and range from 80 to several hundred acres in size. The soil is flooded once every 3 to 7 years.

Typically, the surface layer is yellowish red fine sandy loam about 6 inches thick. The underlying material, from 6 to 60 inches, consists of alternating strata of yellowish red and reddish yellow fine sandy loam and fine sand.

This soil is well drained. Surface runoff is negligible. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are moderate.

Included with this soil in mapping are some small areas of Clairemont soils. Also included are small areas adjacent to sloughs where slopes are more than 1 percent and areas where the surface layer is silt loam. Inclusions make up less than 10 percent of any one mapped area.

The Westola soil is used mainly as cropland. Small grain, cotton, and grain sorghum are the main crops.

The potential for cultivated crops is high. Keeping crop residue on or near the surface increases the rate of water infiltration, conserves soil moisture, and helps to control erosion.

The potential for native range plants is high. An inadequate supply of soil moisture is the most limiting factor. Yields of short and mid grasses are good during favorable years. Some livestock are lost during severe floods.

Areas of this map unit are inhabited by deer, turkey, squirrel, dove, quail, furbearers, and numerous reptiles and amphibians. Turkeys commonly use the larger trees for roosting. Many choice plants provide resting and escape cover for deer and turkey. The tall grasses provide ideal nesting sites. Grazing management improves the habitat for wildlife. Small grain plots provide food for deer and turkey.

The potential for most urban uses is poor. Flooding is the most restrictive feature.

The potential for recreational uses is only moderate because of flooding.

This soil is in capability subclass IIw and is in the Loamy Bottomland ecological site.

Wh—Wheatwood silt loam, occasionally flooded. This very deep, nearly level soil is on the flood plains along the Brazos River. The surface is plane or slightly concave. Slopes generally are less than 1 percent but are undulating in places. The mapped areas are long and narrow and range from 80 to several hundred acres in size. The soil is flooded once every 3 to 10 years.

Typically, the surface layer is reddish brown silt loam about 7 inches thick. The subsoil, from 7 to 40 inches, also is reddish brown silt loam. The underlying material, from 40 to 80 inches, is yellowish red silt loam.

This soil is well drained. Surface runoff is negligible. Permeability is moderate, and available water capacity is low or moderate. The root zone is deep and can be easily penetrated by plant roots. The hazards of water erosion and wind erosion are slight.

Included in this map unit are areas of soils that are closely similar to the Wheatwood soil but have buried A horizons and areas of Clearfork and Westola soils. Also included are small areas adjacent to sloughs where slopes are more than 1 percent and areas where the surface layer is loam. Inclusions make up less than 15 percent of any one mapped area.

The Wheatwood soil is used mainly as cropland. Small grain and grain sorghum are the main crops.

The potential for cultivated crops is high. Keeping crop residue on or near the surface increases the rate of water infiltration, conserves soil moisture, and helps to control wind erosion.

Areas of this map unit are inhabited by deer, turkey, squirrel, dove, quail, furbearers, and numerous reptiles and amphibians. Turkeys commonly use the larger trees for roosting. Many choice plants provide resting and escape cover for deer and turkey. The tall grasses provide ideal nesting sites. Grazing management improves the habitat for wildlife. Small grain plots provide food for deer and turkey.

This soil is poorly suited to most urban uses. Flooding is a severe hazard that is very difficult to overcome.

This soil is poorly suited to most recreational uses. Flooding restricts the use of this soil for playgrounds and camp areas.

This soil is in capability subclass IIw and is in the Loamy Bottomland ecological site.

WtB—Wichita clay loam, 1 to 3 percent slopes. This very deep, very gently sloping soil is on terraces and alluvial plains. The surface is convex. Slopes average 1.5 percent. The mapped areas are irregular in shape and range from 25 to about 75 acres in size.

Typically, the surface layer is brown clay loam about 5 inches thick. The upper part of the subsoil, from 5 to 31 inches, is reddish brown and yellowish red clay loam. The lower part, from 31 to 80 inches, is reddish yellow clay loam that has concretions and masses of calcium carbonate.

This soil is well drained. Surface runoff is very low. Permeability is moderately slow, and available water capacity is high. The root zone is deep. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Contrasting Owens and Harpersville soils on the steeper side slopes, Sagerton and Tillman soils on the slightly higher ridges and in positions similar to those of the Wichita soil, and small spots of Oil-waste land make up about 10 percent of this map unit.

About 85 percent of this map unit is rangeland. The remaining 15 percent is cropland, except for small areas that have been seeded to improved pasture.

The natural climax range vegetation consists of short and mid grasses. This soil responds well to brush control and reseeding. Proper stocking rates and controlled grazing with adequate deferments increase the quantity and improve the quality of desirable forage.

Droughtiness is a problem in most years when this soil is used as cropland. Cool-season small grain usually grows better than warm-season crops, though both are adapted. A surface crust forms if bare soil is exposed to heavy rainfall. The crust decreases the rate of permeability, increases the hazard of erosion, and restricts seed germination and emergence. A protective cover of crop residue, timely but limited tillage, crop rotation, terraces, and contour farming conserve soil moisture and help to prevent excessive erosion. Crop residue management helps to maintain productivity and tilth and helps to prevent crusting. Timely applications of fertilizer increase yields in most years.

Areas of this map unit are inhabited by dove, quail, and small mammals. Deer and turkey utilize these areas for feeding where escape or resting cover is available in nearby areas. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, can improve the habitat for wildlife. Proper grazing by livestock is needed to maintain habitat quality. Brush management in strips or patterns improves the habitat.

Restricted permeability, a high content of clay, low strength, and a moderate shrink-swell potential are limitations if this soil is used for urban development.

This soil is well suited to recreational development.

This soil is in capability subclass IIe and is in the Clay Loam ecological site.

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 5 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 133,130 acres in Throckmorton County, or nearly 23 percent of the total acreage, meets the requirements for prime farmland. Scattered areas of this land are throughout the county. General soil map units 1 and 2 have the largest areas of prime farmland. The main crops grown on this land are cotton, grain sorghum, oats, wheat, and forage sorghum.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. On some soils included in the list, inadequate rainfall is a limitation. These soils may qualify as prime farmland if this limitation is overcome by irrigation. Onsite evaluation is needed to determine whether or not the limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

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 in predicting soil behavior.

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

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

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

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

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

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 Natural Resources Conservation Service or the Texas Agricultural Extension Service.

According to statistics from the Natural Resources Conservation Service, about 82,000 acres in Throckmorton County was used for crops in 1991. The main crops were cotton, wheat, grain, and forage sorghum. The field crops suited to the soils and climate of the survey area include some that are not now commonly grown. Peanuts, guar, corn, sunflowers, castor beans, mung beans, and similar crops can be grown if economic conditions are favorable. Grass seed can be produced from kliengrass, switchgrass, and various introduced bluestems.

Some areas are used for truck crops. The deep, loamy, well drained Grandfield soils are especially suited to truck crops where slopes are less than 3 percent. These soils also are suited to small and large fruits, vineyards, and nursery plants. Production is limited mainly by the amount of rainfall or the availability of irrigation water. The deep, loamy soils on flood plains generally are poorly suited to truck crops and horticultural crops because of the danger of flooding and the concentration of cold air. The latest information about growing specialty crops can be obtained from local offices of the Texas Agricultural Extension Service and Natural Resources Conservation Service.

The potential of the soils in Throckmorton County for increased production of food and fiber is good. More than 100,000 acres of soils that have good potential for cropland is currently used as rangeland. In addition to the reserve production capacity represented by this acreage, food and fiber production could be increased considerably by applying the latest crop-production technology to all of the cropland in the county. The information provided in this soil survey can greatly facilitate the application of such technology.

Erosion is the major problem on nearly all of the cropland in the county. Water erosion is a hazard on nearly all of the cropland where slopes are more than 1 percent. A plant cover, contour farming (fig. 11), terraces, and grassed waterways reduce the risk of water erosion. Wind erosion is a hazard on the more sandy soils, especially when the surface is bare. It occurs most often during droughts and the windstorms that occur in winter and spring. Cotton can provide adequate cover during the growing season but does not leave enough residue on the surface to protect and improve the soil. Rotating cotton with grain sorghum and small grain increases the amount of crop residue and thus 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. In some eroded areas undesirable salts are mixed with the topsoil, causing a dense crust to form on the surface. The crust reduces the ability of air and moisture to enter the soil and hinders the emergence of crop seedlings. Loss of the surface layer is especially damaging if the soil is shallow. Secondly, water erosion on farmland results in the sedimentation of streams. Controlling water erosion minimizes this pollution and improves the quality of water for urban uses, recreation, and wildlife.

Erosion-control practices should provide a protective cover, reduce the runoff rate, and increase the rate of water intake. A cropping system that keeps a plant cover on the soil for long periods can hold soil losses to amounts that do not reduce yields.

Erosion is especially damaging on soils that are moderately deep to bedrock, such as Bluegrove, Rowden, and Vernon soils. As erosion reduces the thickness of these soils, the root zone becomes more restricted and the ability of the soils to store moisture for plant use is reduced.

Crop residue management is an effective management practice. A good cover of crop residue helps to prevent surface compaction during periods of rainfall, minimizes crusting, slows runoff, and conserves soil moisture. It shades the soil and thus reduces the soil temperature. In addition, it adds organic matter to the soil, improves tilth, and minimizes packing by farm machinery. The crop residue should be protected from grazing and burning. Tillage equipment that keeps the residue on the surface should be used.

The use of conservation tillage on the soils in Throckmorton County is increasing. Conservation tillage is effective in controlling erosion on sloping land and can be adapted to most of the soils in the county.

Diversion terraces and field terraces reduce the length of slopes and thus slow runoff. Terraces are most practical on deep and moderately deep soils that have smooth slopes.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The 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 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Texas Agricultural 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 most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the

Figure 11.—Contour farming in an area of Leeray silty clay, 0 to 2 percent slopes. Crop rows that follow the contour of the land help to protect this soil from erosion.

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, for woodland, and for engineering purposes.

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

Capability classes, the broadest groups, are designated by 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. Class V contains only the subclasses indicated by *w, s,* or *c* because

the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

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

Rangeland

By Reginald D. Quiett, range conservationist, Natural Resources Conservation Service.

Rangeland is land on which native vegetation consists of a variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetative species are generally suitable for grazing and occur in sufficient amounts to be used for grazing. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by the soil, climate, topography, overstory canopy, and grazing management.

About 85 percent of Throckmorton County is rangeland. Cow-calf and stocker steer operations are dominant in the county. The average size of an operating unit is about 1,160 acres.

On many ranches the forage produced on rangeland is supplemented by small grain. In winter the native forage is often supplemented by protein concentrate.

A typical growth curve for native vegetation representing the percentage of total growth occurring each month would be:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2	3	7	20	30	15	5	10	4	2	1

Approximately 65 percent of the annual production of forage occur in the months of May through July responding to spring and early summer rains. A second smaller growth period may occur in the fall if sufficient moisture is available.

The native vegetation in much of the county has been greatly depleted by continued excessive use and elimination of fire. Much of the acreage that was once open grassland is now covered with brush, weeds, and cactus. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by management practices that are effective for specific kinds of soil and range sites.

Ecological Sites

Range management requires a knowledge of the kind of soil and of the potential natural, or climax, plant community.

Different kinds of soil vary in their capacity to produce grasses and other plants for grazing. Soils that produce about the same kinds, amounts, and proportions of forage make up a ecological site.

An ecological site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, or proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, ecological sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

The climax vegetation on the ecological site is the stabilized natural plant community that the site is capable of producing. It consists of the plants that were growing on the site when the region was first settled. This plant community reproduces itself and changes very little as long as the environment remains unchanged. If cultivated crops are not grown, the most productive combination of forage plants on an ecological site is generally the climax vegetation.

A rangeland ecological site may be evaluated by three distinct methods: similarity index, rangeland trend, and rangeland health..

Similarity index is a comparison of the present plant community to the historic climax plant community. Similarity index is the percentage, by weight, of historic climax vegetation that is found in present plant community. Similarity index provides an indication of past disturbance as well as potential for improvement.

Rangeland trend determinations assess the direction of change occurring in the present plant community compared to the historic climax plant community. The plant community may be either moving toward or away from the historic climax plant community. This rating provides information to landowners regarding the direction of change in the plant community in response to present management.

Rangeland health is a determination of how the ecological processes on a rangeland ecological site are functioning. Ecological processes evaluated include the water cycle, nutrient cycle, and energy flow.

Knowledge of the ecological site is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to support management objectives, develop planned grazing systems and stocking rates, determine suitable wildlife management practices, evaluate the potential for recreational uses, and determine the condition of watersheds.

How rangeland is managed affects forage production, species composition, plant health, and the ability to the vegetation to protect the soil. Rangeland management requires knowledge of the kinds of soil and of the historic climax plant community. Effective range management conserves rainfall, enhances water quality, reduces the hazard of downstream flooding, improves yields, provides forage for livestock and wildlife, enhances recreational opportunities, and protects the soil.

The primary range management practices used in Throckmorton County include prescribed grazing, stock-water developments, and fences. If undesirable plants become dominant, range seeding, brush management, or prescribed burning are commonly used.

Table 7 shows the ecological 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 potential natural, or climax, plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperature make growing conditions substantially better than average. In a normal year, growing conditions are well below average, generally because of low available soil moisture.

The ecological sites in Throckmorton County are described in the paragraphs that follow. The names of the ecological sites are Clay Loam, Clay Slopes, Clayey Upland, Claypan Prairie, Draw, Loamy Bottomland, Loamy Prairie, Loamy Sand, Low Stony Hill, Redland, Rocky Hill, Sandstone Hill, Sandy, Sandy Bottomland, Sandy Loam, Shaley Hill, Shallow Clay, Very Shallow, and Very Shallow Clay.

Clay Loam ecological site. The Abilene soil in map unit AbA, the Aspermont soil in map unit AsC, the Nukrum soil in map unit NuB, the Nuvalde soils in map units NvA and NvB, the Rowden soil in map unit RdA, the Rowena soils in map units ReA and ReB, the Sagerton soils in map units SaA and SaB, the Springcreek soil in map unit StB and LsD, the Swenson soil in map unit SwA, the Tillman soil in map unit TtA, and the Wichita soil in map unit WtB are in this ecological site. The climax plant community consists of short and mid grasses. The composition, by weight, is about 90 percent grasses, 10 percent forbs, and a trace of woody plants.

The climax vegetation consists of about 25 percent sideoats grama; 25 percent vine mesquite and Arizona cottontop; 15 percent buffalograss and blue grama; 15 percent Texas wintergrass, western wheatgrass, and Canada wildrye; and 10 percent white tridens, dropseeds, plains bristlegrass, Texas cupgrass, and silver bluestem. The 10 percent of the composition made up of forbs consists of Engelmann daisy, heath aster, ragweed, greenthread, dotted gayfeather, guara, verbena, trailing ratany, curlycup gumweed, Maximilian sunflower, milkvetch, and blue-eyed grass. Trace amounts of vine ephedra, condalia, and live oak are in some areas. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 1,500 to 3,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, buffalograss and Texas wintergrass replace mid grasses and dominate the site. Continued heavy grazing results in a plant community of low-quality forbs and grasses, such as broomweed, threeawns, Texas grama, and of woody species, such as mesquite, condalia, pricklypear, and tasajillo.

Clay Slopes ecological site. The Throck soil in map unit ThC and map unit LtD is in this ecological site. The climax plant community is an open mid grass prairie dominated by big bluestem and little bluestem. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consists of about 10 percent big bluestem; 10 percent little bluestem; 10 percent indiangrass; 5 percent Arizona cottontop; 5 percent switchgrass; 15 percent sideoats grama; 5 percent Texas wintergrass; 15 percent buffalograss, meadow dropseed, white tridens, slim tridens, and curly mesquite; and 5 percent threeawns, hairy, and Texas grama. The 5 percent of the composition made up of forbs consists of Engelmann daisy, heath aster, sagewort, woolyshite, ragweed, verbena, bundleflower, curlycup gumweed, trailing ratany, primrose, wild onion, globemallow, dotted gayfeather, gaillardia,

eryngo, gray goldaster, and sawleaf daisy. The 5 percent of the composition made up of woody plants consists of hackberry, ephedra, elbowbush, dalea, bumelia, skunkbush, catclaw acacia, and greenbriar. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,000 to 3,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, big bluestem, indiangrass, switchgrass, and little bluestem decrease in abundance and Arizona cottontop, sideoats grama, vine mesquite, Texas wintergrass, and tall dropseed increase initially. If heavy grazing continues, buffalograss, Texas wintergrass, and threeawns become dominant and mesquite, pricklypear, catclaw, and lotebush invade.

Clayey Upland ecological site. The Leeray soil in map unit LeA is in this ecological site. The climax plant community is an open mid grass prairie. Sideoats grama and Texas wintergrass are the dominant grasses on flats. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and a trace of woody plants.

The climax vegetation consists of about 15 percent sideoats grama; 15 percent vine mesquite; 15 percent Texas wintergrass; 10 percent western wheatgrass and Texas bluegrass; 10 percent buffalograss and curly mesquite; 5 percent white tridens and silver bluestem; 10 percent Arizona cottontop; 15 percent tall dropseed, meadow dropseed, and Texas cupgrass; and a trace amount of Japanese brome and Texas grama. The 5 percent of the composition made up of forbs consists of catclaw, sensitive briar, heath aster, western ragweed, Engelmann daisy, slender greenthread, dotted gayfeather, and guara. The trace amount of woody plants consists of hackberry, vine ephedra, lotebush, and bumelia. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,500 to 4,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, vine mesquite, white tridens, sideoats grama, and Arizona cottontop begin to disappear and silver bluestem, buffalograss, curly mesquite, and Texas wintergrass initially increase in abundance. Continued heavy grazing allows lotebush, mesquite, pricklypear, threeawns, and Texas wintergrass to dominate the site.

Claypan Prairie ecological site. The Thurber soil in map unit TrA is in this ecological site. The climax plant community is an open mid and short grass prairie dominated by sideoats grama. The composition, by weight, is about 90 percent grasses, 10 percent forbs, and a trace of woody plants.

The climax vegetation consists of about 25 percent sideoats grama; 30 percent Arizona cottontop, vine mesquite, tall dropseed, meadow dropseed, sand dropseed, silver bluestem, and white tridens; 20 percent buffalograss and blue grama; 15 percent Texas wintergrass and western wheatgrass; and a trace of threeawns. The 10 percent of the composition made up of forbs consists of heath aster, bush sunflower, dotted gayfeather, Engelmann daisy, western ragweed, verbena, sagewort, greenthread, Maximilian sunflower, wild onion, trailing ratany, and sensitive briar. The trace amount of woody plants consists of vine ephedra and lotebush. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 1,500 to 3,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, sideoats grama decreases in abundance and buffalograss and Texas wintergrass dominate the site. Continued heavy grazing results in an invasion of mesquite, lotebush, pricklypear, hairy tridens, tumble lovegrass, and annual grasses.

Draw ecological site. The Gageby soil in map unit Ga is in this ecological site. The climax plant community consists of mid grasses dominated by sideoats grama and vine mesquite. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consists of about 20 percent vine mesquite; 15 percent sideoats grama; 20 percent western wheatgrass and Texas wintergrass; 10 percent Arizona cottontop and plains bristlegrass; and 25 percent silver bluestem, blue grama, meadow dropseed, and white tridens. The 5 percent of the composition made up of forbs consists of Engelmann daisy, bush sunflower, heath aster, Maximilian sunflower, dotted gayfeather, guara, verbena, sagewort, trailing ratany, greenthread, primrose, and ragweed. The 5 percent of the composition made up of woody plants consists of hackberry, elm, vine ephedra, fourwing saltbush, wolfberry, bumelia, prickly ash, catclaw acacia, and western soapberry. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 3,000 to 4,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, buffalograss, Texas wintergrass, and meadow dropseed initially increase in abundance. It heavy grazing continues, mesquite, pricklypear, and annual grasses invade and buffalograss and Texas wintergrass become the dominant grasses.

Loamy Bottomland ecological site. The Clairemont soil in map unit Cm, the Clearfork soil in map unit Co, the Westola soil in map unit We, and the Wheatwood soil in map unit Wh are in this ecological

site. The climax plant community consists of tall and mid grasses and an abundance of forbs and woody plants. The composition, by weight, is about 75 percent grasses, 10 percent forbs, and 15 percent woody plants.

The climax vegetation consists of about 40 percent indiangrass, switchgrass, big bluestem, and little bluestem; 15 percent vine mesquite and sideoats grama; 20 percent Canada wildrye, Texas wintergrass, western wheatgrass, Texas and bluegrass; and trace amounts of dropseeds, plains lovegrass, plains bristlegrass, Arizona cottontop, silver bluestem, buffalograss, white tridens, and tobosagrass. The 10 percent of the composition made up of forbs consists of Engelmann daisy, Maximilian sunflower, heath aster, guara, bundleflower, sagewort, verbena, sensitive briar, ragweed and greenthread. The 15 percent of the composition made up of woody plants consists of cottonwood, elm, hackberry, oaks, pecan, bumelia, western soapberry, redbud, plum, and greenbriar. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 4,000 to 8,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are initially replaced by sideoats grama, vine mesquite, Texas wintergrass, and western wheatgrass. Continued heavy grazing results in a plant community of Texas wintergrass, western wheatgrass, threeawns, many annual grasses, forbs, and a greatly increased amount of woody plants.

Loamy Sand ecological site. The Grandfield soil in map unit GdB is in this ecological site. The climax plant community is a tall grass prairie with scattered spots of oaks and an abundance of forbs. The composition, by weight, is about 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

The climax vegetation consists of about 25 percent big bluestem, indiangrass, and switchgrass; 30 percent little bluestem; 5 percent purpletop tridens and giant dropseed; 5 percent Canada wildrye and Texas bluegrass; 10 percent sideoats grama and sand lovegrass; and 10 percent plains bristlegrass, Arizona cottontop, silver bluestem, sand dropseed, sand paspalum, Scribner panicum, and threeawns. The 5 percent of the composition made up of forbs consists of Engelmann daisy, primrose, prairie clover, dotted gayfeather, sagewort, verbena, dayflower, ragweed, guara, pricklypoppy, woollywhite, croton, western indigo, and sensitive briar. The 10 percent of the composition made up of woody plants consists of post oak, blackjack oak, hackberry, skunkbush, bumelia, prickly ash, shin oak, yucca, bundleflower, greenbriar, elbowbush, dalea, and plum. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 3,000 to 6,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are grazed out and little bluestem may initially increase in abundance. If heavy grazing continues, the site has dense stands of oak and greenbriar, mesquite invades, and the dominant grasses are threeawns, sand dropseed, fringed signalgrass, gummy lovegrass, and sand paspalum.

Low Stony Hill ecological site. The Palopinto soil in map unit PaC is in this ecological site. The climax plant community is a live oak and post oak savannah with an understory of mid grasses and scattered tall grasses. Sideoats grama and little bluestem are the dominant grasses. The composition, by weight, is about 75 percent grasses, 10 percent forbs, and 15 percent woody plants.

The climax vegetation consists of about 15 percent sideoats grama; 10 percent little bluestem; 10 percent Canada wildrye and Texas wintergrass; 10 percent vine mesquite, green sprangletop, and Texas cupgrass; 5 percent dropseeds and silver bluestem; 10 percent indiangrass and big bluestem; 10 percent buffalograss, curly mesquite, and hairy grama; and trace amounts of slim tridens, rough tridens, threeawns, and red grama. The 10 percent of the composition made up of forbs consists of Engelmann daisy, bush sunflower, orange zexmania, sagewort, mealycup sage, and dotted gayfeather. The 15 percent of the composition made up of woody plants consists of about 10 percent live oak, post oak, and shin oak and 5 percent catclaw, lotebush, yucca, honeysuckle, pricklypear, prickly ash, sumacs, and bumelia. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,500 to 3,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the mid and tall grasses are replaced by buffalograss, slim tridens, and Texas wintergrass. Continued heavy grazing results in an invasion of threeawns, red grama, hairy tridens, catclaw, and pricklypear.

Redland ecological site. The Speck soils in map units SpB and SsB are in this ecological site. The climax plant community is a live oak and post oak savannah. Little bluestem is the dominant grass, and the site supports an abundance of forbs and woody species. The composition, by weight, is about 80 percent grasses, 5 percent forbs, and 15 percent woody plants.

The climax vegetation consists of about 30 percent little bluestem, big bluestem, and indiangrass; 20 percent sideoats grama, tall dropseed, silver bluestem, vine mesquite, Texas cupgrass, green sprangletop, and plains lovegrass; 15 percent Texas

wintergrass and Canada wildrye; 5 percent fall witchgrass; 10 percent buffalograss and curly mesquite; and a trace of threeawns. The 5 percent of the composition made up of forbs consists of Maximilian sunflower, bush sunflower, Engelmann daisy, dotted gayfeather, sagewort, bundleflower, trailing wildbean, western indigo, heath aster, western ragweed, and sensitive briar. The 15 percent of the composition made up of woody plants consists of about 10 percent live oak, post oak, Texas oak, and Bigelow oak and 5 percent elm, hackberry, redbud, bumelia, sumacs, elbowbush, catclaw memosa, greenbriar, ephedra, dalea, and honeysuckle. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,500 to 5,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are initially replaced by sideoats grama, Texas wintergrass, silver bluestem, and buffalograss. Continued heavy grazing results in a site that is dominated by buffalograss, Texas grama, red grama, hairy tridens, Texas wintergrass, scrub live oak, Bigelow oak, mesquite, and lotebush.

Rocky Hill ecological site. The Owens soils in map units OsE and OrE is in this ecological site. The climax plant community is a mixture of mid and tall grasses with scattered woody plants. Because they receive less direct sunlight, north-facing slopes support a denser canopy of vegetation than south-facing slopes. The composition, by weight, is about 80 percent grasses, 5 percent forbs, and 15 percent woody plants.

The climax vegetation consists of about 30 percent big bluestem, indiangrass, switchgrass, purpletop tridens, and little bluestem; 15 percent sideoats grama; 15 percent Arizona cottontop, vine mesquite, and threeawns; and 5 percent Texas wintergrass and Canada wildrye. The 5 percent of the composition made up of forbs consists of heath aster, Engelmann daisy, bush sunflower, sagewort, guara, dotted gayfeather, trailing ratany, bigtop dalea, skullcap, gray goldaster, plains blackfoot, verbena, bundleflower, sensitive briar, and Maximilian sunflower. The 15 percent of the composition made up of woody plants consists of about 5 percent skunkbush sumac, littleleaf sumac, and flameleaf sumac and 10 percent hackberry, elbowbush, bumelia, ephedra, plum dalea, oaks, lotebush, prickly ash, catclaw, and yucca. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 1,200 to 2,400 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are replaced initially by little bluestem and sideoats grama and then by buffalograss, Texas wintergrass, slim tridens, and rough tridens. Continued heavy grazing results in an invasion of red grama, Texas grama, threeawns, western ragweed, many annual forbs, catclaw, mesquite, and pricklypear.

Sandstone Hill ecological site. The Bluegrove soil in map unit BeD and the Jolly soil in map unit JrD are in this ecological site. The climax plant community is a mixture of mid and tall grasses with an open stand of post oak and other trees. Little bluestem is the dominant grass. The composition, by weight, is about 80 percent grasses, 5 percent forbs, and 15 percent woody plants.

The climax vegetation consists of about 25 percent little bluestem; 15 percent big bluestem, indiangrass, and switchgrass; 15 percent sideoats grama and sand lovegrass; 5 percent silver bluestem, hairy grama, and hooded windmillgrass; 10 percent Scribner panicum, dropseeds, purpletop tridens, buffalograss, and blue grama; and 10 percent Texas wintergrass and Canada wildrye. The 5 percent of the composition made up of forbs consists of Engelmann daisy, bush sunflower, bundleflower, prairie clover, lespedeza, and ragweed. The 15 percent of the composition made up of woody plants consists of about 10 percent post oak, blackjack oak, and live oak and 5 percent elm, Texas ash, greenbriar, skunkbush, honeysuckle, elbowbush, bumelia, and prickly ash. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,500 to 4,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, big bluestem, indiangrass, switchgrass, and sand lovegrass are replaced initially by little bluestem and sideoats grama and then by silver bluestem, hairy grama, buffalograss, blue grama, and Texas wintergrass. Continued heavy grazing results in an increase in the amount of invaders, such as threeawns, red lovegrass, sand dropseed, and annual grasses. Post oak, elm, greenbriar, and mesquite increase in abundance with regression of the grasses.

Sandy ecological site. The Anson soil in map unit AnB is in this ecological site. The climax plant community is a tall grass prairie with scattered spots of oaks. The composition, by weight, is about 75 percent grasses, 5 percent forbs and 20 percent woody plants.

The climax vegetation consist of about 25 percent little bluestem; 15 percent big or sand bluestem, switchgrass, and indiangrass; 25 percent purpletop, tridens, tall dropseed, Canada wildrye, silver bluestem, hairy grama, plains bristlegrass, Arizona cottontop and sideoats grama; 5 percent sand lovegrass; 5 percent sand dropseed, hooded windmillgrass, threeawn panicum and paspalums. The 5 percent of

the composition made up of forbs consists or primroses, western ragweed, sagewart and sensitive briar. The 20 percent of the composition made up of woody plants consists of 15 percent post oak and blackjack oak; 5 percent skunkbrush, bumelia, sand sage, hackberry, plum, prickly ash, and greenbriar. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 3,000 to 4,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are grazed out and little bluestem may initially increase. If heavy grazing continues, the site will be dominated eventually by dense stands of oak and greenbriar, mesquite will invades and the dominant grasses are threeawns, sand dropseed, and gummy lovegrass.

Sandy Bottomland ecological site. The Lincoln soil in map unit Ln is in this ecological site. The climax plant community consists of tall grasses and a wide variety of desirable forbs and browse. As a result of deposition, the vegetation may occur as a pure stand of grasses dominated by little bluestem. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and a trace of woody plants

The climax vegetation consists of about 55 percent switchgrass, indiangrass, big bluestem, giant dropseed, and purpletop tridens; 15 percent Canada wildrye and western wheatgrass; 10 percent little bluestem; 10 percent sand lovegrass, vine mesquite, Arizona cottontop, Texas cupgrass, and sideoats grama; 5 percent Texas wintergrass and Texas bluegrass; and trace amounts of beaked panicum, fall witchgrass, sand paspalum, and sand dropseed. The 5 percent of the composition made up of forbs consists of prairie senna, western indigo, Maximilian sunflower, bush sunflower, guara, heath aster, sagewort, dayflower, trailing wildbean, bundleflower, verbena, and sensitive briar. The trace amount of woody plants consists of skunkbush, elbowbush, vine ephedra, western soapberry, prickly ash, oaks, greenbriar, baccharis, and snailseed. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 4,000 to 9,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the tall grasses are replaced by mid and short grasses and little bluestem becomes dominant. Continued heavy grazing results in dense stands of baccharis, mesquite, and saltcedar. Such grasses as alkali sacaton, inland saltgrass, and seep muhly become dominant as the site becomes more salty.

Sandy Loam ecological site. The Newcastle soil in map unit NeB, the Enterprise soil in map unit EnB, the Grandfield soil in map unit GfB, the Lusk soil in map unit LuC, and the Rochelle soil in map unit RcB are in this ecological site. The climax plant community is a post oak and blackjack oak savannah with a mid and tall grass understory. Little bluestem, indiangrass, and big bluestem are the dominant grasses. The composition, by weight, is about 80 percent grasses, 10 percent forbs, and 10 percent woody plants.

The climax vegetation consists of about 20 percent little bluestem; 15 percent big bluestem, indiangrass, switchgrass, and purpletop tridens; 10 percent sideoats grama; 10 percent sand lovegrass; 10 percent Arizona cottontop, vine mesquite, and plains bristlegrass; 5 percent silver bluestem; 5 percent Texas wintergrass and Canada wildrye; and 5 percent blue grama, hairy grama, buffalograss, dropseeds, and hooded windmillgrass. The 10 percent of the composition made up of forbs consists of yellow neptunia, scurfpea, ragweed, Engelmann daisy, bundleflower, daleas, dotted gayfeather, prairie clover, and primrose. The 10 percent of the composition made up of woody plants consists of post oak, blackjack oak, live oak, elm, prickly ash, bumelia, hackberry, elbowbush, and skunkbush. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 3,500 to 6,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, big bluestem, indiangrass, switchgrass, and sand lovegrass disappear and are initially replaced by little bluestem and sideoats grama, which are then replaced by silver bluestem, hooded windmillgrass, hairy grama, buffalograss, and Texas wintergrass. Continued heavy grazing results in an invasion of threeawns, dropseeds, red lovegrass, annual grasses, ragweed, silverleaf nightshade, mesquite, and greenbriar.

Shaly Hill ecological site. The Harpersville soil in map unit OrE is in this range site. The climax plant community consists of short and mid grasses. Sideoats grama dominates this site. The composition, by weight, is about 85 percent grasses, 5 percent forbs and 10 percent woody plants.

The climax plant community is an open midgrass prairie. Typically, sideoats grama makes up 30 percent of the plant community; Arizona cottontop and silver bluestem 20 percent; Texas wintergrass, buffalograss, curlymesquite and rough tridens 20 percent; purple threeawn, hairy grama, and Texas grama 15 percent; forbs, such as verbena and mildvetch, 5 percent; and woody plants, such as catclaw acacia, vine ephedra, lotebush and algerita, 10 percent. The approximate total annual yield of air dry herbage from the climax vegetation ranges from 800 to 1600 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, sideoats grama is removed from the plant community and is replaced by Arizona cottontop, buffalograss, curlymesquite, and Texas wintergrass. If heavy grazing continues for many years, lotebush, mesquite, pricklypear, threeawn, and hairy grama will eventually dominate this site.

Shallow Clay ecological site. The Vernon soil in map unit VnC and the Owens soil in map unit OnD are in this ecological site. The climax plant community consists of short and mid grasses. Sideoats grama dominates, and little bluestem is in areas of favorable moisture. The composition, by weight, is about 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

The climax vegetation consists of about 40 percent sideoats grama; 15 percent buffalograss, curly mesquite, blue grama, and hairy grama; 15 percent vine mesquite, Arizona cottontop, and silver bluestem; 5 percent little bluestem; 5 percent Texas wintergrass; and 5 percent tridens species and dropseeds. The 5 percent of the composition made up of forbs consists of skullcap, verbena, greenthread, sensitive briar, trailing ratany, dotted gayfeather, dalea, western ragweed, twoleaf senna, and mentzelia. The 10 percent of the composition made up of woody plants consists of vine ephedra, yucca, daleas, and hackberry. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 500 to 2,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, sideoats grama is initially replaced by buffalograss. If heavy grazing continues, buffalograss is replaced by threeawns, Texas grama, pricklypear, mesquite, and lotebush.

Tight Sandy Loam ecological site. The Bluegrove soil in map unit BeB, the Jolly soil in map unit JoC, and the Truce soil in map unit TuB are in this ecological site (fig. 12). The climax plant community is a scattered post oak savannah with a mid grass understory. Other woody species are in scattered areas throughout the site. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consists of about 25 percent sideoats grama; 25 percent Arizona cottontop and vine mesquite; 5 percent silver bluestem; 10 percent little bluestem; 5 percent Texas wintergrass; 10 percent blue grama and buffalograss; 5 percent sand dropseed, hairy grama, and slim tridens; and 5 percent threeawns. The 5 percent of the composition made up of forbs consists of ragweed, sagewort, dayflower, catclaw, sensitive briar, trailing ratany, Engelmann daisy, primrose, dotted gayfeather, heath aster, guara, and verbena. The 5 percent of the composition made up of woody plants consists of post oak, prickly ash, lotebush, skunkbush, catclaw acacia, greenbriar, and bumelia. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 2,000 to 4,000 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the mid grasses decrease in abundance and are replaced by buffalograss, Texas wintergrass, and hooded windmillgrass. Continued heavy grazing results in a plant community that is dominated by buffalograss, hairy tridens, Texas grama, sand dropseed, Texas wintergrass, mesquite, lotebush, pricklypear, and tasajillo.

Very Shallow ecological site. The Lueders soil in map unit LrC, LsD, and OsE and the Pitzer soil in map unit PtC are in this ecological site. The climax plant community consists primarily of mid and short grasses, small amounts of tall grasses, and a variety of forbs and woody plants. The composition, by weight, is about 80 percent grasses, 15 percent forbs, and 5 percent woody plants.

The climax vegetation consists of about 35 percent sideoats grama; 15 percent little bluestem; 5 percent Texas wintergrass; 20 percent buffalograss, green sprangletop, fall witchgrass, Arizona cottontop, plains bristlegrass, and vine mesquite; and 5 percent hairy grama, slim tridens, silver bluestem, threeawns, fall panicum, dropseeds, and red grama. The 15 percent of the composition made up of forbs consists of dotted gayfeather, trailing ratany, Engelmann daisy, bush sunflower, skullcap, gray goldaster, sagewort, heath aster, and others. The 5 percent of the composition made up of woody plants consists of hackberry, catclaw acacia, littleleaf sumac, skunkbush, vine ephedra, elbowbush, bumelia, and dalea. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 450 to 1,500 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, the site is invaded by catclaw acacia, mesquite, hairy tridens, Texas grama, threeawns, croton, and ragweed. Because of the limited depth of the soils, this site cannot support a dense stand of brush. The woody invaders appear stunted. Continued heavy grazing results in extensive bare areas and the formation of gullies.

Very Shallow Clay ecological site. The Knoco soil in the Knoco-Vernon complex (KrE) is in this ecological site. The climax plant community consists of short and mid grasses. Sideoats grama dominates,

Figure 12.—An area of Jolly fine sandy loam, 2 to 5 percent slopes, which is in the Tight Sandy Loam ecological site. The range in this area is in good condition.

and buffalograss also is prevalent. The woody species are widely scattered and shrubby. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consists of about 40 percent sideoats grama; 25 percent buffalograss and curly mesquite; 10 percent silver bluestem; and 15 percent hairy grama, sand dropseed, meadow dropseed, tridens species, and threeawns. The 5 percent of the composition made up of forbs consists of plains blackfoot, rushpea, western ragweed, dotted gayfeather, and sensitive briar. The 5 percent of the composition made up of woody plants consists of lotebush, pricklypear, tasajillo, vine ephedra, and fourwing saltbush. The approximate total annual yield of air-dry herbage from the climax vegetation ranges from 400 to 1,200 pounds per acre, depending on rainfall.

If regression occurs as a result of heavy grazing, sideoats grama is initially replaced by buffalograss. Continued heavy grazing results in a decrease in the amount of buffalograss and an increase in the amount of threeawns, Texas grama, hairy tridens, pricklypear, mesquite, and lotebush.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water

impoundment sites, and access to public 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 8, 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 a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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

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

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

Paths and trails for hiking 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

By Richard M. Prather, biologist, Natural Resources Conservation Service.

Throckmorton County is in an ecological area known as the Rolling Plains, which provides important habitat for bobwhite quail *(3)*. Bobwhite quail are in areas throughout the county where suitable escape cover is available. Other game species, such as white-tailed deer, Rio Grande turkey, and mourning dove, are common in the county. Deer and turkey are more prevalent along the river drainageways. The number of doves tends to fluctuate according to the amount of milo produced in the county. Numerous species of waterfowl feed and rest in areas of the county as they make their annual migrations. The wildlife species indigenous to the county include cottontail rabbit, California jackrabbit, fox squirrel, armadillo, opossum, raccoon, skunk, several species of bats, small rodents, raptors, and various songbirds. Predator species, such as bobcat and coyote, are prevalent in the county. Reptiles and amphibians also are abundant.

Wildlife have four basic requirements—food, cover, water, and space. The abundance and diversity of animal life in a given area results from the quality, quantity, and diversity of wildlife habitat in the area. According to the Texas Parks and Wildlife Department, Throckmorton County has four vegetative types *(4)*. These are Mesquite-Lotebush Shrub, Mesquite Brush, Mesquite-Saltcedar, and Brush/Woods and Crops.

The Mesquite-Lotebush Shrub type covers approximately 80 percent of the county. Mesquite is the major woody species. Bobwhite quail commonly are plentiful. Downed mesquite and mesquite with low broken limbs provide loafing cover for quail. Lotebush and tasajillo provide higher quality loafing and escape cover for the quail. The major grain crops are winter

wheat, oats and milo. Various forbs and legumes also provide food for quail and dove. Deer and turkey are in areas of this vegetative type but are not so plentiful as in other areas of the county. Western diamondback rattlesnakes thrive in areas of this vegetative type. The major soils associated with this vegetative type are the Throck and Springcreek soils in complexes with Lueders soils (map units LsD and LtD) and the Throck soil in map unit ThC.

Pecan, hackberry, willow, post oak, and blackjack oak on the flood plains along the Clear and Salt Forks of the Brazos River and along other streams provide very good habitat for deer and turkey. The Texas Parks and Wildlife Department estimates that these areas have one deer in every 22 acres. These areas are also rich in nongame species. Songbirds, small mammals, reptiles, and amphibians abound throughout the river corridors. Scattered live oak is throughout the areas but is not common enough to be considered a major woody species. Maximilian sunflower, other sunflowers, western ragweed, and various other forbs make up the herbaceous vegetation.

The Mesquite Brush type is in patches primarily adjacent to the rivers in the county. Mesquite is the dominate vegetative species along with grassland pricklypear, juniper, red grama, Texas grama, western ragweed, wild buckwheat, tobosa, and sand dropseed. Quail, dove, deer, turkey, and numerous nongame species are in areas of this vegetative type. The major soils associated with this vegetative type are the Grandfield, Enterprise, Clairemont, and Clearfork soils in map units GfB, EnB, Cm, and Co.

The Mesquite-Saltcedar type is only in the extreme northwest part of the county, directly southwest of the Millers Creek Reservoir. This area is small, but it adds diversity to the northwest part of the county. It supports saltcedar, cottonwood, desert willow, common buttonbush, saltgrass, and various emergent hydrophytic species. Waterfowl frequent this area annually. The major soils associated with this vegetative type are the Clairemont and Clearfork soils in map units Cm and Co.

The Brush/Woods and Crops type is mainly in the northeastern part of the county. A narrow band of this vegetative type meanders through the center of the county and then southeastward. There are approximately 82,000 acres of cropland in areas of this vegetative type. About 75 percent of the cropland is planted to small grain. Small mammals, dove, quail, and songbirds are prevalent in these areas. The habitat for certain species of wildlife can be improved by leaving strips of unharvested grain around crop field borders and leaving crop residue on the surface as long as possible. The major soils associated with this vegetative type are the Rowena, Sagerton, Nuvalde, and Leeray soils in map units ReA, ReB, SaA, SaB, NvA, NvB, and LeA.

A major concern in managing the wildlife habitat in Throckmorton County is overgrazing by livestock. Overgrazing is especially disastrous during dry years when little forage is left for wildlife. The habitat can be improved by deferred grazing and proper grazing management plans. Brush management and range disking on selected sites are cost-effective ways to improve the habitat for quail. Food plots of winter wheat are beneficial during the cool season. Deer, dove, and waterfowl utilize winter wheat when it is available and benefit from its 16 percent protein content. The dry summer months also are stressful periods for wildlife. Milo is a good grain crop for wildlife during these periods and is utilized by all types of game species.

Numerous ponds are throughout the county. Many are stocked with largemouth bass, bluegill, redear sunfish, and channel catfish. In addition to those fish species, other species inhabiting in the Clear and Salt Forks of the Brazos River and the associated streams and commonly in managed ponds include green sunfish, bullhead catfish, crappie, gar, longear sunfish, carp, and various minnows. Throck, Owens, Leeray, Vernon, Knoco, and Harpersville soils are well suited to the construction of ponds.

The quality of water in fish ponds is greatly affected by the soils on which the ponds are constructed. Generally, the surface water in Throckmorton County is of good quality and is well suited to fish production. The principal concerns in managing fish ponds are obtaining and maintaining adequate water depths and controlling aquatic weeds in excessively clear or shallow water.

The areas in Throckmorton County that can be classified as wetland habitat are so small that they could not be mapped separately. They are mostly on large flood plains and consist of sloughs, scour channels, and other shallow depressions. These areas are included with Clairemont, Clearfork, Gageby, and Grandfield soils in mapping.

Federally listed endangered species that are known to winter or migrate through Throckmorton County are the bald eagle and whooping crane. State-listed threatened species in the county are the Texas horned lizard and the Brazos water snake.

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 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 establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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, goldenrod, croton, Texas wintergrass, and grama.

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 agarita, kidneywood, littleleaf sumac, and wild plum.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, dove, meadowlark, field sparrow, cottontail, and fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, turkey, coyote, bobcat, and meadowlark.

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

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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 11 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 11 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 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage 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 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* 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 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

A soil rated as 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 nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

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 and 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.

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 14 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, CL-ML.

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.

Rock fragments 3 to 10 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 are generally 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 15 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 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.

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

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

of the kind and amount of clay minerals in the soil and on measurements of similar soils.

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

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

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 0.02 to 0.64. Other factors being equal, 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 of soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
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 15, 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 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is

caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Table 16 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* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are 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.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in table 16 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 16. An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

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.

A *cemented pan* is a cemented or indurated subsurface layer within a depth of 5 feet. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in 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 typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. The data

are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series. They are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

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. The codes in parentheses refer to published methods *(7)*.

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).
Water retained—pressure extraction, percentage of ovendry weight of less than 2 mm material; $^1/_3$ or $^1/_{10}$ bar (4B1), 15 bars (4B2).
Bulk density—of less than 2 mm material, saran-coated clods field moist (4A1a), $^1/_3$ 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).
Extractable cations—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).
Cation-exchange capacity—ammonium acetate, pH 7.0, steam distillation (5A8b).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1f).
Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).
Exchangeable sodium percentage (5D2).
Carbonate as calcium carbonate—(fraction less than 2 mm) manometric (6E1g).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(5, 8)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 Alfisol.

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 Ustalf (*Ust*, meaning dry, plus *alf*, from Alfisol).

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; type of saturation; 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 Haplustalfs (*Hapl*, meaning minimal horizonation, plus *ustalf*, the suborder of the Alfisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. 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 Haplustalfs.

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, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, thermic Typic Haplustalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. 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” *(9)*. Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” *(5)* and in “Keys to Soil Taxonomy” *(8)*. Unless otherwise indicated, 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.”

Abilene Series

The Abilene series consists of very deep, nearly level, well drained soils on uplands. These soils are moderately slowly permeable. They formed in calcareous, clayey and loamy alluvial material. Slopes are 0 to 1 percent.

The soils of the Abilene series are fine, mixed, thermic Pachic Argiustolls.

Typical pedon of Abilene clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highways 380

and 283 in Throckmorton, 8.6 miles west on U.S. Highway 380, about 13.1 miles northwest on Texas Highway 222, about 3.6 miles north on a gravel road, 0.3 mile east on a private road, and 60 feet south in an area of rangeland:

A—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/3) moist; weak fine subangular blocky and granular structure; hard, friable; common fine roots; common fine pores; few wormcasts; moderately alkaline; clear smooth boundary.

Bt1—7 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; common fine pores; few wormcasts; few patchy clay films on faces of peds; moderately alkaline; gradual smooth boundary.

Bt2—15 to 22 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate coarse angular blocky structure; very hard, firm; common fine roots; few patchy clay films on faces of peds; few threads and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Btk—22 to 40 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, firm; common very fine pores; few patchy clay films on faces of peds; 10 to 15 percent films, threads, masses, and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk1—40 to 60 inches; reddish yellow (7.5YR 7/6) silty clay loam, reddish yellow (7.5YR 6/6) moist; weak medium subangular blocky structure; hard, firm; common fine pores; about 30 to 40 percent films, threads, and masses of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk2—60 to 70 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; weak fine and medium subangular blocky structure; hard, firm; common fine pores; about 15 to 20 percent films, threads, and masses of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

2BCk3—70 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; very hard, very firm; about 15 to 20 percent films, threads, masses, and concretions of calcium carbonate; few iron-manganese (FeMn) concretions and stains; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The mollic epipedon is more than 20 inches thick. The depth to secondary carbonates is 10 to 28 inches in most pedons.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. The texture is clay loam, silty clay loam, or clay.

The Btk horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. The texture is clay loam, silty clay loam, or clay.

The BCk horizon has hue of 5YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. The texture is silty clay loam or clay.

Anson Series

The Anson series consists of very deep, nearly level or very gently sloping, moderately well drained soils on uplands. These soils are moderately slowly permeable. They formed in thick deposits of sandy eolian material. Slopes range from 0 to 3 percent.

The soils of the Anson series are loamy, siliceous, thermic Aquic Arenic Paleustalfs.

Typical pedon of Anson fine sand, 0 to 3 percent slopes; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 13.3 miles south on U.S. Highway 283, about 0.25 mile east on a private road, and 0.4 mile north in an area of cropland;

A—0 to 6 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; common fine roots; neutral; clear smooth boundary.

E—6 to 28 inches; very pale brown (10YR 8/4) loamy fine sand, very pale brown (10YR 7/4) moist; single grained; loose; few fine roots in the upper part; 1 to 3 percent siliceous pebbles; neutral; abrupt smooth boundary.

Bt1—28 to 38 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common coarse reddish yellow (7.5YR 6/6) mottles; weak medium subangular blocky structure; very hard, very firm; few thin patchy clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bt2—38 to 46 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium distinct yellow (10YR 7/6) mottles; weak medium subangular blocky structure; very hard, very firm; few thin patchy clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bt3—46 to 58 inches; very pale brown (10YR 7/3)

sandy clay loam, pale brown (10YR 6/3) moist; common medium distinct yellow (10YR 7/6) mottles; weak fine and medium subangular blocky structure; hard, firm; few thin patchy clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bt4—58 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium distinct brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; hard, firm; few thin patchy clay films on faces of some peds; slightly alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The average content of clay in the control section ranges from 20 to 35 percent.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. The E horizon is 1 to 3 units higher in value than the A horizon. The texture of the E horizon is fine sand or loamy fine sand. Reaction in the A and E horizons ranges from moderately acid to neutral. The combined thickness of these horizons ranges from 20 to 40 inches.

Some pedons have a BC horizon. The Bt and BC horizons have hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 to 6. The texture is mainly sandy clay loam. Reaction is neutral or slightly alkaline.

Aspermont Series

The Aspermont series consists of very deep, gently sloping, well drained soils on uplands. These soils are moderately permeable. They formed in calcareous, loamy alluvial material overlying silty and clayey red beds. Slopes range from 3 to 5 percent.

The soils of the Aspermont series are fine-silty, mixed, thermic Typic Ustochrepts.

Typical pedon of Aspermont silty clay loam, 3 to 5 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 8.3 miles west on U.S. Highway 380 to its intersection with Texas Highway 222, about 13.2 miles northwest on Texas Highway 222, about 2.8 miles north on a county road, and 870 feet east in an area of rangeland:

A—0 to 10 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium granular structure; hard, friable; common fine roots; 10 percent concretions of calcium carbonate; 3 percent rounded siliceous pebbles less than 3 inches in diameter; moderately alkaline; clear smooth boundary.

Bk1—10 to 20 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine and medium roots; 10 percent masses and concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

Bk2—20 to 38 inches; red (2.5YR 4/6) silt loam, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; 15 percent masses and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk—38 to 65 inches; red (2.5YR 4/6) silt loam, reddish brown (2.5YR 3/6) moist; weak fine and medium subangular blocky structure; hard, firm; partially weathered red bed clays and shale; 7 percent masses of calcium carbonate in the upper part; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to more than 60 inches. The content of clay in the 10- to 40-inch control section ranges from 25 to 35 percent. Reaction is moderately alkaline throughout the profile. The calcium carbonate equivalent ranges from 7 to 35 percent. The depth to a distinct zone of calcium carbonate ranges from 12 to 18 inches.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is 5 to 15 inches thick.

The Bk horizon has hue of 2.5YR or 5YR and value and chroma of 4 to 6. The texture is silty clay loam or silt loam.

The C horizon, if it occurs, has hue of 2.5YR or 5YR and value and chroma of 4 to 6. The texture is clay, clay loam, silty clay loam, silt loam, or very fine sandy loam and consists of partially weathered Permian red bed material.

Bluegrove Series

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

The soils of the Bluegrove series are fine, mixed, thermic Typic Haplustalfs.

Typical pedon of Bluegrove fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 6.5 miles south on U.S. Highway 283, about 11.4 miles southeast on U.S. Highway 183, about 1.3 miles east on Farm Road 3227, and about 170 feet south in a field:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular

structure; slightly hard, friable; common fine roots; common medium pores; few sandstone fragments on the surface; neutral; clear wavy boundary.

Bt1—7 to 12 inches; reddish brown (5YR 5/4) sandy clay, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; common fine pores; few distinct clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

Bt2—12 to 22 inches; yellowish red (5YR 4/6) clay, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine and medium roots; few fine pores; few or common distinct clay films on faces of peds; few very fine iron-manganese (FeMn) concretions; slightly alkaline; gradual smooth boundary.

Bt3—22 to 29 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate and weak medium subangular blocky structure; very hard, firm; few distinct clay films on faces of peds; 5 percent weakly cemented or strongly cemented sandstone fragments; neutral; abrupt smooth boundary.

Cr—29 to 32 inches; weakly cemented or strongly cemented, reddish yellow sandstone.

The thickness of the solum and the depth to weathered sandstone bedrock range from 20 to 40 inches. The average content of clay in the control section ranges from 35 to 45 percent.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The texture is fine sandy loam or loam. The content of flaggy sandstone fragments ranges from 0 to 15 percent, by volume. Reaction is slightly acid or neutral. The horizon is 4 to 8 inches thick.

The Bt horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. The texture is sandy clay, clay loam, or clay in the upper part and clay or clay loam in the lower part. Reaction ranges from slightly acid to moderately alkaline. Some pedons have strata of weakly cemented or strongly cemented sandstone and flagstones.

The Cr horizon is weakly cemented or strongly cemented, thin-bedded sandstone. It is interbedded with reddish brown, yellowish brown, yellowish red, reddish yellow, or olive brown shale in some pedons.

Clairemont Series

The Clairemont series consists of very deep, nearly level, well drained soils on flood plains. These soils are moderately permeable. They formed in calcareous, silty alluvium along the Brazos River (fig. 13). Slopes range from 0 to 2 percent.

The soils of the Clairemont series are fine-silty, mixed (calcareous), thermic Typic Ustifluvents.

Typical pedon of Clairemont silt loam, occasionally flooded; 0.9 mile north on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 4 miles east on Texas Highway 79 to its intersection with Farm Road 2356, about 5.9 miles northeast on a county road, 0.7 mile north and 1.8 miles east on a private road, and 8 feet south in an area of rangeland:

A—0 to 5 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; moderate very fine granular and subangular blocky structure; slightly hard, friable; common roots; common fine and medium pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—5 to 22 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 4/4) moist; massive; hard, friable and firm; few fine roots; common earthworm casts; many fine pores; slightly effervescent; moderately alkaline; gradual smooth boundary.

C2—22 to 48 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable and firm; few very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C3—48 to 65 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; prominent bedding planes; hard, friable; few pores; few iron-manganese concretions; few threads of calcium carbonate; slightly effervescent; moderately alkaline.

The content of clay in the control section generally is less than 25 percent but ranges from 18 to 35 percent. Typically, the soils are calcareous throughout, but a few pedons are noncalcareous to a depth of 10 inches.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6.

The C horizon consists of strata that have hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. The texture of the strata generally is silt loam, silty clay loam, or loam, but some pedons have thin strata with other textures. The thickness of the strata ranges from 2 to 6 inches.

Clearfork Series

The Clearfork series consists of very deep, nearly level, well drained soils on flood plains. These soils are moderately slowly permeable. They formed in

calcareous, clayey and loamy alluvium. Slopes are 0 to 1 percent.

The soils of the Clearfork series are fine, mixed, thermic Cumulic Haplustolls.

Typical pedon of Clearfork silty clay loam, occasionally flooded; 1.5 miles east on Texas Highway 79 from its intersection with U.S. Highway 183 north of Throckmorton, 35 feet north of the highway, in an area of cropland:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular and fine subangular blocky structure; very hard, very firm; few fine pores; few dry-weather cracks 5 to 15 millimeters wide; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A1—10 to 14 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 3/2) moist; moderate coarse and medium blocky structure; very hard, very firm; few fine roots; few fine pores; common shiny pressure faces; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—14 to 24 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium blocky structure; very hard, very firm; few fine roots; few fine pores; few shiny pressure faces; few threads and films of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—24 to 34 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate coarse and medium blocky structure; very hard, very firm; few fine roots; few fine pores; about 5 percent masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—34 to 48 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse and medium subangular blocky structure; very hard, very firm; few fine pores; estimated 5 percent masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

BCk1—48 to 54 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm; 5 percent films and threads of calcium carbonate; 5 percent concretions of calcium carbonate; strongly effervescent; moderately alkaline; clear wavy boundary.

BCk2—54 to 62 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm; 10 percent concretions and masses of calcium carbonate; strongly effervescent; moderately alkaline.

The mollic epipedon is 20 to 40 inches thick. COLE ranges from 0.035 to 0.065. The content of clay in the control section averages 35 to 40 percent. Reaction is moderately alkaline throughout the profile.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3. The texture is silty clay loam or clay loam. Dry-weather cracks 5 to 15 millimeters wide are in most pedons.

The Bk and BCk horizons have hue of 5YR to 10YR, value of 3 to 6, and chroma of 4 to 6. The texture is clay loam, silty clay, or silty clay loam. Strata of light brown silty clay loam occur at varying depths and range from 0.5 to 3 inches in thickness. The horizons have films and threads of calcium carbonate.

Enterprise Series

The Enterprise series consists of very deep, very gently sloping, well drained soils on uplands. These soils are moderately rapidly permeable. They formed in loamy eolian material. Slopes range from 1 to 3 percent.

The soils of the Enterprise series are coarse-silty, mixed, thermic Typic Ustochrepts.

Typical pedon of Enterprise very fine sandy loam, 1 to 3 percent slopes; 0.7 mile west on a county road from its intersection with Farm Road 210 at Spring Creek, 0.7 mile south on a gravel county road, and 80 feet east in an area of cropland:

Ap—0 to 7 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular structure; soft, very friable; few very fine roots; moderately alkaline; clear smooth boundary.

A1—7 to 11 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak granular and subangular blocky structure; soft, very friable; few fine roots; moderately alkaline; gradual smooth boundary.

A2—11 to 24 inches; reddish brown (5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular and subangular blocky structure; hard, friable; slightly effervescent at a depth of 22 inches; moderately alkaline; gradual smooth boundary.

Bk—24 to 53 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard,

friable; 5 percent films, threads, and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

2BCk—53 to 65 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; slightly effervescent; 3 percent limestone gravel; 5 percent concretions and masses of calcium carbonate and common films and threads of calcium carbonate; moderately alkaline.

The thickness of the A horizon and the depth to carbonates range from 10 to 30 inches. The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

The B horizon has hue of 2.5YR or 5YR, value of 5 or 6, and chroma of 4 to 6. It ranges from 12 to 36 inches in thickness. The texture is very fine sandy loam, loam, or silt loam.

The 2BC horizon has hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 3 to 6.

Gageby Series

The Gageby series consists of very deep, nearly level or very gently sloping, well drained soils on flood plains. These soils are moderately permeable. They formed in loamy alluvium along local streams (fig. 14). Slopes are dominantly about 0.5 percent but range from 0 to 2 percent.

The soils of the Gageby series are fine-loamy, mixed, thermic Cumulic Haplustolls.

Typical pedon of Gageby loam, occasionally flooded; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 7.9 miles east on U.S. Highway 380, about 0.8 mile south on a county road, 0.3 mile west on a private road, and 80 feet south in an area of rangeland:

A1—0 to 12 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; common fine and medium pores; moderately alkaline; clear smooth boundary.

A2—12 to 22 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; common very fine pores; 5 percent very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—22 to 34 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common medium to very fine pores; 5 percent very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk2—34 to 58 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; few fine roots; common fine pores; 5 percent very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

BCk—58 to 80 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable; few very fine roots; few threads and films of calcium carbonate; thin lenses of fine sandy loam and silt loam on the exterior of peds; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 25 to more than 60 inches. The mollic epipedon is 20 to 40 inches thick. The depth to secondary carbonates ranges from 0 to 25 inches. The texture of the 10- to 40-inch control section is loam, sandy clay loam, or clay loam with a clay content of 18 to 35 percent.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. It generally is moderately alkaline and calcareous, but some pedons are slightly alkaline and noncalcareous above 25 inches.

The Bk and BCk horizons have hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 6. The texture is loam, silty clay loam, sandy clay loam, or clay loam. The content of calcium carbonate in the form of threads, films, and concretions ranges from 5 to 10 percent.

Grandfield Series

The Grandfield series consists of very deep, nearly level or very gently sloping, well drained soils on river terraces. These soils are moderately permeable. They formed in alluvial sediments. Slopes range from 0 to 3 percent.

The soils of the Grandfield series are fine-loamy, mixed, thermic Typic Haplustalfs.

Typical pedon of Grandfield fine sandy loam, 0 to 3 percent slopes; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 0.9 mile north on U.S. Highway 283, about 17.8 miles east-northeast on Texas Highway 79, about 3 miles north on Farm Road 2898, about 1.6 miles west on Farm Road 210, about 7.5 miles west-northwest on a county road, 1 mile

south on a private road, and 275 feet west in an area of rangeland:

A—0 to 7 inches; dark brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine granular and subangular blocky structure; hard, friable; common fine roots; common fine pores; 5 percent siliceous gravel; slightly alkaline; clear smooth boundary.

Bt1—7 to 24 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic and fine subangular blocky structure; hard, friable; very few fine roots; few pores; thin patchy clay films on faces of peds; 5 percent siliceous gravel; slightly alkaline; gradual smooth boundary.

Bt2—24 to 38 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few pores and wormcasts; few patchy clay films on faces of peds; 5 percent siliceous gravel; slightly alkaline; gradual smooth boundary.

Bt3—38 to 58 inches; light red (2.5YR 6/6) sandy clay loam, red (2.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine roots; common fine pores; few patchy clay films on faces of peds; 5 percent siliceous gravel; moderately alkaline; gradual smooth boundary.

Bk—58 to 80 inches; light red (2.5YR 6/6) fine sandy loam, red (2.5YR 5/6) moist; weak fine subangular blocky structure; hard, friable; common fine and medium pores; few very fine roots; estimated 10 percent films and threads of calcium carbonate; 3 percent strongly cemented or weakly cemented concretions of calcium carbonate; moderately alkaline.

The thickness of the solum ranges from 50 to more than 80 inches. The depth to secondary lime in the form of films and threads is 36 to 60 inches. A calcic horizon, if it occurs, is at a depth of more than 60 inches.

The A horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 2 to 4. It is 4 to 18 inches thick. The texture is fine sandy loam or loamy fine sand. Reaction is slightly acid to slightly alkaline.

The Bt and Bk horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. The texture is sandy clay loam or fine sandy loam. Reaction is slightly acid to moderately alkaline.

The C horizon, if it occurs, has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is fine sandy loam with thin strata of loam or sandy clay loam.

Harpersville Series

The Harpersville series consists of very shallow or shallow, strongly rolling or hilly, well drained soils on uplands. These soils are very slowly permeable. They formed in clayey material weathered from shale. Slopes range from 5 to 30 percent.

The soils of the Harpersville series are fine, mixed (calcareous), thermic Ustic Torriorthents.

Typical pedon of Harpersville clay, in an area of Owens-Harpersville complex, 8 to 30 percent slopes, extremely bouldery; from the intersection of U.S Highways 283 and 380 in Throckmorton, 4 miles south on U.S. Highway 283, about 2.4 miles west on Farm Road 923, about 4.0 miles southwest on a county road, 0.5 mile east on a private road, and 500 feet north in an area of rangeland:

A—0 to 9 inches; grayish brown (2.5Y 5/2) extremely bouldery clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse and medium blocky structure; very hard, very firm, sticky and plastic; few fine roots; 0.01 to 0.1 percent of the surface covered with limestone fragments, cobbles, stones, and boulders; very slightly effervescent; moderately alkaline; clear smooth boundary.

C—9 to 22 inches; light olive gray (5Y 6/2) and olive gray (5Y 5/2) clay; few coarse grayish brown (10YR 5/2) mottles; massive; distinct shale fragments with weak coarse angular blocky rock structure; extremely hard, very firm; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 3 to 12 inches. It is the same as the thickness of the A horizon. Limestone or sandstone stones and boulders up to 6 feet across are on the surface. They are few in number or cover as much as about 15 percent of the surface. Boulders cover as much as 75 percent of the surface.

The A horizon has hue of 7.5YR to 5Y, value of 3 to 7, and chroma of 2 to 6. It is 3 to 12 inches thick.

The C horizon has hue of 10YR to 5Y, value of 3 to 7, and chroma of 2 to 6. It is clay, stratified with weakly consolidated shale that can be excavated with a backhoe.

Jolly Series

The Jolly series consists of shallow, gently sloping or moderately sloping, well drained soils on uplands. These soils are moderately permeable. They formed in material weathered from fine and medium grained sandstone of Permian age. Slopes range from 1 to 8 percent.

The soils of the Jolly series are loamy, siliceous, thermic, shallow Typic Haplustalfs.

Typical pedon of Jolly fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1711 with Texas Highway 79 in Elbert, 5.2 miles east on Texas Highway 79, about 4.9 miles north on Farm Road 2459, and 35 feet east in an area of rangeland:

A—0 to 4 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine and medium granular; loose, very friable; common fine roots; few fine pores; few sandstone fragments and siliceous pebbles; neutral; abrupt smooth boundary.

Bt1—4 to 14 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, very firm, sticky and slightly plastic; few fine roots; common fine pores; common continuous clay films on faces of peds; 5 percent sandstone fragments, siliceous pebbles, and iron-manganese (FeMn) concretions; slightly acid; clear smooth boundary.

Bt2—14 to 17 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine and fine roots; few fine pores; few patchy clay films on faces of peds; 10 percent sandstone fragments; 5 percent siliceous pebbles and iron-manganese (FeMn) concretions; slightly acid; abrupt smooth boundary.

Cr—17 to 23 inches; pale yellow (2.5Y 8/4), weakly cemented sandstone.

The thickness of the solum and the depth to sandstone bedrock range from 12 to 20 inches. Rock fragments cover 0 to about 10 percent of the surface. They range in size from gravel to boulders.

The A horizon has hue of 5YR to 10YR, value of 4 or 5, and a dominant chroma of 4. Reaction ranges from moderately acid to neutral.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and a dominant chroma of 4. The content of clay ranges from 20 to 30 percent. The content of sandstone fragments 1 to 8 centimeters across ranges from 0 to 15 percent. Reaction is slightly acid or neutral.

The Cr horizon is weakly cemented or strongly cemented, noncalcareous sandstone in shades of brown, yellow, gray, or olive. Hardness generally is 1 to 3 on the Mohs scale, but in some pedons it is more than 3 below a depth of 40 inches. Coarse reddish and brownish mottles and black streaks are in some pedons. In some pedons the Cr horizon is interbedded with or underlain by shale.

Knoco Series

The Knoco series consists of very shallow or shallow, gently sloping to strongly sloping, well drained soils on uplands. These soils are very slowly permeable. They formed in Permian red bed clays and shales. Slopes range from 3 to 12 percent.

The soils of the Knoco series are clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents.

Typical pedon of Knoco clay, in an area of Knoco-Vernon complex, 3 to 12 percent slopes, very bouldery; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 8.1 miles west on U.S. Highway 380, about 12 miles northwest on Texas Highway 222, and 0.3 mile northeast in an area of rangeland:

A—0 to 11 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak fine and medium blocky structure; very hard, very firm; few fine and medium roots; few medium concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

C—11 to 32 inches; reddish brown (5YR 5/4) shale with clay texture, reddish brown (5YR 4/4) moist; extremely hard, extremely firm, very sticky and plastic; common splotches and thin strata of greenish gray shale in the lower part; moderately alkaline.

The thickness of the solum ranges from 4 to 14 inches. Typically, the soils are calcareous throughout. Calcareous nodules gravel cover 0 to 15 percent of the surface.

The A horizon has hue of 2.5YR to 10R, value of 3 to 5, and chroma of 4 to 6.

The C horizon has hue of 2.5YR to 10R, value of 3 to 5, and chroma of 4 to 8.

Leeray Series

The Leeray series consists of very deep, nearly level or very gently sloping, well drained soils on uplands. These soils are very slowly permeable. They formed in calcareous clays. Slopes range from 0 to 2 percent.

The soils of the Leeray series are fine, montmorillonitic, thermic Typic Chromusterts.

Typical pedon of Leeray silty clay, 0 to 2 percent slopes (fig. 15); from the intersection of U.S. Highways 283 and 380 in Throckmorton, 12 miles south on U.S. Highway 283, about 3.5 miles east on Farm Road 209,

about 1.1 miles north on a private road, and 100 feet east in an area of cropland:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; very hard, very firm; few fine and medium roots; few fine pores; 5 percent siliceous pebbles; very slightly effervescent; moderately alkaline; clear smooth boundary.

A—6 to 19 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; few fine black concretions; common distinct pressure faces on peds; very slightly effervescent; moderately alkaline; gradual wavy boundary.

Bkss—19 to 37 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; extremely hard, very firm; few fine roots; 5 percent concretions and masses of calcium carbonate; many distinct parallel pipeds tilted 30 degrees from the horizontal; prominent grooved slickensides that intersect; common distinct pressure faces; 5 percent iron-manganese (FeMn) concretions; cracks filled with very dark grayish brown material; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bkssy1—37 to 54 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few very fine roots; 5 percent concretions and soft bodies of calcium carbonate and siliceous gravel; 1.4 percent gypsum crystals; common distinct pressure faces and intersecting slickensides; cracks filled with dark grayish brown material; slightly effervescent; moderately alkaline; gradual wavy boundary.

2Bkssy2—54 to 65 inches; strong brown (7.5YR 5/6) silty clay, strong brown (7.5YR 4/6) moist; massive; very hard, very firm; few very fine roots; 5 percent concretions of calcium carbonate and siliceous gravel; 1.3 percent gypsum crystals; common distinct pressure faces and intersecting slickensides; slightly effervescent; moderately alkaline; clear wavy boundary.

2Bkssy3—65 to 73 inches; strong brown (7.5YR 5/6) silty clay loam, strong brown (7.5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; 5 percent siliceous gravel; few concretions of calcium carbonate; common distinct intersecting slickensides; 5 percent, by volume, gypsum crystals; filled cracks of brown material from above; slightly effervescent; moderately alkaline; gradual wavy boundary.

2Bssy—73 to 80 inches; strong brown (7.5YR 5/6) silty clay, strong brown (7.5YR 4/6) moist; weak coarse and medium angular blocky structure; very hard, very firm; few distinct intersecting slickensides; 1.3 percent, by volume, gypsum crystals; very slightly effervescent; moderately alkaline.

These are cyclic soils in which the thickness of the solum ranges from 40 to more than 80 inches. In undisturbed areas there is gilgai microrelief. The soils are moderately alkaline and calcareous throughout the 10- to 40-inch control section. In some pedons the upper 10 inches is noncalcareous and slightly alkaline.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 5, and chroma of 2 or 3. The texture is clay or silty clay.

The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. The texture is silty clay loam, clay, or silty clay.

Lincoln Series

The Lincoln series consists of very deep, nearly level or gently undulating, somewhat excessively drained soils on the flood plains in the Central Rolling Red Plains. These soils are rapidly permeable. They formed in sandy material of recent age. Slopes range from 0 to 3 percent.

The soils of the Lincoln series are sandy, mixed, thermic Typic Ustifluvents.

Typical pedon of Lincoln sandy loam, occasionally flooded; 0.9 mile north on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 4 miles east on Texas Highway 79, about 5.1 miles north on Farm Road 2356, about 5.9 miles northeast on a county road, 0.7 mile north and 2.5 miles east on a private road, and 110 feet north in an area of rangeland:

A—0 to 7 inches; yellowish red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) moist; weak fine granular structure and single grained; loose; many fine roots; many fine pores; few small snail shell fragments; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—7 to 52 inches; reddish yellow (5YR 7/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; loose; common fine roots in the upper part; slightly effervescent; moderately alkaline; gradual smooth boundary.

C2—52 to 74 inches; reddish yellow (5YR 7/6) fine sand, reddish yellow (5YR 6/6) moist; single grained; loose; few fine roots; few distinct bedding

planes; slightly effervescent; moderately alkaline; gradual smooth boundary.
C3—74 to 80 inches; reddish yellow (5YR 7/6) coarse sand and gravel, reddish yellow (5YR 6/6) moist; distinct bedding planes; slightly effervescent; moderately alkaline.

These soils are moderately alkaline and calcareous throughout the 10- to 40-inch control section. In some pedons the upper 10 inches is noncalcareous and slightly alkaline.

The A horizon has hue of 5YR to 2.5Y, value of 4 to 7, and chroma of 2 to 6.

The C horizon has hue of 5YR to 2.5Y, value of 6 to 8, and chroma of 2 to 6. It is loamy fine sand, fine sand, and coarse sand and gravel.

Lueders Series

The Lueders series consists of shallow or very shallow, gently sloping or undulating, well drained soils on uplands. These soils are moderately permeable. They formed in residuum derived from Permian limestone (fig. 16). Slopes range from 1 to 8 percent.

The soils of the Lueders series are loamy-skeletal, carbonatic, thermic Lithic Calciustolls.

Typical pedon of Lueders cobbly loam, 1 to 5 percent slopes; 20.4 miles south on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 3.5 miles west on a private road, 0.7 mile north on a private road, 0.9 mile west on a private road, 0.25 mile north on a private road, 250 feet west on a ranch road, and 25 feet south in an area of rangeland:

A—0 to 6 inches; dark brown (10YR 4/3) cobbly loam, dark brown (10YR 3/3) moist; moderate medium granular structure; hard, friable; common fine roots and pores; 20 percent limestone cobbles and 10 percent limestone pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.
Bk—6 to 12 inches; dark brown (10YR 4/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate granular structure; hard, friable; about 50 percent limestone fragments coated with secondary carbonates occurring as pendants on the underside of the fragments; slightly effervescent; moderately alkaline; abrupt smooth boundary.
R—12 to 24 inches; fractured limestone bedrock.

The thickness of the solum ranges from 7 to 20 inches. It is the same as the depth to bedrock. The control section has 35 to 80 percent limestone fragments less than 10 inches across.

The A and Bk horizons have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. The texture of the fine-earth fraction is loam, clay loam, or silty clay loam. The content of rock fragments ranges from about 35 to 80 percent. The Bk horizon generally has more rock fragments than the A horizon. Most of the fragments in the Bk horizon are coated with calcium carbonate occurring as pendants on the lower side of the fragments.

The R layer is hard, coarsely fractured limestone. Calcium carbonate coatings are in the fractures in the upper few inches.

Lusk Series

The Lusk series consists of moderately deep, undulating, well drained soils on ancient stream terraces. These soils are slowly permeable. They formed in gravelly alluvium. Slopes range from 1 to 5 percent.

The soils of the Lusk series are clayey-skeletal, mixed, thermic Typic Paleustalfs.

Typical pedon of Lusk very gravelly sandy loam, 1 to 5 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 14.8 miles south on U.S. Highway 283, about 1.8 miles west on a gravel county road, and 100 feet north in an area of rangeland:

A—0 to 7 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak medium granular structure; hard, friable; many fine roots; common pores; 20 percent quartz pebbles 1 to 4 centimeters across on the surface and within the horizon; slightly alkaline; abrupt wavy boundary.
Bt1—7 to 16 inches; reddish brown (5YR 5/4) extremely gravelly clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; many fine and medium roots; common pores; few faint clay films on faces of peds; 75 percent quartz pebbles, mostly less than 1 centimeter across; neutral; abrupt smooth boundary.
Bt2—16 to 36 inches; reddish brown (5YR 5/4) very gravelly clay, reddish brown (5YR 4/4) moist; moderate fine granular and subangular blocky structure; common roots; few faint clay films on faces of peds; 55 percent quartz pebbles 2 to 30 millimeters across; neutral; abrupt smooth boundary.
2Cr—36 to 52 inches; reddish yellow (5YR 6/6) extremely gravelly coarse sand, yellowish red (5YR 4/6) moist; conglomerate that is weakly cemented or strongly cemented with silica and

calcium carbonate; massive; porous; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of quartz gravel in the control section ranges from 35 to 70 percent, by volume. Secondary carbonates are within 28 inches of the surface.

The A horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 2 to 4. Reaction ranges from slightly acid to slightly alkaline.

The Bt and 2Cr horizons have hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 8. The texture of the Bt horizon generally is very gravelly clay, extremely gravelly clay loam, or very gravelly sandy clay, but some layers are gravelly clay or gravelly sandy clay. The Cr horizon is extremely gravelly loam to coarse sand. It is moderately alkaline.

Newcastle Series

The Newcastle series consists of moderately deep, very gently sloping, well drained soils on uplands. These soils are moderately permeable. They formed in material weathered from weakly cemented, thin-bedded sandstone of Permian age. Slopes range from 1 to 3 percent.

The soils of the Newcastle series are fine-loamy, mixed, thermic Typic Haplustalfs.

Typical pedon of Newcastle fine sandy loam, 1 to 3 percent slopes; from the intersection of State Highway 79 and Farm Road 1711 in Elbert, 3.3 miles north on Farm Road 1711, about 0.5 mile on a county road, 0.4 mile north on a private road, and 15 feet east of a fence:

A—0 to 4 inches; brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak medium and coarse subangular blocky structure; common very fine and fine roots; common fine pores; 1 to 3 percent siliceous gravel; neutral; clear smooth boundary.

Bt1—4 to 24 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few very fine and fine roots; few fine pores; patchy clay films on faces of peds; 1 to 3 percent siliceous gravel; neutral; clear wavy boundary.

Bt2—24 to 33 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm; few very fine and fine roots; few fine pores; patchy clay films on faces of peds; 1 to 3 percent siliceous gravel and sandstone fragments; neutral; abrupt smooth boundary.

Cr—33 to 50 inches; reddish brown (5YR 5/4), weakly cemented sandstone, reddish brown (5YR 4/4) moist; few black iron-manganese (FeMn) stains; hardness increasing with increasing depth.

The thickness of the solum and the depth to weathered sandstone bedrock range from 20 to 40 inches. The content of clay in the upper 20 inches of the Bt horizon ranges from 22 to 35 percent.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is 4 to 12 inches thick. Reaction is slightly acid or neutral.

The Bt horizon has hue of 2.5YR or 5YR and value and chroma of 4 to 6. The texture is sandy clay loam or clay loam. Reaction ranges from slightly acid to slightly alkaline. Thin, discontinuous layers of soft sandstone make up 0 to 10 percent of the lower 12 inches.

The Cr horizon is weakly cemented sandstone in shades of red to brown. It grades to strongly cemented sandstone with increasing depth. The number of calcium carbonate coatings in fissures and crevices ranges from none to many.

Nukrum Series

The Nukrum series consists of very deep, very gently sloping, well drained soils in valleys. These soils are slowly permeable. They formed in calcareous, clayey sediments derived from interbedded limestone and shale of Permian age. Slopes range from 1 to 3 percent.

The soils of the Nukrum series are fine, montmorillonitic, thermic Vertic Haplustolls.

Typical pedon of Nukrum clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 4.0 miles south on U.S. Highway 283, about 2.4 miles west on Farm Road 923, about 2.9 miles southwest on a county road, and 100 feet west in an area of rangeland:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable; few concretions of calcium carbonate; very slightly effervescent; moderately alkaline; clear wavy boundary.

A2—6 to 36 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; very hard, very firm; common roots; many fine pores; few pressure faces; few very fine limestone fragments;

very slightly effervescent; moderately alkaline; clear wavy boundary.

Bw—36 to 52 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, very firm; common pressure faces; few threads of calcium carbonate; 5 percent limestone fragments; slightly effervescent; moderately alkaline; gradual wavy boundary.

BCk—52 to 66 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; common threads and concretions of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 42 to more than 72 inches. When the soils are dry, cracks 1 to 2 inches wide extend to a depth of 20 inches or more. The content of clay in the control section is 35 to 60 percent.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3. The texture of the A2 horizon is silty clay, clay, or clay loam.

The Bw horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4. The texture is clay or silty clay. The horizon has a trace to 5 percent concretions, masses, threads, and films of calcium carbonate.

The BCk horizon has hue of 10YR to 2.5Y, value of 4 to 7, and chroma of 2 to 6. It is silty clay loam, silty clay, clay loam, clay, or shale with clay texture. In some pedons limestone bedrock is at a depth of more than 60 inches.

Nuvalde Series

The Nuvalde series consists of very deep, nearly level or very gently sloping, well drained soils on alluvial plains. These soils are moderately permeable. They formed in calcareous alluvial sediments. Slopes range from 0 to 3 percent.

The soils of Nuvalde series are fine-silty, mixed, thermic Typic Calciustolls.

Typical pedon of Nuvalde clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 10.9 miles north on U.S. Highway 283 to the Wagon Creek Ranch entrance, about 0.4 mile northeast on a private road, and 60 feet north in an area of rangeland:

A1—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, firm and friable, sticky and plastic; many fine and medium roots; common wormcasts; few fine limestone fragments; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—8 to 13 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; common medium pores; common wormcasts; few quartz pebbles up to 1 centimeter across; few limestone fragments up to 5 millimeters across; dry-weather cracks less than 1 centimeter wide; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bw—13 to 23 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many medium pores; common wormcasts; few limestone fragments up to 1 centimeter across; dry-weather cracks less than 1 centimeter wide; thin brown (7.5YR 5/2) coatings on faces of peds; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk1—23 to 37 inches; pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) moist; moderate medium and fine subangular blocky structure; hard, friable; few wormcasts; common fine roots; few fine pores; 20 to 25 percent masses of calcium carbonate and about 5 percent concretions of calcium carbonate less than 3 centimeters across; few limestone fragments coated with calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—37 to 47 inches; reddish yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 6/6) moist; weak fine and medium subangular blocky and granular structure; hard, friable; few medium and fine roots; few medium pores; few wormcasts; about 30 percent masses and 5 percent concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual diffuse boundary.

BCk—47 to 62 inches; reddish yellow (7.5YR 6/6) silty clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; many fine pores; common fine weakly cemented iron-manganese (FeMn) concretions; about 25 percent masses of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The content of clay in the 10- to 40-inch control section is 30 to 45 percent.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. Dry-weather cracks are common but are less than 1 centimeter wide.

The Bw horizon has hue of 7.5YR or 10YR, value of

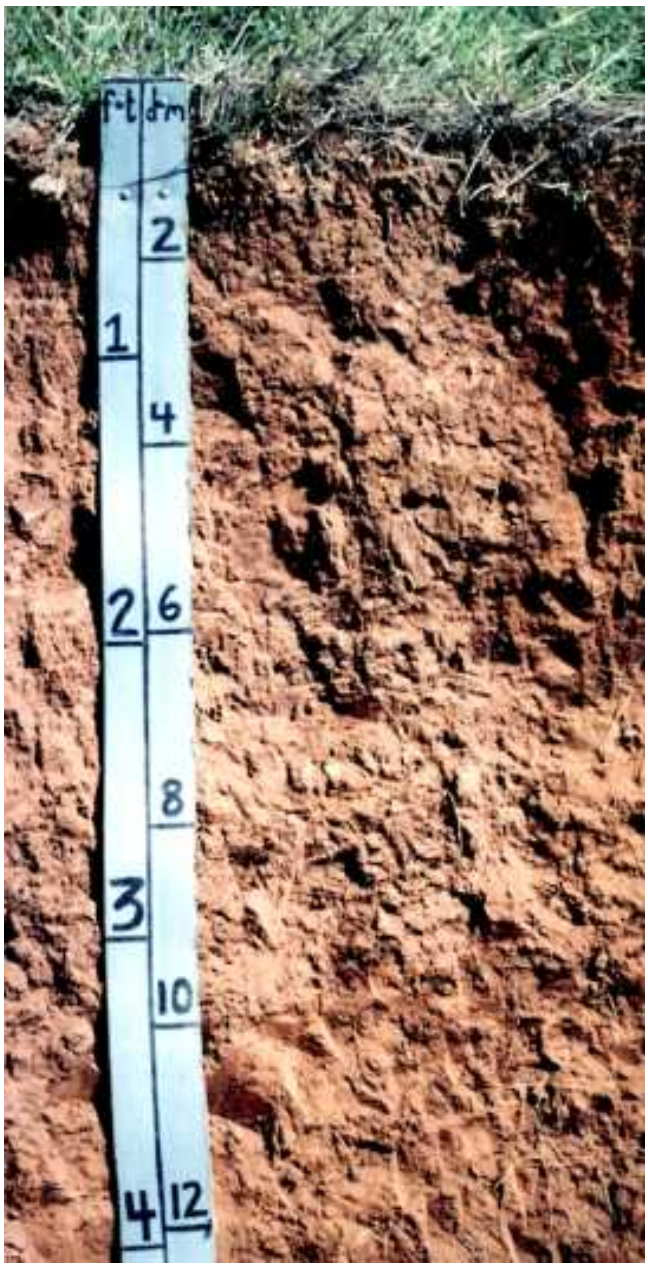


Figure 13.—Profile of Clairemont silt loam. The reddish brown color of this soil is derived from the reddish parent material deposited by the floodwater of major streams.

Figure 14.—Profile of Gageby loam. This well drained, moderately permeable soil formed in calcareous, loamy alluvium on flood plains along small streams.

Figure 15.—Profile of Leeray silty clay. The dark color is from organic matter that has accumulated in the surface layer.

Figure 16.—Profile of Lueders cobbly loam. This soil is droughty because it is shallow to bedrock and contains many fragments of limestone.

Figure 17.—Profile of Owens clay. This soil is underlain by dense shale, which restricts the growth of roots.

Figure 18.—Profile of Pitzer gravelly clay loam. A cemented caliche layer is at a depth of 12 inches.

Figure 19.—Profile of Rowden clay loam. The subsoil, which is reddish brown clay, is underlain by hard limestone bedrock at a depth of about 31 inches.

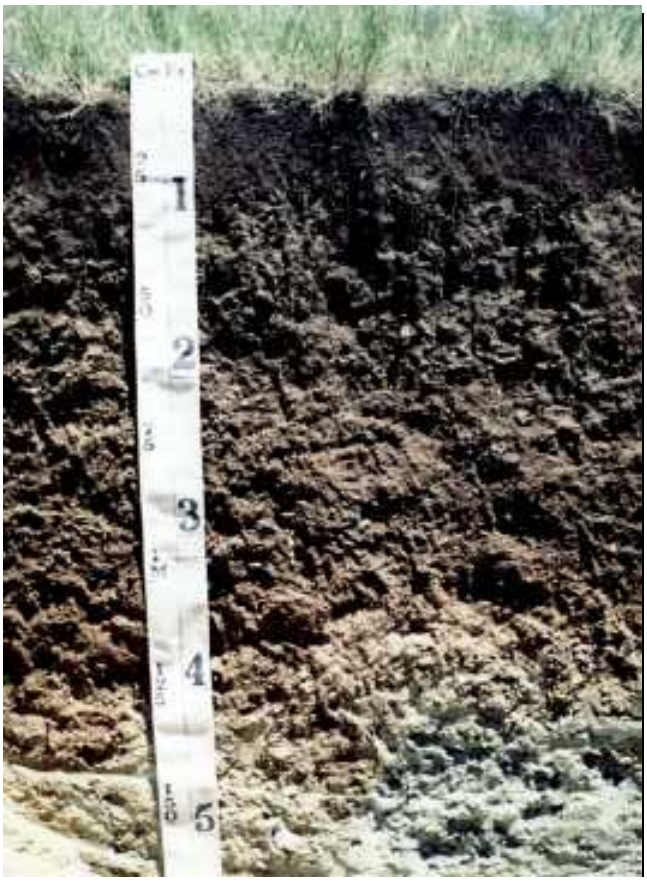


Figure 20.—Profile of Throck silty clay loam. Light gray shale underlies the subsoil at a depth of about 49 inches.

4 or 5, and chroma of 2 to 4. The texture is silty clay loam, silty clay, clay, or clay loam.

The Bk horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. The texture is loam or clay loam. The content of calcium carbonate ranges from 5 to 40 percent.

Owens Series

The Owens series consists of rolling to hilly, well drained soils on erosional uplands. These soils are moderately deep to dense, weathered shale (fig. 17). They are slowly permeable. They formed in material weathered from shale. Slopes range from 8 to 30 percent.

The soils of the Owens series are fine, mixed, thermic Typic Ustochrepts.

Typical pedon of Owens clay, in an area of Owens-Harpersville complex, 8 to 30 percent slopes, extremely bouldery; 4 miles south on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 2.4 miles west on Farm Road 923, about 4 miles southwest on a private road, 0.5 mile east on a private road, and 250 feet north in an area of rangeland:

A—0 to 7 inches; light yellowish brown (10YR 6/4) extremely bouldery clay, yellowish brown (10YR 5/4) moist, moderate coarse and medium angular blocky structure; hard, firm and friable; many roots; many pores; 10 percent very fine and fine shale and limestone fragments; limestone fragments, cobbles, boulders, and stones on 0.01 to 0.1 percent of the surface; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk—7 to 17 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; moderate coarse and medium subangular blocky and blocky structure; extremely hard, very firm; few roots; few pores; few films, threads, and very fine masses of calcium carbonate; few very fine limestone pebbles; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C—17 to 26 inches; gray (5Y 6/1) shale with clay texture, gray (5Y 5/1) moist; massive; extremely hard, very firm; few fine roots; common distinct red, yellow, and brown mottles; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 14 to 30 inches. The soils are moderately alkaline, but some pedons are noncalcareous in the A horizon.

The A horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 2 to 6. It is 3 to 10 inches thick. The texture is clay or extremely bouldery clay.

The Bk horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 2 to 6. It is 4 to 24 inches thick. The texture is clay, clay loam, or silty clay.

The C horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 6. It shale that has clay texture.

Palopinto Series

The Palopinto series consists of very shallow or shallow, undulating, well drained soils on uplands. These soils are moderately permeable. They formed in material weathered from limestone. Slopes range from 2 to 5 percent.

The soils of the Palopinto series are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Typical pedon of Palopinto loam, 2 to 5 percent slopes, very stony; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 2.6 miles east on U.S. Highway 380, about 2.3 miles south-southeast on a gravel road, 1.5 miles southeast on a private road, and 100 feet south in an area of rangeland:

A1—0 to 4 inches; dark brown (7.5YR 4/2) very stony loam, dark brown (7.5YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, friable; common fine roots; common fine pores; estimated 35 percent cover of cobbly and stony limestone and 35 percent similar fragments within the horizon; slightly effervescent; moderately alkaline; clear wavy boundary.

A2—4 to 8 inches; dark brown (7.5YR 4/2) very stony loam, dark brown (7.5YR 3/2) moist; strong fine granular structure; hard, friable; 40 percent limestone cobbles and stones 3 to 15 inches across; slightly effervescent; moderately alkaline; abrupt smooth boundary.

R—8 to 14 inches; hard, coarsely fractured limestone bedrock.

The solum is 6 to 20 inches deep over hard limestone bedrock. It has 35 to 85 percent flattened limestone rocks 1 centimeter to more than 1 meter across. The solum is moderately alkaline and is calcareous or noncalcareous.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. The texture is silty clay loam, extremely stony silty clay loam, very stony loam, or extremely stony loam. The content of clay in the fine-earth fraction is 18 to 35 percent.

Pitzer Series

The Pitzer series consists of gently undulating, well drained soils on uplands. These soils are very shallow or shallow to a petrocalcic horizon (fig. 18). They are moderately permeable. They formed in gravelly terrace deposits over limestone and shale. Slopes range from 1 to 5 percent.

The soils of the Pitzer series are loamy, mixed, thermic, shallow Petrocalcic Calciustolls.

Typical pedon of Pitzer gravelly clay loam, 1 to 5 percent slopes; from the intersection of Texas Highway 79 and U.S. Highway 283 in Throckmorton, 0.4 mile northeast on Texas Highway 79, about 0.2 mile north on a county road, and 175 feet southeast, near gravel pit in an area of rangeland:

A1—0 to 5 inches; reddish brown (5YR 4/3) gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine granular and subangular blocky structure; hard, friable; many fine roots; common pores; about 20 percent, by volume, limestone pebbles 1/4 inch to 2 inches across; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—5 to 10 inches; reddish brown (5YR 4/3) gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; common pores; about 25 percent, by volume, limestone pebbles 1/4 inch to 2 inches across; slightly effervescent; moderately alkaline; abrupt wavy boundary.

Bkm—10 to 16 inches; white (10YR 8/2), indurated caliche; fractured plates 4 to 7 inches across and 1 to 2 inches thick with calcium carbonate pendants on the lower side; a laminar cap about 1 centimeter thick on the upper plates; common fine and medium roots in fractures; some embedded limestone and siliceous pebbles; slightly effervescent; moderately alkaline; abrupt wavy boundary.

BCk—16 to 50 inches; pink (7.5YR 8/4) very gravelly loam, pink (7.5YR 7/4) moist; massive; hard, friable; few roots in the upper part; about 60 percent, by volume, concretions of calcium carbonate with limestone and a few siliceous pebbles 2 millimeters to 8 centimeters across; strongly effervescent; moderately alkaline; clear wavy boundary.

2BCk—50 to 65 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; seams of gray shale; weak fine and medium subangular blocky structure; very hard, very firm; common masses and concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The depth to a petrocalcic horizon is 4 to 20 inches. The depth to layers containing more than 35 percent siliceous and limestone pebbles ranges from 10 to 36 inches.

The A horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. It is 4 to 14 inches thick.

The Bkm horizon is 2 to 10 inches thick. It varies in hardness from weakly cemented material to hard, indurated caliche plates with laminar caps.

The 2BCk horizon has hue of 2.5YR to 7.5YR, value of 6 to 8, and chroma of 2 to 8. The texture of the fine-earth fraction is sandy loam, loam, sandy clay loam, or clay. The underlying limestone bedrock or weathered shale does not occur in some pedons.

Rochelle Series

The Rochelle series consists of moderately deep or deep, very gently sloping, well drained soils on high river terraces. These soils are moderately slowly permeable. They formed in loamy sediments underlain by gravelly alluvium of the Quarternary Period. Slopes range from 1 to 3 percent.

The soils of the Rochelle series are fine-loamy, mixed, thermic Typic Haplustalfs.

Typical pedon of Rochelle fine sandy loam, 1 to 3 percent slopes; 0.5 mile north on U.S. Highway 183 from the Throckmorton-Stephens County line, 0.5 mile west on a county road, and 0.3 mile southwest, in a gravel pit:

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; common fine roots; many fine pores; few quartz pebbles; neutral; clear smooth boundary.

Bt1—7 to 12 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 3/6) moist; weak medium granular and subangular blocky structure; hard, friable; few fine roots; many fine pores; few clay films on faces of peds; common quartz pebbles 3 to 10 millimeters across; neutral; abrupt smooth boundary.

Bt2—12 to 25 inches; red (2.5YR 4/6) gravelly sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few pores; common clay films on faces of peds; 25 percent quartz pebbles 3 to 10 millimeters across; slightly alkaline; gradual smooth boundary.

Bt3—25 to 40 inches; red (2.5YR 4/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few fine roots; few fine pores; 40 percent siliceous pebbles; very few distinct clay films on faces of prisms; slightly alkaline; gradual smooth boundary.
Bt4—40 to 53 inches; red (2.5YR 4/6) gravelly sandy clay loam, dark red (2.5YR 3/6) moist; weak medium and fine subangular blocky structure; hard, firm; few very fine roots; few pores; 25 percent siliceous pebbles; very few faint clay films on faces of peds; moderately alkaline; gradual smooth boundary.
2C—53 to 65 inches; red (2.5YR 5/8) extremely gravelly sandy loam, red (2.5YR 4/8) moist; massive; hard, friable; about 70 percent well graded chert and quartz gravel; moderately alkaline.

The thickness of the solum and the depth to beds of gravel range from 10 to about 48 inches. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4.

The Bt1 horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. The texture is fine sandy loam or sandy clay loam.

The lower Bt horizons have hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. They are sandy clay loam, clay loam, sandy clay, or the gravelly or very gravelly counterparts of those textures.

The 2C horizon is very gravelly or extremely gravelly sandy loam.

Rowden Series

The Rowden series consists of moderately deep, nearly level or very gently sloping, well drained soils on uplands. These soils are slowly permeable. They formed in material weathered from hard limestone (fig. 19). Slopes range from 0 to 2 percent.

The soils of the Rowden series are fine, mixed, thermic Typic Argiustolls.

Typical pedon of Rowden clay loam, 0 to 2 percent slopes; from the intersection of U.S. Highway 283 and Texas Highway 79 in Throckmorton, 4.3 miles east on Texas Highway 79, about 0.5 mile south on a county road, 0.4 mile east on a county road, and 35 feet north of road, in a field:

Ap—0 to 5 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable; common very fine roots; few wormcasts; 1 to 3 percent siliceous pebbles and iron-manganese (FeMn) concretions; neutral; abrupt smooth boundary.
A—5 to 12 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few wormcasts; slightly alkaline; clear smooth boundary.
Bt1—12 to 19 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium blocky structure; very hard, firm; few fine roots; few fine pores; few wormcasts; patchy to continuous clay films on faces of peds; moderately alkaline; clear wavy boundary.
Bt2—19 to 31 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; very few to common distinct clay films on faces of peds; noncalcareous; moderately alkaline; abrupt smooth boundary.
2R—31 to 39 inches; coarsely fractured limestone bedrock with thin calcium carbonate coatings on the surface.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. A few limestone pebbles and cobbles are on the surface. The content of rock fragments ranges from 0 to 10 percent in the solum.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3. It is 5 to 12 inches thick.

The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 2 to 6. It is 15 to 30 inches thick.

Rowena Series

The Rowena series consists of very deep, nearly level or very gently sloping, well drained soils on uplands. These soils are moderately slowly permeable. They formed in calcareous, loamy and clayey sediments. Slopes range from 0 to 3 percent.

The soils of the Rowena series are fine, mixed, thermic Vertic Calciustolls.

Typical pedon of Rowena clay loam, 0 to 1 percent slopes; 8.3 miles north on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 1.1 miles west on a private road to a ranch headquarters, 0.6 mile south and 0.3 mile west on a private road, and 140 feet north in an area of rangeland:

A—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist;

moderate fine granular structure; hard, friable, sticky and plastic; common fine and medium roots; common pores; few wormcasts; 2 percent siliceous pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bw1—7 to 21 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; very hard, firm and friable; common very fine pores; few very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bw2—21 to 38 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium blocky structure; very hard, very firm, sticky and plastic; cracks filled with dark grayish brown clay loam from the surface layer; few distinct pressure faces on peds; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk—38 to 46 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; few very fine roots; cracks filled with dark material from the surface layer; many threads and films and 4 percent masses and concretions of calcium carbonate; strongly effervescent; moderately alkaline; abrupt smooth boundary.

BCk—46 to 65 inches; reddish yellow (7.5YR 7/6) silty clay loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable; about 40 percent, by volume, masses and concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. Secondary carbonates are throughout the solum. The 6- to 34-inch zone has COLE of 0.07 or more in some part. The depth to a calcic horizon ranges from 19 to 40 inches.

The A and Bw horizons have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. The texture is clay loam, silty clay, or clay.

The Bk horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 2 to 4. The texture is clay loam, silty clay, or clay. The content of clay ranges from 35 to 50 percent.

The BCk horizon has hue of 5YR or 7.5YR, value of 6 to 7, and chroma of 4 to 6. The texture is silty clay loam or clay loam. The calcium carbonate equivalent ranges from 20 to 60 percent. The calcium carbonate is in the form of masses and concretions.

Sagerton Series

The Sagerton series consists of very deep, nearly level or very gently sloping, well drained soils on uplands. These soils are moderately slowly permeable. They formed in calcareous, loamy alluvial material. Slopes range from 0 to 3 percent.

The soils of the Sagerton series are fine, mixed, thermic Typic Argiustolls.

Typical pedon of Sagerton clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 8.6 miles west on U.S. Highway 380, about 11.7 miles northwest on Texas Highway 222, about 0.15 mile west on a county road, 0.6 mile south and 0.1 mile east on a private road, and 100 feet south in an area of cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; common fine pores; few wormcasts; slightly alkaline; abrupt smooth boundary.

Bt1—6 to 12 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; common fine pores; few wormcasts; common distinct clay films on faces of peds; moderately alkaline; gradual smooth boundary.

Bt2—12 to 22 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; very hard, firm; few very fine roots; common faint clay films on faces of peds; common threads and concretions of calcium carbonate at a depth of 20 inches; slightly effervescent; moderately alkaline; gradual smooth boundary.

Btk—22 to 34 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm; common very fine pores; few thin clay films on faces of peds; about 15 percent films, threads, masses, and concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—34 to 50 inches; reddish yellow (5YR 6/6) clay, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; common fine pores; about 35 percent films, threads, and masses of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—50 to 62 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, friable; common fine pores; about 40 percent films, threads, and masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk3—62 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few fine pores; about 30 percent films, threads, and masses of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The depth to secondary carbonates is 20 to 28 inches. A calcic horizon is at a depth of 30 to 60 inches.

The A horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction is neutral or slightly alkaline.

The Bt1 horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. The texture is clay loam or clay. The content of clay is 35 to 45 percent.

The Bt2 horizon has hue of 5YR to 7.5YR and value and chroma of 4 to 6. The texture is clay loam or clay. The content of clay is 35 to 45 percent. This horizon is 8 to 16 inches thick.

The Btk and Bk horizons have hue of 2.5YR to 7.5YR and value and chroma of 4 to 6. The Btk horizon is 8 to 26 inches thick. The content of calcium carbonate in this horizon ranges from 20 to 50 percent.

The C horizon, if it occurs, is dominantly clay loam, clay, or silty clay, but some pedons have strata of loam or fine sandy loam. The content of calcium carbonate in this horizon ranges from less than 1 percent to about 5 percent.

Speck Series

The Speck series consists of shallow, nearly level or very gently sloping, well drained soils on uplands. These soils are slowly permeable. They formed in material weathered from hard limestone. Slopes range from 0 to 3 percent.

The soils of the Speck series are clayey, mixed, thermic Lithic Argiustolls.

Typical pedon of Speck silty clay loam, 0 to 2 percent slopes; from the intersection of U.S. Highways 283 and 380 in Throckmorton, 20.1 miles south on U.S. Highway 283, about 8.1 miles west and 1.6 miles north on a county road, and 0.3 mile east in an area of rangeland:

A—0 to 5 inches; dark brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky and granular structure; hard, firm; many very fine roots; few wormcasts; neutral; clear smooth boundary.

Bt—5 to 12 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate coarse and medium blocky structure; very hard, very firm; common fine roots; common fine pores; common wormcasts; continuous clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

R—12 to 20 inches; limestone bedrock that is fractured and has a hardness of more than 3 on the Mohs scale.

The thickness of the solum ranges from 14 to 20 inches. It is the same as the depth to limestone bedrock. A few limestone pebbles and cobbles are on the surface. The content of rock fragments ranges from 0 to about 10 percent in the solum.

The A horizon has hue of 5YR to 10YR, value of 2 to 4, and chroma of 2 or 3. The texture is silty clay loam or stony silty clay loam. Reaction is slightly acid to slightly alkaline.

The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 4. The texture is clay loam, silty clay, or clay. Reaction is neutral or slightly alkaline.

The R layer is coarsely fractured, hard limestone bedrock.

Springcreek Series

The Springcreek series consists of moderately deep, very gently sloping, well drained soils on uplands. These soils are moderately permeable. They formed in loamy material deposited over hard limestone bedrock. Slopes range from 1 to 3 percent.

The soils of the Springcreek series are fine-loamy, carbonatic, thermic Typic Calciustolls.

Typical pedon of Springcreek clay loam, 1 to 3 percent slopes; 9.0 miles north on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 2.4 miles east on McWhorter Road, and 40 feet south in an area of rangeland:

A—0 to 9 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate very fine subangular blocky and granular structure; hard, friable; common fine roots; common wormcasts;

few limestone pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.
Bk1—9 to 18 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; common wormcasts; 20 percent pebbles coated with hardened calcium carbonate up to 3/4 inch thick; violently effervescent; moderately alkaline; gradual smooth boundary.
Bk2—18 to 30 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; 25 percent limestone pebbles coated with hardened calcium carbonate up to 3/4 inch thick; 5 to 10 percent concretions of calcium carbonate; violently effervescent; moderately alkaline; abrupt wavy boundary.
R—30 to 40 inches; indurated, brown, coarsely fractured limestone bedrock; coatings of calcium carbonate up to 1/4 inch thick on the surface of the bedrock and in fractures.

The thickness of the solum and the depth to hard, fractured limestone bedrock range from 20 to 40 inches. The content of rock fragments ranges from 5 to 30 percent, by volume, in the control section. The rock fragments are coated with hardened calcium carbonate. A thin coating of calcium carbonate is on the bedrock and commonly seals fractures in the bedrock. The calcium carbonate equivalent in the control section ranges from 40 to 60 percent. The content of silicate clay in the control section ranges from 25 to 35 percent.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. The content of rock fragments ranges from 0 to 15 percent. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon has hue of 7.5YR or 10YR, value of 4 to 8, and chroma of 2 to 6. The texture is gravelly loam or gravelly or cobbly clay loam. The content of gravel ranges from 10 to 25 percent, and the content of cobbles ranges from 5 to 10 percent. This horizon is calcareous and is slightly alkaline or moderately alkaline.

The R layer is fractured and layered limestone that is grayish or brownish and has a hardness of more than 3 on the Mohs scale.

Swenson Series

The Swenson series consists of moderately deep, nearly level or very gently sloping, well drained soils on uplands. These soils are moderately slowly permeable. They formed in loamy and clayey material deposited over hard limestone bedrock. Slopes range from 0 to 2 percent.

The soils of the Swenson series are fine, mixed, thermic Typic Argiustolls.

Typical pedon of Swenson clay loam, 0 to 2 percent slopes; 8.4 miles west on U.S. Highway 380 from its intersection with U.S. Highway 283 in Throckmorton, 4.1 miles northwest on Texas Highway 222 to the entrance to the headquarters of Throckmorton Land and Cattle Company, 4.2 miles west on a private road, and 75 feet north in an area of rangeland:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; common wormcasts; few fine quartz and chert pebbles; slightly alkaline; clear smooth boundary.
Bt1—4 to 10 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; common wormcasts; common distinct clay films on faces of peds; few fine quartz and chert pebbles; slightly effervescent moderately alkaline; clear wavy boundary.
Btk—10 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; few wormcasts; common distinct clay films on faces of peds; few fine quartz and chert pebbles; 10 percent concretions of calcium carbonate; strongly effervescent; moderately alkaline; abrupt wavy boundary.
BCk—25 to 32 inches; reddish yellow (7.5YR 8/6) gravelly silt loam, reddish yellow (7.5YR 7/6) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; many masses of calcium carbonate; 30 percent limestone fragments coated with hardened calcium carbonate as much as 0.8 inch thick; violently effervescent; moderately alkaline; abrupt smooth boundary.
R—32 to 36 inches; indurated, coarsely fractured, brown limestone bedrock; coatings of calcium carbonate less than 0.3 inch thick on the surface of the bedrock and in fractures in the bedrock.

The thickness of the solum and the depth to hard bedrock range from 20 to 40 inches. The depth to secondary carbonates ranges from 4 to 12 inches. A thin coating of secondary calcium carbonate is on the bedrock and commonly seals some of the fractures in

the bedrock. The content of rock fragments ranges from 0 to 15 percent in the A and Bt horizons.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3. The texture is clay loam with a clay content of 27 to 35 percent. Reaction is neutral or slightly alkaline.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The texture is clay loam or clay with a clay content of 35 to 50 percent. Reaction is slightly alkaline or moderately alkaline.

The Btk horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The texture is clay loam or clay with a clay content 35 to 50 percent. This horizon is calcareous and moderately alkaline. It has few or common masses, threads, and concretions of calcium carbonate.

The BCk horizon has hue of 5YR or 7.5YR, value of 6 to 8, and chroma of 4 to 6. The texture is gravelly silt loam, gravelly silty clay loam, or gravelly clay loam. Masses and concretions of calcium carbonate make up 40 to 70 percent of the horizon, by volume. The content of gravel ranges from 10 to 20 percent, and the content of cobbles ranges from 5 to 10 percent. The rock fragments are coated with common or many masses, threads, and concretions of calcium carbonate.

The R layer is fractured and layered limestone that is grayish or brownish and has a hardness of more than 3 on the Mohs scale.

Throck Series

The Throck series consists of gently sloping to steep, well drained, slowly permeable soils on uplands. These soils are moderately deep or deep to weathered shale (fig. 20). They formed in material weathered from Permian shale. Slopes range from 1 to 30 percent.

The soils of the Throck series are fine, mixed, thermic Vertic Ustochrepts.

Typical pedon of Throck silty clay loam, 1 to 5 percent slopes; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 12 miles south on U.S. Highway 283 to Farm Road 209, about 1.2 miles west on a county road, 0.2 mile northwest on a private road, 0.9 mile west-southwest on a private road, 0.5 mile north on a private road, and 40 feet east in an area of rangeland:

A—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, friable; numerous fine roots; common fine and medium pores; few wormcasts; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—8 to 16 inches; dark yellowish brown (10YR 4/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine roots; common very fine pores; common wormcasts; 4 percent iron-manganese (FeMn) concretions up to 2 millimeters in diameter; few very fine masses of calcium carbonate in the lower 4 centimeters; slightly effervescent; moderately alkaline; clear wavy boundary.

Bk1—16 to 27 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine roots; common fine pores; few wormcasts; few pressure faces on some peds; 4 percent iron-manganese (FeMn) concretions up to 2 millimeters in diameter; about 10 percent medium to very fine masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—27 to 39 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few wormcasts; few grayish brown stains on faces of peds; 4 percent iron-manganese (FeMn) concretions up to 2 millimeters in diameter; about 3 percent fine and very fine masses of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCky—39 to 49 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky and granular structure; hard, firm; 4 percent concretions and masses of calcium carbonate; 5 percent pockets of gypsum crystals; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Ck—49 to 62 inches; light gray (5Y 7/2) shale with loam texture, olive gray (5Y 5/2) moist; massive; extremely hard, firm; strongly effervescent; 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 with 35 to about 50 percent clay.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. The texture of the fine-earth fraction is clay loam or silty clay loam. This horizon is 4 to 14 inches thick. Limestone fragments cover 1 to 15 percent of the surface.

The Bw horizon has hue of 7.5YR to 2.5Y, value of

4 or 5, and chroma of 2 to 4. The content of limestone fragments ranges from a few to 30 percent, by volume. The fragments are mostly less than 3 inches across. This horizon is 5 to 12 inches thick.

The Bk and BCk horizons have hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 2 to 7. The texture is clay loam, silty clay, or clay. Masses of calcium carbonate and gypsum make up 3 to 15 percent of the horizon, by volume.

The 2C horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 2 to 7. It is shale with loam or clay texture. Interbedded strata of limestone 4 to 24 inches thick are at varying depths in most pedons.

Thurber Series

The Thurber series consists of very deep, nearly level or very gently sloping, moderately well drained soils on uplands. These soils are slowly permeable. They formed in Pennsylvanian sediments. Slopes range from 0 to 2 percent.

The soils of the Thurber series are fine, montmorillonitic, thermic Typic Haplustalfs.

Typical pedon of Thurber clay loam, 0 to 2 percent slopes; 0.5 mile north on U.S. Highway 183 from the Throckmorton-Stephens County line, 1.4 miles west on a county road, and 360 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 medium and thick platy structure in the upper 2 inches and massive in the lower part; very hard, very firm; common fine roots and pores; few wormcasts; 2 percent siliceous pebbles up to 1 inch across; slightly alkaline; clear smooth boundary.

Bt1—4 to 22 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse blocky structure; very hard, very firm; few very fine roots; common very fine pores; common continuous clay films on faces of peds; 4 percent siliceous gravel; slightly alkaline; clear wavy boundary.

Bt2—22 to 36 inches; brown (10YR 5/3) clay, brown (10YR 5/3) moist; moderate medium blocky structure; very hard, very firm; few very fine roots; few very fine pores; common continuous clay films on faces of peds; 4 percent siliceous gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Btk1—36 to 50 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate fine and medium 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 masses and concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

Btk2—50 to 62 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; weak fine blocky structure; hard, firm; 4 percent siliceous gravel; iron-manganese (FeMn) concretions; common films and threads and very fine masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—62 to 80 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; few faint brown mottles; weak medium subangular blocky structure; hard, friable; few very fine roots; estimated 3 percent soft masses of calcium carbonate and about 2 percent concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to secondary carbonates ranges from 15 to 28 inches. The surface layer is hard and massive when dry.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 or 3. It is 4 to 12 inches thick.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 4. The texture is dominantly clay. This horizon is slightly alkaline and noncalcareous in the upper part and moderately alkaline and calcareous in the lower part.

The Btk, BCk, and BC horizons have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4. The texture is clay or clay loam. The content of calcium carbonate ranges from 5 to about 10 percent, by volume. It includes a few concretions.

Tillman Series

The Tillman series consists of very deep, nearly level or very gently sloping, well drained soils on uplands. These soils are slowly permeable. They formed in calcareous, clayey alluvial material. Slopes range from 0 to 2 percent.

The soils of the Tillman series are fine, mixed, thermic Typic Paleustolls.

Typical pedon of Tillman clay loam, 0 to 2 percent slopes; 8.6 miles west on U.S. Highway 380 from its intersection with U.S. Highway 283 in Throckmorton, 11.7 miles northwest on Texas Highway 222, about 0.5

mile west on a gravel road, and 0.1 mile west in an area of cropland:

Ap—0 to 6 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3.2) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine roots; common fine pores; few wormcasts; moderately alkaline; abrupt smooth boundary.

Bt—6 to 12 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/3) moist; moderate medium angular blocky structure; very hard, firm; few fine roots; common fine pores; few wormcasts; common faint clay films on faces of peds; moderately alkaline; clear smooth boundary.

Btk1—12 to 24 inches; reddish brown (5YR 4/4) clay, dark reddish brown 5YR 3/4) moist; strong coarse and medium subangular blocky structure; very hard, firm; few very fine roots; common patchy clay films on faces of peds; 4 percent concretions of calcium carbonate and few threads and films of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Btk2—24 to 38 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; strong coarse and medium subangular blocky structure; very hard, very firm; few fine roots; common very fine pores; few distinct clay films on faces of peds; about 15 percent films, threads, masses, and concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk3—38 to 46 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate coarse and medium subangular blocky structure; very hard, firm; few fine roots between peds; 4 percent weakly cemented or strongly cemented concretions of calcium carbonate; common fine pores; few distinct clay films on faces of peds; slightly effervescent; moderately alkaline; gradual smooth boundary.

Btk4—46 to 62 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; few thin patchy clay films on faces of peds; 4 percent distinct coatings of calcium carbonate concretions and soft masses; strongly effervescent; moderately alkaline; abrupt smooth boundary.

BCk—62 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; very hard, very firm; 4 percent weakly cemented or strongly cemented concretions of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Secondary lime is within 24 inches of the surface. A calcic horizon, if it occurs, is below a depth of 40 inches.

The A horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. It is 5 to 16 inches thick.

The B horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. The texture is clay or clay loam.

The BCk horizon is clay loam, clay, or weakly consolidated shale in shades of red brown, gray, or green.

Truce Series

The Truce series consists of gently sloping, well drained, slowly permeable soils on uplands. These soils are deep to weathered shale. They formed in material weathered from shale. Slopes range from 2 to 5 percent. These soils are taxadjuncts to the Truce series because they are dry in the moisture control section for longer periods than is defined as the range for the series.

The soils of Truce series are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Truce fine sandy loam, 2 to 5 percent slopes; from the intersection of U.S. Highway 283 and Farm Road 209 in Woodson, about 0.9 mile north on U.S. Highway 283, about 0.4 mile northwest on a private road, and 90 feet south in an area of rangeland:

A—0 to 5 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky and granular structure; hard, friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—5 to 20 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; very hard, firm; few fine roots; common clay films on faces of peds; few fine pores; neutral; clear smooth boundary.

Bt2—20 to 34 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; thin patchy clay films on faces of peds; moderately alkaline; gradual wavy boundary.

BCk—34 to 42 inches; strong brown (7.5YR 5/6) clay, strong brown (7.5YR 4/6) moist; weak medium

angular blocky structure; hard, firm; common medium yellowish red (5YR 5/6) mottles; few very fine roots; few very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C—42 to 60 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; massive; contains strata of weakly consolidated shale; few masses of calcium carbonate on fracture faces; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is 2 to 10 inches thick. Reaction is slightly acid or neutral.

The Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 3 to 8. The texture is clay, sandy clay, or clay loam. The content of clay ranges from 35 to 50 percent. Reaction ranges from neutral to moderately alkaline. Some pedons have secondary carbonates below a depth of 30 inches.

The BC or BCk horizon has hue of 7.5YR to 2.5Y, value of 5 to 8, and chroma of 6 to 8. The texture is clay. Reaction ranges from neutral to moderately alkaline. The content of calcium carbonate ranges from 0 to about 10 percent.

The C horizon has hue of 2.5Y or 10YR, value of 6 to 8, and chroma of 2 to 6. It is clay, weakly consolidated shale, indurated shale, limestone, or sandstone. Reaction is slightly alkaline or moderately alkaline. Some pedons have carbonates in fracture zones in the upper few inches.

Vernon Series

The Vernon series consists of gently sloping to strongly sloping, well drained, very slowly permeable soils on uplands. These soils are moderately deep to weathered shale. They formed in Permian red bed clays and shales. Slopes range from 1 to 12 percent.

The soils of the Vernon series are fine, mixed, thermic Typic Ustochrepts.

Typical pedon of Vernon clay, 1 to 5 percent slopes; from the intersection of U.S. Highways 380 and 283 in Throckmorton, 8.1 miles west on U.S. Highway 380, about 12 miles northwest on Texas Highway 222, and 120 feet north in an area of rangeland:

A—0 to 6 inches; reddish brown (2.5YR 5/4) clay, dark reddish brown (2.5YR 4/4) moist; weak fine and medium blocky structure; very hard, very firm; few fine and medium roots; few medium concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk—6 to 28 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 4/4) moist; weak fine and medium blocky structure; very hard, very firm; few very fine and medium roots; common distinct pressure faces; few distinct slickensides that do not intersect; common fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

C—28 to 36 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak and moderate angular rocklike structure parting to fine and medium blocks; extremely hard, extremely firm, very sticky; slightly alkaline; gradual smooth boundary.

Cr—36 to 65 inches; reddish brown (2.5YR 5/4 and 4/4) shale with clay texture; common weathered shale fragments; massive; extremely hard, very firm; slightly alkaline.

The thickness of the solum ranges from 20 to 40 inches. Calcareous nodules cover 0 to 15 percent of the surface.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is 3 to 12 inches thick.

The Bk horizon has hue of 10R to 5YR, value of 4 or 5, and chroma of 3 to 6. The texture is silty clay or clay.

The Cr horizon has hue of 2.5YR or 5YR and value and chroma of 4 to 6. It is shale with clay texture. It is noneffervescent to strongly effervescent and is slightly alkaline or moderately alkaline.

Westola Series

The Westola series consists of very deep, nearly level, well drained soils on flood plains. These soils are moderately rapidly permeable. They formed in alluvial sediments along the Brazos River. Slopes are 0 to 1 percent.

The soils of the Westola series are coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents.

Typical pedon of Westola fine sandy loam, occasionally flooded; about 5.1 miles north on Farm Road 2356 from its intersection with Texas Highway 79, about 5.9 miles north and east on a gravel county road, 0.7 mile north and 2.3 miles east on a private road, 95 feet north of the road:

A—0 to 6 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak fine granular structure; soft, very friable; common fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—6 to 30 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive;

soft, very friable; few roots; few pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—30 to 60 inches; strata of pink (5YR 7/4) fine sand, light reddish brown (5YR 6/4) moist, and reddish yellow (5YR 6/6) fine sandy loam, reddish yellow (5YR 5/6) moist; massive; soft, very friable; strongly effervescent; moderately alkaline.

The content of clay in the fine-earth fraction of the control section ranges from 5 to 18 percent.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 2 to 6. Reaction is slightly alkaline or moderately alkaline.

The C horizon has hue of 2.5YR to 7.5YR, value of 5 to 7, and chroma of 3 to 8. The texture is dominantly fine sandy loam or fine sand, but in some pedons thin strata of coarser or finer textured material are throughout the horizon. The horizon is moderately alkaline and calcareous.

Wheatwood Series

The Wheatwood series consists of very deep, nearly level, well drained soils on flood plains. These soils are moderately permeable. They formed in alluvial sediments along the Clear Fork of the Brazos River. Slopes are 0 to 1 percent.

The soils of the Wheatwood series are fine-silty, mixed, thermic Fluventic Ustochrepts.

Typical pedon of Wheatwood silt loam, occasionally flooded; 9.8 miles south on U.S. Highway 283 from its intersection with U.S. Highway 380 in Throckmorton, 2 miles west on Farm Road 2584, about 4.0 miles southwest on a county road, 0.1 mile south on a county road, and 50 feet east in an area of rangeland:

A—0 to 7 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; weak very fine granular and subangular blocky structure; slightly hard, friable; common roots; common fine and medium pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw1—7 to 24 inches; reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable; few fine roots; common earthworm casts; many fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—24 to 40 inches; reddish brown (5YR 4/4) silt loam, reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable; few very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C—40 to 80 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few pores; few threads of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches.The content of clay in the control section generally is less than 25 percent but ranges from 20 to 35 percent.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

The Bw horizon has hue of 2.5YR to 7.5YR and value and chroma of 4 to 6. The texture is silty clay loam, clay loam, or silt loam.

The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 6. The texture of the strata is silty clay loam to very fine sandy loam.

Wichita Series

The Wichita series consists of very deep, very gently sloping, well drained soils on stream terraces, low divides, and upland plains. These soils are moderately slowly permeable. They formed in loamy and clayey alluvium. Slopes range from 1 to 3 percent.

The soils of the Wichita series are fine, mixed, thermic Typic Paleustalfs.

Typical pedon of Wichita clay loam, 1 to 3 percent slopes; 7.9 miles east on U.S. Highway 380 from its intersection with U.S. Highway 183 in Throckmorton, 1.7 miles south on a county road, 1.5 miles east on a private road, and 30 feet east in an area of rangeland:

A—0 to 5 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; few concretions of calcium carbonate 2 to 5 millimeters across; slightly alkaline; gradual smooth boundary.

Bt—5 to 21 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse and medium subangular blocky structure; very hard, very firm; common fine and medium roots; common continuous clay films on faces of peds; few concretions of calcium carbonate up to 5 millimeters across; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk1—21 to 31 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, very firm; few fine and medium roots; common thin continuous clay films on faces of peds; few concretions and many masses of calcium

carbonate 2 to 20 millimeters across; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk2—31 to 68 inches; reddish yellow (5YR 6/6) clay loam, dark yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, very firm; few fine and medium roots; common thin continuous clay films on faces of peds; 4 percent concretions and 10 percent masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—68 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable; about 5 percent films and threads and 5 percent masses of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The depth to secondary carbonates is 8 to 28 inches. A calcic horizon is at a depth of 40 to 60 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is 5 to 10 inches thick. Reaction is neutral or slightly alkaline.

The Bt horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6. It is 26 to 68 inches thick. The texture is clay or clay loam. The content of clay is 35 to 45 percent. Reaction ranges from neutral to moderately alkaline.

The BC horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6. The texture is dominantly clay loam, clay, or silty clay, but some pedons have 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

This section relates the major factors of soil formation to the soils in Throckmorton County.

Time

A great length of time is required for the formation of soils with distinct horizons. Differences in length of time that the parent material has been in place are generally reflected in the degree of development of the soil profile.

The soils in Throckmorton County range from young to old. The young soils are characterized by very little profile development, whereas the older soils have well expressed horizons. Clairemont, Wheatwood, and Clearfork are examples of young soils with little horizon development. More horizon development is evident in Nukrum and Abilene soils.

Some of the older soils are calcareous and have a prominent accumulation of calcium carbonate, or a calcic horizon, in the lower part of the solum. In some even older soils, the calcic horizon has become cemented, or indurated. The indurated horizon is called a petrocalcic horizon. It requires a great length of time for development, possibly millions of years. Pitzer soils have a petrocalcic horizon.

Relief

Relief influences soil formation through its effect on drainage and runoff. Slopes in Throckmorton County range from nearly level to steep.

If other factors of soil formation are equal, the degree of profile development depends on the amount of moisture and the depth of moisture penetration. Nearly level soils absorb more moisture than the more sloping soils and generally have a better developed solum. Many of the soils on the steeper slopes are eroded almost as quickly as they form.

The most deeply developed soils in the county are those of the Leeray series. The nearly level Rowena and Rowden soils are of intermediate depth. Shallow development is exemplified by the more sloping Jolly and Speck soils, and the least development is exemplified by the undulating to steep, very shallow Lueders and Palopinto soils.

Plants and Animals

Plants, animals, insects, and micro-organisms are important in the formation of soils. Living organisms affect gains or losses in organic matter and plant nutrients. They also affect soil structure and porosity.

The content of organic matter in the soils of Throckmorton County ranges from low to high, depending on the amount of vegetation on the soils. Organic matter forms from decaying leaves and stems. Such soils as those in the Grandfield and Enterprise series are low in content of organic matter. The porosity of soils is affected by burrowing organisms, such as earthworms and termites, and by the development of root systems.

Climate

The climate of Throckmorton County is subhumid. It has had a definite effect on soil formation. Rainfall, evaporation, temperature, and wind are some of the climatic factors that affect soil formation. The average annual rainfall at Throckmorton is about 25 inches. The amount of rainfall in the county has not been great enough to leach minerals completely from the soils. As a result, most of the soils have a layer in which calcium carbonate has accumulated.

Mild winters and hot summers in the county contribute to the continuous decomposition of residue from plants and animals by micro-organisms. This decomposition has resulted in a high content of organic matter in Leeray, Nukrum, Nuvalde, Rowena, and other soils.

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. Most of the soils in Throckmorton County formed in material of the Permian and Quarternary Periods. The Quarternary Period is represented by Pleistocene and Recent deposits.

Permian material has influenced the soils throughout the county. It is dominantly red and gray

shales with varying proportions of limestone and sandstone strata. The limestones and sandstones have formed cuestas, while the shales are represented by nearly level to undulating topography.

Several geological formations are represented in Throckmorton County. The major formations that have affected soil formation are, from west to east, the Clear Fork, Lueders, Talpa, Grape Creek, Bead Mountain, Valera, Elm Creek, Admiral, Coleman Junction, Santa Anna, Sedwick, Moran, and Pueblo Formations.

The Clear Fork Formation is in the northwestern part of the county. It is covered in part by a mantle of Quarternary alluvium. The soils in areas of this formation are primarily those of the Rowena, Nuvalde, and Leeray series. Where the formation is exposed, the soils are mainly those of the Vernon, Tillman, and Knoco series.

The Lueders and Talpa Formations are in the western third of the county. Lueders and Springcreek soils are in areas of the Lueders Formation. Nukrum and Leeray soils are in areas of the Talpa Formation in valleys.

The Grape Creek Formation is characterized by undulating to hilly topography and by thin beds of limestone and thick beds of soft shales. The dominant soils in areas of this formation are those of the Throck series.

The Bead Mountain and Valera Formations are characterized by gently sloping uplands. Throck, Nuvalde, and Palopinto are the dominant soils in areas of this formation. Thick beds of limestone underlie these soils at varying depths.

The Elm Creek Formation crops out primarily on steep escarpments. The underlying material is thickly bedded, yellowish brown limestone and thinner beds of shale. Throck and Palopinto soils are dominant in areas of this formation. Throck soils formed in material weathered from the shale, and Palopinto soils formed in material weathered from the limestone.

The Admiral Formation is characterized by nearly level to gently sloping topography. Local alluvial remnants of limestone gravel and caliche form a mantle over much of the area. The dominant soils in areas of this formation are those of the Leeray, Pitzer, and Throck series.

The Coleman Junction Formation is characterized by gently sloping or undulating topography and by thin beds of both limestone and sandstone with shale. Many of the soils in areas of this formation are noncalcareous. The dominant soils are those of the Speck, Bluegrove, Throck, and Truce series.

The Sedwick Formation is characterized by nearly level to gently sloping topography and by thick beds of shale with thin strata of limestone. Leeray and Rowden soils are dominant in areas of this formation.

The Santa Anna, Moran, and Pueblo Formations are characterized by undulating to hilly topography and by thick sandstone and shale layers with thin beds of limestone. The dominant soils in areas of this formation are those of the Bluegrove, Thurber, and Truce series. Some geologists consider the Pueblo Formation to be of the Pennsylvanian age.

The Pleistocene deposits in the county are on terraces and in areas of eolian mantles from the Clear Fork of the Brazos River. The dominant soils on the terraces are those of the Grandfield, Enterprise, and Anson series. They are underlain by loamy, calcareous sediments and quartz gravel.

Recent sediments are in drainageways of local streams and on flood plains along the Clear Fork of the Brazos River and along the Brazos River. Clearfork soils are in local drainageways, Clairemont and Clearfork soils are along the Clear Fork of the Brazos River, and Lincoln and Westola soils are along the Brazos River.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

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.

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, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

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.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

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 directly beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles.

Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

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. Synonyms: 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 plant community. 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 textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Soil material or 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 or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

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, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

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 a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15

to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 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 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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

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 material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

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.

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 A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following 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 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-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

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. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 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. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

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.

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 or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 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, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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 or very 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.

Potential native plant community. See Climax plant community.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

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 natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

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 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:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

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 generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

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 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.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

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. Seepage 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. 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 (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Classes for complex slopes are as follows:

Nearly level	0 to 1 percent
Gently undulating	1 to 5 percent
Undulating	1 to 8 percent
Rolling	5 to 10 percent
Strongly rolling	5 to 16 percent
Hilly	10 to 30 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

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.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter 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. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

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 content of organic matter 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. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt 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). 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.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to 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.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1951-1988 at Throckmorton, TX)

Month	Temperature (Degrees F.)						Precipitation (Inches)				
				2 yrs in 10 will have				2 yrs in 10 will have			
	avg daily max	avg daily min	avg	max temp. >than	min temp. <than	avg # of grow deg days*	avg	less than	more than	avg # of days w/.1 or more	avg total snow fall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	54.1	27.9	41.0	82	6	40	0.93	0.11	1.50	2	1.5
February	58.8	32.4	45.6	86	9	74	1.25	0.45	1.91	3	1.8
March	67.3	40.2	53.8	92	18	201	1.35	0.43	2.25	2	0.6
April	77.1	50.8	63.9	97	28	426	2.48	0.85	3.92	3	0.0
May	84.0	59.4	71.7	102	41	670	3.60	1.60	5.28	5	0.0
June	91.9	67.7	79.8	106	52	890	2.87	1.04	4.70	4	0.0
July	96.8	71.8	84.3	107	60	1057	1.92	0.41	3.33	3	0.0
August	96.7	70.9	83.8	108	58	1047	2.17	0.58	3.41	3	0.0
September	88.4	63.5	75.9	104	44	773	3.66	0.86	6.54	4	0.0
October	78.0	51.8	64.9	97	34	467	2.70	0.71	4.45	3	0.0
November	65.0	39.8	52.4	87	19	165	1.27	0.39	2.04	2	0.5
December	57.0	31.3	44.1	82	11	50	1.22	0.28	2.04	2	1.0
Yearly:											
Average	76.3	50.6	63.4	---	---	---	----	----	----	---	---
Extreme			---	110	4	---	----	----	----	---	---
Total	---	---	---	---	---	5859	25.40	19.92	30.97	36	5.5

Average # of days per year with at least 1 inch of snow on the ground: 3

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum 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 oF).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1951-1988 at Throckmorton, Texas)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 26	April 3	April 12
2 year in 10 later than--	March 18	March 28	April 7
5 year in 10 later than--	March 3	March 16	March 29
First freezing Temperature in fall:			
1 yr in 10 earlier than--	November 9	November 4	October 28
2 yr in 10 earlier than--	November 16	November 9	November 2
5 yr in 10 earlier than--	November 30	November 19	November 10

Table 3.--Growing Season

(Recorded in the period 1951-1988 at Throckmorton)

Probability	Daily minimum temperature		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
9 years in 10	241	224	208
8 years in 10	251	232	214
5 years in 10	271	247	225
2 years in 10	291	263	237
1 year in 10	301	271	243

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AbA	Abilene clay loam, 0 to 1 percent slopes	1,598	0.3
AnB	Anson fine sand, 0 to 3 percent slopes	1,191	0.2
AsC	Aspermont silty clay loam, 3 to 5 percent slopes	603	0.1
BeB	Bluegrove fine sandy loam, 1 to 3 percent slopes	17,824	3.0
BeD	Bluegrove loam, 1 to 8 percent slopes, stony	1,643	0.3
Cm	Clairemont silt loam, occasionally flooded	11,827	2.0
Co	Clearfork silty clay loam, occasionally flooded	31,080	5.3
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	2,105	0.4
Ga	Gageby loam, occasionally flooded	11,177	1.9
GdB	Grandfield loamy fine sand, 0 to 3 percent slopes	580	*
GfB	Grandfield fine sandy loam, 0 to 3 percent slopes	8,687	1.5
JoC	Jolly fine sandy loam, 2 to 5 percent slopes	6,676	1.1
JrD	Jolly-Rock outcrop complex, 1 to 8 percent slopes, very stony	5,482	0.9
KrE	Knoco-Vernon complex, 3 to 12 percent slopes, very bouldery	1,651	0.3
LeA	Leeray silty clay, 0 to 2 percent slopes	55,220	9.4
Ln	Lincoln sandy loam, occasionally flooded	4,128	0.7
LrC	Lueders cobbly loam, 1 to 5 percent slopes	7,066	1.2
LsD	Lueders-Springcreek complex, 1 to 8 percent slopes, very stony	23,127	3.9
LtD	Lueders-Throck complex, 1 to 8 percent slopes, extremely stony	94,849	16.2
LuC	Lusk very gravelly sandy loam, 1 to 5 percent slopes	1,008	0.2
NeB	Newcastle fine sandy loam, 1 to 3 percent slopes	1,982	0.3
NuB	Nukrum clay loam, 1 to 3 percent slopes	15,532	2.7
NvA	Nuvalde clay loam, 0 to 1 percent slopes	1,541	0.3
NvB	Nuvalde clay loam, 1 to 3 percent slopes	9,226	1.6
Od	Oil-waste land	306	*
OnD	Owens clay, 3 to 8 percent slopes	2,349	0.4
OrE	Owens-Harpersville complex, 8 to 30 percent slopes, extremely bouldery	34,761	5.9
OsE	Owens-Lueders complex, 5 to 30 percent slopes, extremely bouldery	43,525	7.4
PaC	Palopinto loam, 2 to 5 percent slopes, very stony	3,209	0.5
PtC	Pitzer gravelly clay loam, 1 to 5 percent slopes	4,892	0.8
RcB	Rochelle fine sandy loam, 1 to 3 percent slopes	953	0.2
RdA	Rowden clay loam, 0 to 2 percent slopes	25,433	4.3
ReA	Rowena clay loam, 0 to 1 percent slopes	9,254	1.6
ReB	Rowena clay loam, 1 to 3 percent slopes	10,833	1.8
SaA	Sagerton clay loam, 0 to 1 percent slopes	12,860	2.2
SaB	Sagerton clay loam, 1 to 3 percent slopes	17,281	3.0
SpB	Speck silty clay loam, 0 to 2 percent slopes	8,751	1.5
SsB	Speck silty clay loam, 1 to 3 percent slopes, stony	678	0.1
StB	Springcreek clay loam, 1 to 3 percent slopes	8,712	1.5
SwA	Swenson clay loam, 0 to 2 percent slopes	10,963	1.9
ThC	Throck silty clay loam, 1 to 5 percent slopes	37,359	6.4
TrA	Thurber clay loam, 0 to 2 percent slopes	11,300	1.9
TtA	Tillman clay loam, 0 to 2 percent slopes	6,075	1.0
TuB	Truce fine sandy loam, 2 to 5 percent slopes	3,614	0.6
VnC	Vernon clay, 1 to 5 percent slopes	6,297	1.1
W	Water	2,377	0.4
We	Westola fine sandy loam, occasionally flooded	1,716	0.3
Wh	Wheatwood silt loam, occasionally flooded	3,771	0.6
WtB	Wichita clay loam, 1 to 3 percent slopes	2,630	0.4
	Total	585,702	100.0

* Less than 0.1 percent.

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
AbA	Abilene clay loam, 0 to 1 percent slopes
AsC	Aspermont silty clay loam, 3 to 5 percent slopes
Cm	Clairemont silt loam, occasionally flooded
Co	Clearfork silty clay loam, occasionally flooded
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes
Ga	Gageby loam, occasionally flooded
GfB	Grandfield fine sandy loam, 0 to 3 percent slopes
LeA	Leeray silty clay, 0 to 2 percent slopes
NeB	Newcastle fine sandy loam, 1 to 3 percent slopes
NuB	Nukrum clay loam, 1 to 3 percent slopes
NvA	Nuvalde clay loam, 0 to 1 percent slopes
NvB	Nuvalde clay loam, 1 to 3 percent slopes
ReA	Rowena clay loam, 0 to 1 percent slopes
ReB	Rowena clay loam, 1 to 3 percent slopes
SaA	Sagerton clay loam, 0 to 1 percent slopes
SaB	Sagerton clay loam, 1 to 3 percent slopes
TtA	Tillman clay loam, 0 to 2 percent slopes
Wh	Wheatwood silt loam, occasionally flooded
WtB	Wichita clay loam, 1 to 3 percent slopes

Table 6.--Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Cotton	Wheat	Grain sorghum
		Lbs	Bu	Bu
AbA---------- Abilene	IIc	375	30	35
AnB---------- Anson	IIIe	---	---	40
AsC---------- Aspermont	IVe	150	16	26
BeB---------- Bluegrove	IIIe	250	25	30
BeD---------- Bluegrove	VIs	---	---	---
Cm---------- Clairemont	IIw	350	25	40
Co---------- Clearfork	IIw	375	30	35
EnB---------- Enterprise	IIe	350	25	35
Ga---------- Gageby	IIw	300	20	30
GdB---------- Grandfield	IIIe	250	20	30
GfB---------- Grandfield	IIe	300	20	30
JoC---------- Jolly	IVe	---	15	---
JrD*:				
Jolly----------	VIs	---	---	---
Rock outcrop----------	VIIIs	---	---	---
KrE:				
Knoco----------	VIIs	---	---	---
Vernon----------	VIe	---	---	---
LeA---------- Leeray	IIe	250	25	45
Ln---------- Lincoln	IVs	---	20	25
LrC---------- Lueders	VIIs	---	---	---

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Cotton	Wheat	Grain sorghum
		Lbs	Bu	Bu
LsD:				
Lueders	VIIs	---	---	---
LsD*:				
Springcreek	IVe	---	15	---
LtD*:				
Lueders	VIIs	---	---	---
Throck	VIs	---	---	---
LuC	VIs	---	---	---
Lusk				
NeB	IIIe	200	18	25
Newcastle				
NuB	IIe	---	---	50
Nukrum				
NvA	IIc	300	20	40
Nuvalde				
NvB	IIe	250	20	35
Nuvalde				
Od*	VIIIs	---	---	---
Oil-waste land				
OnD	VIe	---	---	---
Owens				
OrE:				
Owens	VIIs	---	---	---
Harpersville	VIIs	---	---	---
OsE*:				
Owens	VIIs	---	---	---
Lueders	VIIs	---	---	---
PaC	VIs	---	---	---
Palopinto				
PtC	VIs	---	---	---
Pitzer				
RcB	IIIe	150	15	20
Rochelle				
RdA	IIIe	250	20	40
Rowden				
ReA	IIc	350	30	55
Rowena				
ReB	IIe	325	25	40
Rowena				

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Cotton	Wheat	Grain sorghum
		Lbs	Bu	Bu
SaA---------- Sagerton	IIc	250	25	30
SaB---------- Sagerton	IIe	225	20	25
SpB---------- Speck	IVs	---	15	---
SsB---------- Speck	VIs	---	---	---
StB---------- Springcreek	IIIe	225	25	---
SwA---------- Swenson	IIIe	250	20	---
ThC---------- Throck	IVe	150	15	25
TrA---------- Thurber	IIIe	---	20	30
TtA---------- Tillman	IIIe	300	30	30
TuB---------- Truce	IVe	---	---	30
VnC---------- Vernon	IVe	---	15	14
We---------- Westola	IIw	425	30	50
Wh---------- Wheatwood	IIw	350	30	35
WtB---------- Wichita	IIe	275	25	26

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 7.--Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Ecological site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
AbA Abilene	Clay Loam Pe 31-44	2,500	2,000	1,300
AnB Anson	Sandy Pe 36-50	4,600	4,000	3,500
AsC Aspermont	Clay Loam Pe 34-42	2,400	1,700	1,200
BeB Bluegrove	Tight Sandy Loam Pe 36-50	4,000	3,200	2,000
BeD Bluegrove	Sandstone Hill Pe 36-50	4,000	3,000	2,500
Cm Clairemont	Loamy Bottomland Pe 31-44	5,000	3,500	2,500
Co Clearfork	Loamy Bottomland Pe 34-42	6,000	3,500	2,500
EnB Enterprise	Sandy Loam Pe 31-44	3,000	2,400	1,700
Ga Gageby	Draw Pe 31-44	3,000	2,400	1,800
GdB Grandfield	Loamy Sand Pe 34-42	3,700	2,600	1,900
GfB Grandfield	Sandy Loam Pe 34-42	4,000	2,800	2,000
JoC Jolly	Tight Sandy Loam Pe 36-50	4,000	3,000	2,000
JrD*: Jolly	Sandstone Hill Pe 36-50	3,500	2,500	1,500
Rock outcrop.				
KrE*: Knoco	Very Shallow Clay Pe 31-44	1,400	1,000	600
Vernon	Shallow Clay Pe 31-44	2,500	1,700	1,000
LeA Leeray	Clayey Upland Pe 34-42	4,500	3,500	2,500
Ln Lincoln	Sandy Bottomland Pe 31-44	3,000	2,300	1,800
LrC Lueders	Very Shallow Pe 34-42	1,200	800	500
LsD*: Lueders	Very Shallow Pe 34-42	1,200	800	500

See footnote at end of table.

Table 7.--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
LsD*:				
Springcreek	Clay Loam Pe 34-42	3,000	2,300	1,500
LtD*:				
Lueders	Very Shallow Pe 34-42	1,200	800	500
Throck	Clay Slopes Pe 34-42	3,500	2,500	1,200
LuC	Sandy Loam Pe 34-42	3,000	2,400	1,600
Lusk				
NeB	Sandy Loam Pe 34-42	3,000	2,400	1,800
Newcastle				
NuB	Clay Loam Pe 34-42	4,500	3,500	2,500
Nukrum				
NvA, NvB	Clay Loam Pe 34-42	4,500	3,500	2,000
Nuvalde				
OnD	Shallow Clay Pe 34-42	2,500	1,700	1,000
Owens				
OrE*:				
Owens	Rocky Hill Pe 34-42	1,700	1,200	900
Harpersville	Shaly Hill Pe 34-42	1,600	1,200	800
OsE*:				
Owens	Rocky Hill Pe 34-42	1,700	1,200	900
Lueders	Very Shallow Pe 34-42	1,200	800	500
PaC	Low Stony Hill Pe 34-42	3,500	2,500	1,000
Palopinto				
PtC	Very Shallow Pe 34-42	2,000	1,200	500
Pitzer				
RcB	Sandy Loam Pe 34-42	4,500	3,500	2,000
Rochelle				
RdA	Clay Loam Pe 34-42	4,500	3,500	2,500
Rowden				
ReA, ReB	Clay Loam Pe 34-42	3,000	2,000	1,400
Rowena				
SaA, SaB	Clay Loam Pe 34-42	3,000	2,000	1,400
Sagerton				
SpB, SsB	Redland Pe 36-50	3,800	3,000	2,000
Speck				
StB	Clay Loam Pe 34-42	3,000	2,300	1,500
Springcreek				

See footnote at end of table.

Table 7.--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
SwA Swenson	Clay Loam Pe 34-42	3,000	2,500	1,500
ThC Throck	Clay Slopes Pe 34-42	3,000	2,000	1,200
TrA Thurber	Claypan Prairie Pe 36-50	3,500	3,000	2,000
TtA Tillman	Clay Loam Pe 31-44	2,400	1,700	1,400
TuB Truce	Tight Sandy Loam Pe 36-50	4,000	3,000	2,000
VnC Vernon	Shallow Clay Pe 31-44	2,500	1,700	1,000
We Westola	Loamy Bottomland Pe 31-44	7,000	4,900	3,500
Wh Wheatwood	Loamy Bottomland Pe 34-42	8,000	6,500	5,000
WtB Wichita	Clay Loam Pe 31-44	3,000	2,500	1,500

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 8.--Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AbA Abilene	Slight	Slight	Slight	Slight	Slight.
Anson	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
AsC Aspermont	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
BeB Bluegrove	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
BeD Bluegrove	Slight	Slight	Moderate: large stones, slope.	Slight	Moderate: large stones, depth to rock.
Cm Clairemont	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Co Clearfork	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
EnB Enterprise	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Ga Gageby	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
GdB, GfB Grandfield	Slight	Slight	Slight	Slight	Slight.
JoC Jolly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
JrD*: Jolly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: depth to rock.
KrE*: Knoco	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.	Severe: too clayey.
Vernon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Slight	Severe: too clayey.
LeA Leeray	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ln Lincoln	Severe: flooding.	Slight	Moderate: flooding.	Slight	Severe: droughty.
LrC Lueders	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
LsD*: Lueders	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, small stones.	Slight	Severe: depth to rock.
Springcreek	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: droughty, depth to rock.
LtD*: Lueders	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, small stones.	Slight	Severe: depth to rock.
Throck	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
LuC Lusk	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
NeB Newcastle	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
NuB Nukrum	Slight	Slight	Moderate: slope.	Slight	Slight.
NvA Nuvalde	Slight	Slight	Slight	Slight	Slight.
NvB Nuvalde	Slight	Slight	Moderate: slope.	Slight	Slight.
Od* Oil-waste land	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt.
OnD Owens	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Slight	Severe: too clayey.
OrE*: Owens	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.	Severe: large stones, slope.
Harpersville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: droughty, slope.
OsE*: Owens	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OsE*:					
Lueders	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: depth to rock.
PaC	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, depth to rock.	Slight	Severe: depth to rock.
PtC	Severe: cemented pan.	Severe: cemented pan.	Severe: small stones, cemented pan.	Slight	Severe: cemented pan.
RcB	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
RdA	Slight	Slight	Moderate: small stones.	Slight	Moderate: depth to rock.
ReA	Slight	Slight	Slight	Slight	Slight.
ReB	Slight	Slight	Moderate: slope.	Slight	Slight.
SaA	Slight	Slight	Slight	Slight	Slight.
SaB	Slight	Slight	Moderate: slope.	Slight	Slight.
SpB, SsB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
StB	Slight	Slight	Moderate: small stones.	Slight	Moderate: Depth to rock.
SwA	Slight	Slight	Moderate: small stones.	Slight	Moderate: depth to rock.
ThC	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
TrA	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Moderate: droughty.
TtA	Slight	Slight	Slight	Slight	Slight.
TuB	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VnC	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Slight	Severe: too clayey.
We	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Wh Wheatwood	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
WtB Wichita	Slight	Slight	Moderate: slope.	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 9.--Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AbA---- Abilene	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
An---- Anson	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
AsC---- Aspermont	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
BeB---- Bluegrove	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
BeD---- Bluegrove	Poor	Poor	Good	Fair	Poor	Very poor	Poor	Very poor	Fair.
Cm---- Clairemont	Good	Good	Fair	Good	Very poor	Very poor	Good	---	Fair.
Co---- Clearfork	Poor	Fair	Poor	Fair	Fair	Poor	Poor	Poor	Poor.
EnB---- Enterprise	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ga---- Gageby	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
GdB---- Grandfield	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
GfB---- Grandfield	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
JoC---- Jolly	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
JrD*:									
Jolly----	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Rock outcrop----	---	---	---	---	---	---	---	---	---
KrE*:									
Knoco----	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Vernon----	Fair	Fair	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
LeA---- Leeray	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Ln---- Lincoln	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
LrC---- Lueders	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.

See footnote at end of table.

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
LsD*:									
Lueders.									
Springcreek	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
LtD*:									
Lueders.									
Throck	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
LuC	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Lusk									
NeB	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Newcastle									
NuB	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
Nukrum									
NvA, NvB	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
Nuvalde									
Od*	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Oil-waste land									
OnD	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Owens									
OrE*:									
Owens	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Harpersville	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
OsE*:									
Owens	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Lueders	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
PaC	Poor	Poor	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Palopinto									
PtC	Poor	Poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
Pitzer									
RcB	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
Rochelle									
RdA	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Rowden									
ReA, ReB	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
Rowena									
SaA, SaB	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Sagerton									
SpB	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Speck									

See footnote at end of table.

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
SsB---- Speck	Poor	Poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
StB---- Springcreek	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
SwA---- Swenson	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
ThC---- Throck	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
TrA---- Thurber	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
TtA---- Tillman	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
TuB---- Truce	Fair	Good	Good	Good	Poor	Very poor	Fair	Very poor	Good.
VnC---- Vernon	Fair	Fair	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
We---- Westola	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Wh---- Wheatwood	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
WtB---- Wichita	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 10.--Building Site Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. 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
AbA---- Abilene	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
AnB---- Anson	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Slight----	Moderate: droughty.
AsC---- Aspermont	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
BeB---- 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.
BeD---- 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.
Cm---- Clairemont	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Co---- Clearfork	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: flooding.
EnB---- Enterprise	Slight----	Slight----	Slight----	Slight----	Slight----	Slight.
Ga---- Gageby	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
GdB, GfB---- Grandfield	Slight----	Slight----	Slight----	Slight----	Slight----	Slight.
JoC---- Jolly	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
JrD*:						
Jolly----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
Rock outcrop-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.
KrE*:						
Knoco----	Moderate: too clayey, dense layer.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KrE*:						
Vernon	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Severe: too clayey.
LeA Leeray	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Ln Lincoln	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
LrC Lueders	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
LsD*:						
Lueders	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Springcreek	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, shrink-swell, low strength.	Moderate: droughty, depth to rock.
LtD*:						
Lueders	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Throck	Moderate: too clayey, dense layer.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: small stones.
LuC Lusk	Moderate: depth to rock, too clayey.	Slight.	Moderate: depth to rock.	Moderate: shrink-swell, slope.	Slight.	Severe: small stones.
NeB Newcastle	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight	Moderate: depth to rock.
NuB Nukrum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
NvA, NvB Nuvalde	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Od* Oil-waste land	Variable	Variable	Variable	Variable	Variable	Severe: excess salt.
OnD Owens	Moderate: too clayey, dense layer.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
OrE*:						
Owens	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: large stones, slope.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OrE*:						
Harpersville	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: large stones, slope.
OsE*:						
Owens	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Lueders	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
PaC	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Palopinto	depth to rock, large stones.	depth to rock, large stones.	depth to rock, large stones.	depth to rock, large stones.	depth to rock, low strength.	depth to rock.
PtC	Severe:	Moderate:	Severe:	Moderate:	Moderate:	Severe:
Pitzer	cemented pan.	cemented pan.	cemented pan.	cemented pan.	cemented pan.	cemented pan.
RcB	Severe:	Slight	Slight	Slight	Slight	Moderate:
Rochelle	cutbanks cave.					droughty.
RdA	Severe:	Severe:	Severe:	Severe:	Severe:	Moderate:
Rowden	depth to rock.	shrink-swell.	depth to rock, shrink-swell.	shrink-swell.	shrink-swell, low strength.	depth to rock.
ReA, ReB	Moderate:	Severe:	Severe:	Severe:	Severe:	Slight.
Rowena	too clayey.	shrink-swell.	shrink-swell.	shrink-swell.	shrink-swell, low strength.	
SaA, SaB	Moderate:	Moderate:	Moderate:	Moderate:	Severe:	Slight.
Sagerton	too clayey.	shrink-swell.	shrink-swell.	shrink-swell.	low strength.	
SpB, SsB	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Speck	depth to rock.	shrink-swell, depth to rock.	depth to rock, shrink-swell.	shrink-swell, depth to rock.	depth to rock, shrink-swell, low strength.	depth to rock.
StB	Severe:	Moderate:	Severe:	Moderate:	Moderate:	Moderate:
Springcreek	depth to rock.	shrink-swell, depth to rock.	depth to rock.	shrink-swell, depth to rock.	depth to rock, shrink-swell, low strength.	droughty, depth to rock.
SwA	Severe:	Severe:	Severe:	Severe:	Severe:	Moderate:
Swenson	depth to rock.	shrink-swell.	depth to rock, shrink-swell.	shrink-swell.	shrink-swell, low strength.	depth to rock.
ThC	Moderate:	Severe:	Severe:	Severe:	Severe:	Slight.
Throck	too clayey, dense layer.	shrink-swell.	shrink-swell.	shrink-swell.	shrink-swell, low strength.	
TrA	Moderate:	Severe:	Severe:	Severe:	Severe:	Moderate:
Thurber	too clayey.	shrink-swell.	shrink-swell.	shrink-swell.	shrink-swell, low strength.	droughty.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TtA---------- Tillman	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
TuB---------- Truce	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
VnC---------- Vernon	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
We---------- Westola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Wh---------- Wheatwood	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
WtB---------- 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 11.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbA Abilene	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
AnB Anson	Severe: percs slowly, poor filter.	Severe: seepage.	Slight	Severe: seepage.	Good.
AsC Aspermont	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
BeB, BeD 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.
Cm Clairemont	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Co Clearfork	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey.
EnB Enterprise	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ga Gageby	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
GdB, GfB Grandfield	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Good.
JoC Jolly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
JrD*: Jolly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones.
Rock outcrop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
KrE*: Knoco	Severe: percs slowly.	Severe: slope.	Slight	Slight	Poor: hard to pack.
Vernon	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LeA Leeray	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ln Lincoln	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
LrC Lueders	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, small stones.
LsD*: Lueders	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, small stones.
Springcreek	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack, small stones.
LtD*: Lueders	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, small stones.
Throck	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
LuC 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.
NeB Newcastle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
NuB Nukrum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NvA Nuvalde	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
NvB Nuvalde	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey.
Od* Oil-waste land	Variable	Variable	Severe: excess salt.	Variable	Severe: excess salt.
OnD Owens	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
OrE*: Owens	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OrE*:					
Harpersville	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.
OsE*:					
Owens	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Lueders	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
PaC	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.
PtC	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan, small stones.
RcB	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, small stones.
RdA	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.
ReA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
ReB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SaA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
SaB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
SpB, SsB	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.
StB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones, hard to pack.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SwA---------- Swenson	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.
ThC---------- Throck	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
TrA---------- Thurber	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
TtA---------- Tillman	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
TuB---------- Truce	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
VnC---------- Vernon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
We---------- Westola	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Wh---------- Wheatwood	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
WtB---------- Wichita	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 12.--Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbA Abilene	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AnB Anson	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
AsC Aspermont	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
BeB, BeD Bluegrove	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Cm Clairemont	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Co Clearfork	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
EnB Enterprise	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Ga Gageby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
GdB, GfB Grandfield	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
JoC Jolly	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
JrD*: Jolly	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Rock outcrop	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
KrE*: Knoco	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
Vernon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LeA Leeray	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ln Lincoln	Good	Probable	Improbable: too sandy.	Poor: too sandy.
LrC Lueders	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
LsD*: Lueders	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Springcreek	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
LtD*: Lueders	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Throck	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LuC Lusk	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
NeB Newcastle	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, small stones.
NuB Nukrum	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
NvA, NvB Nuvalde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Od* Oil-waste land	Severe: area reclaim.	Severe: excess fines.	Severe: excess fines.	Severe: excess salt.
OnD Owens	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
OrE*: Owens	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
Harpersville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, slope.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OsE*: Owens	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
OsE*: Lueders	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
PaC: 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.
PtC: Pitzer	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
RcB: Rochelle	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
RdA: Rowden	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
ReA, ReB: Rowena	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SaA, SaB: Sagerton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SpB: Speck	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
SsB: Speck	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
StB: Springcreek	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
SwA: Swenson	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
ThC: Throck	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TrA---------- Thurber	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TtA---------- Tillman	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TuB---------- Truce	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
VnC---------- Vernon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
We---------- Westola	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Wh---------- Wheatwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
WtB---------- 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 13.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. 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-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
AbA---- Abilene	Slight	Moderate: hard to pack.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
AnB---- Anson	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
AsC---- Aspermont	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily.	Erodes easily	Erodes easily.
BeB---- Bluegrove	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Soil blowing, depth to rock.	Depth to rock	Depth to rock.
BeD---- Bluegrove	Moderate: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Slope, depth to rock.	Depth to rock	Depth to rock.
Cm---- Clairemont	Moderate: seepage.	Severe: piping.	Severe: no water.	Erodes easily, flooding.	Erodes easily	Erodes easily.
Co---- Clearfork	Slight	Slight	Severe: no water.	Flooding	Favorable	Favorable.
EnB---- Enterprise	Severe: seepage.	Severe: piping.	Severe: no water.	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
Ga---- Gageby	Moderate: seepage.	Moderate: piping.	Severe: no water.	Flooding	Favorable	Favorable.
GdB---- Grandfield	Severe: seepage.	Severe: piping.	Severe: no water.	Fast intake, soil blowing.	Soil blowing	Favorable.
GfB---- Grandfield	Severe: seepage.	Severe: piping.	Severe: no water.	Soil blowing	Soil blowing	Favorable.
JoC---- Jolly	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Slope, depth to rock.	Depth to rock	Depth to rock.
JrD*:						
Jolly----	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Slope, depth to rock.	Depth to rock	Depth to rock.
Rock outcrop----	Severe: depth to rock, slope.	Slight	Severe: no water.	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
KrE*:						
Knoco----	Slight	Moderate: piping, hard to pack.	Severe: no water.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Too arid, erodes easily.
Vernon----	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
LeA---------- Leeray	Slight---------	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
Ln---------- Lincoln	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
LrC---------- Lueders	Severe: depth to rock.	Severe: large stones.	Severe: no water.	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
LsD*:						
Lueders----------	Severe: depth to rock.	Severe: large stones.	Severe: no water.	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Springcreek------	Moderate: seepage, depth to rock.	Moderate: thin layer, hard to pack.	Severe: no water.	Slope, droughty, depth to rock.	Depth to rock	Droughty, depth to rock.
LtD*:						
Lueders----------	Severe: depth to rock.	Severe: large stones.	Severe: no water.	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Throck----------	Moderate: slope.	Slight---------	Severe: no water.	Slope, droughty.	Percs slowly---	Droughty, percs slowly.
LuC---------- Lusk	Moderate: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Slope, droughty, percs slowly.	Depth to rock, percs slowly.	Droughty, depth to rock, percs slowly.
NeB---------- Newcastle	Moderate: seepage, depth to rock.	Severe: piping.	Severe: no water.	Soil blowing---	Depth to rock, soil blowing.	Depth to rock.
NuB---------- Nukrum	Slight---------	Severe: hard to pack.	Severe: no water.	Percs slowly---	Percs slowly---	Percs slowly.
NvA, NvB---------- Nuvalde	Moderate: seepage.	Moderate: piping.	Severe: no water.	Favorable------	Favorable------	Favorable.
Od*---------- Oil-waste land	Variable-------	Severe: excess salt.	Severe: no water.	Excess salt----	Variable-------	Excess salt.
OnD---------- Owens	Slight---------	Moderate: hard to pack.	Severe: no water.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
OrE*:						
Owens----------	Slight---------	Moderate: hard to pack.	Severe: no water.	Slope, droughty.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
Harpersville-----	Moderate: large stones.	Moderate: hard to pack.	Severe: no water.	Slope, droughty, slow intake.	Slope, erodes easily.	Too arid, slope, erodes easily.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
OsE*:						
Owens	Slight	Moderate: hard to pack.	Severe: no water.	Slope, droughty.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
Lueders	Severe: depth to rock, slope.	Severe: large stones.	Severe: no water.	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
PaC	Severe: depth to rock.	Severe: large stones.	Severe: no water.	Slope, large stones, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
PtC	Severe: cemented pan.	Moderate: thin layer.	Severe: no water.	Slope, droughty, cemented pan.	Cemented pan	Droughty, cemented pan.
RcB	Severe: seepage.	Severe: seepage.	Severe: no water.	Droughty, soil blowing.	Erodes easily, too sandy, soil blowing.	Erodes easily, droughty, rooting depth.
RdA	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
ReA, ReB	Slight	Moderate: hard to pack.	Severe: no water.	Favorable	Favorable	Favorable.
SaA, SaB	Slight	Moderate: piping.	Severe: no water.	Favorable	Favorable	Favorable.
SpB, SsB	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Percs slowly	Depth to rock, percs slowly.	Depth to rock, percs slowly.
StB	Moderate: seepage, depth to rock.	Moderate: thin layer, hard to pack.	Severe: no water.	Depth to rock	Depth to rock	Droughty, depth to rock.
SwA	Moderate: seepage, depth to rock.	Moderate: thin layer, hard to pack.	Severe: no water.	Depth to rock	Depth to rock	Depth to rock.
ThC	Moderate: slope.	Slight	Severe: no water.	Slope, percs slowly.	Percs slowly	Percs slowly.
TrA	Slight	Severe: hard to pack.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, droughty, percs slowly.
TtA	Slight	Moderate: hard to pack.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
TuB	Slight	Moderate: hard to pack.	Severe: no water.	Slope, droughty, soil blowing.	Erodes easily, soil blowing, percs slowly.	Erodes easily, droughty, percs slowly.
VnC	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
We	Severe: seepage.	Severe: piping.	Severe: no water.	Favorable	Soil blowing	Favorable.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Irrigation	Terraces and diversions	Grassed waterways
Wh---------- Wheatwood	Moderate: seepage.	Severe: piping.	Severe: no water.	Erodes easily, flooding.	Erodes easily	Erodes easily.
WtB---------- Wichita	Slight---------	Slight---------	Severe: no water.	Favorable------	Favorable------	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 14.--Engineering Index Properties

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
AbA--Abilene	0-7	Clay loam	CL	A-4, A-6	0	98-100	96-100	90-100	60-96	25-35	8-16
	7-40	Clay loam, silty clay loam, clay.	CL, CH	A-7, A-6	0	98-100	96-100	90-100	75-95	34-58	22-40
	40-80	Clay loam, clay, silty clay loam.	CL	A-6, A-7-6	0	90-100	88-100	80-98	60-95	35-50	19-32
AnB--Anson	0-6	Fine sand	SP-SM, SM, SC-SM	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	6-28	Fine sand, loamy fine sand.	SM, SM, SC-SM	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	28-58	Sandy clay loam	SC, CL	A-6, A-2-6	0	95-100	95-100	90-100	25-55	22-30	11-16
	58-80	Sandy loam, sandy clay loam, loamy fine sand.	SC, CL, SC-SM, CL-ML	A-4, A-6, A-2-4	0	95-100	95-100	90-100	15-55	18-28	2-11
AsC--Aspermont	0-10	Silty clay loam	CL	A-6, A-7-6	0	98-100	90-100	90-100	65-95	30-45	15-28
	10-20	Silt loam, loam, silty clay loam.	CL	A-6, A-7-6	0	98-100	90-100	85-100	65-95	30-45	15-28
	20-38	Silt loam, loam, silty clay loam.	CL	A-6, A-7-6	0	98-100	90-100	85-100	65-95	30-45	15-28
	38-65	Silt loam, loam, silty clay loam.	CL	A-6, A-7-6	0	98-100	90-100	85-100	65-95	30-45	15-28
BeB--Bluegrove	0-7	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4, A-6	0	100	98-100	70-98	40-65	16-30	NP-14
	7-29	Sandy clay, clay loam, clay.	CL, SC	A-6, A-7	0-5	95-100	95-100	80-100	45-80	28-50	11-30
	29-32	Weathered bedrock	---	---	---	---	---	---	---	---	---
BeD--Bluegrove	0-2	Stony loam	SM, ML, SC, CL	A-4, A-6	5-15	85-95	75-90	60-80	40-60	16-30	NP-14
	2-22	Clay loam, sandy clay, clay.	CL	A-6, A-7	0-5	95-100	95-100	80-100	45-80	28-50	11-30
	22-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cm--Clairemont	0-5	Silt loam	CL, CL-ML	A-4, A-6	0	100	98-100	85-100	60-90	20-35	4-17
	5-65	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--Clearfork	0-24	Silty clay loam	CL	A-6, A-7-6	0	100	100	98-100	85-100	35-50	20-32
	24-62	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7-6	0	100	100	95-100	75-100	35-50	20-32
EnB--Enterprise	0-24	Very fine sandy loam.	CL-ML, ML, CL	A-4, A-6	0	100	98-100	95-100	65-90	20-32	3-13
	24-53	Very fine sandy loam, loam, silt loam.	CL-ML, ML, CL	A-4, A-6	0	98-100	98-100	95-100	65-90	20-32	3-13
	53-65	Very fine sandy loam, loam, silt loam.	CL-ML, ML, CL	A-4, A-6	0	98-100	98-100	95-100	65-90	20-32	3-13

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Ga	0-22	Loam	CL, SC	A-6	0	100	96-100	80-98	45-70	23-35	11-20
Gageby	22-58	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0	95-100	92-100	90-100	45-80	23-40	11-25
	58-80	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0	95-100	75-100	70-100	45-85	23-40	11-25
GdB	0-6	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	0-14	NP
Grandfield	6-28	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	15-37	NP-16
	28-44	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	15-37	NP-16
	44-80	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4	0	100	98-100	90-100	36-60	15-30	NP-10
GfB	0-7	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	100	98-100	94-100	36-60	15-26	NP-7
Grandfield	7-58	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	15-37	NP-16
	58-80	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4	0	100	98-100	90-100	36-60	15-30	NP-10
JoC	0-4	Fine sandy loam	SC-SM, SC, CL, CL-ML	A-4	0	95-100	90-100	80-100	35-60	20-30	4-9
Jolly	4-14	Sandy clay loam	SC, CL	A-6, A-2-6	0	95-100	90-100	80-100	30-55	28-40	10-20
	14-17	Fine sandy loam, sandy clay loam.	SC	A-6, A-2-6	0-3	90-100	75-100	65-100	20-50	28-40	10-20
	17-23	Weathered bedrock	---	---	---	---	---	---	---	---	---
JrD*:											
Jolly	0-3	Stony fine sandy loam.	SM, ML	A-2, A-4	5-15	95-100	90-100	75-100	30-55	0-30	NP-7
	3-9	Sandy clay loam	SC, CL	A-4, A-6	0-3	85-100	75-100	70-100	36-65	25-40	8-20
	9-15	Fine sandy loam, sandy clay loam, gravelly fine sandy loam.	SC, GC	A-6, A-2-6, A-4	0-3	60-80	45-75	40-70	20-50	25-40	8-20
	15-18	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop	0-80	Variable	---	---	---	---	---	---	---	---	---
KrE*:											
Knoco	0-11	Clay	CL, CH	A-7-6, A-6	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	11-32	Clay, shale.	CL, CH	A-7-6, A-6	0-2	90-100	85-100	70-100	70-100	30-60	12-38
Vernon	0-5	Clay	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	5-26	Clay, silty clay	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-40
	26-42	Shale, clay.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-96	30-60	15-38
	42-65	Clay, shale.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-96	30-60	15-38

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LeA----------	0-19	Silty clay-------	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
Leeray	19-54	Clay, silty clay	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
	54-73	Clay, silty clay	CH	A-7-6	0-5	95-100	95-100	85-100	75-95	51-70	30-45
	73-80	Silty clay loam, clay, silty clay.	CH, CL	A-7-6	0-5	95-100	95-100	85-100	70-95	44-57	30-40
Ln----------	0-7	Sandy loam-------	ML, SM, CL-ML, SC-SM	A-4	0	95-100	85-100	80-100	36-60	15-24	NP-7
Lincoln											
	7-80	Stratified fine sand to clay loam.	SM, SP-SM	A-2, A-3	0	95-100	85-100	82-100	5-35	0-34	NP-10
LrC----------	0-6	Cobbly loam------	CL, SC	A-4, A-6, A-7	5-25	75-90	75-90	50-85	45-75	25-49	8-25
Lueders											
	6-12	Very cobbly loam, very cobbly clay loam, very gravelly clay loam.	CL, GC, SC	A-2, A-4, A-6, A-7	25-50	40-75	35-70	30-65	30-60	25-49	8-25
	12-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LsD*:											
Lueders----------	0-6	Very stony clay loam.	CL	A-4, A-6, A-7-6	5-20	70-90	70-90	60-90	55-85	25-49	8-25
	6-12	Very cobbly loam, very cobbly clay loam, very gravelly clay loam.	CL, GC, SC	A-2, A-4, A-6, A-7	25-50	40-75	35-70	30-65	30-60	25-49	8-25
	12-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Springcreek-----	0-8	Clay loam--------	CH, CL	A-6, A-7	0-5	85-100	75-100	70-90	50-75	35-57	18-34
	8-26	Gravelly loam, gravelly clay loam, cobbly clay loam.	CL, CH, GC, SC	A-6, A-7	5-15	65-85	50-75	45-70	35-55	34-59	16-38
	26-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LtD*:											
Lueders----------	0-5	Extremely stony clay loam.	CL	A-4, A-6, A-7-6	5-20	70-90	70-90	60-90	55-85	25-49	8-25
	5-14	Very cobbly loam, very cobbly clay loam, very gravelly clay loam.	CL, GC, SC	A-2, A-4, A-6, A-7	25-50	40-75	35-70	30-65	30-60	25-49	8-25
	14-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Throck----------	0-7	Stony clay loam	CL	A-6, A-7-6	5-20	70-90	70-90	60-90	55-85	30-50	15-30
	7-32	Silty clay, clay	CL	A-6, A-7-6	0	95-100	95-100	90-100	80-98	35-50	18-31
	32-50	Clay, silty clay loam, shale.	CL	A-6, A-7-6	0	95-100	95-100	90-100	70-98	28-50	12-30

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LuC---------- Lusk	0-7	Very gravelly sandy loam.	GC, SC, GM-GC, SC-SM	A-1, A-2-4, A-2-6	0-5	35-75	15-40	15-40	10-30	20-33	4-15
	7-36	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
	36-52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
NeB---------- Newcastle	0-4	Fine sandy loam	SM, SC-SM, SC	A-2-4, A-4	0	90-100	90-100	75-98	30-50	17-25	3-8
	4-33	Fine sandy loam, sandy clay loam, clay loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	90-100	80-100	65-100	40-65	20-40	7-22
	33-50	Weathered bedrock	---	---	---	---	---	---	---	---	---
NuB---------- Nukrum	0-6	Clay loam--------	CL, CH	A-7-6	0	95-100	90-100	90-100	75-85	41-60	21-35
	6-36	Silty clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	90-100	90-100	70-95	45-68	27-45
	36-66	Silty clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	85-100	75-100	70-95	65-95	41-60	25-40
NvA---------- Nuvalde	0-13	Clay loam--------	CH, CL	A-7-6, A-6	0	95-100	95-100	90-99	80-96	38-60	20-38
	13-23	Clay loam, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	95-100	95-100	85-100	70-98	38-58	20-36
	23-80	Loam, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	85-100	75-98	65-90	30-50	14-30
NvB---------- Nuvalde	0-11	Clay loam--------	CH, CL	A-7-6, A-6	0	95-100	95-100	90-99	80-96	38-60	20-38
	11-24	Clay loam, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	95-100	95-100	85-100	70-98	38-58	20-36
	24-80	Loam, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	85-100	75-98	65-90	30-50	14-30
Od*---------- Oil-waste land	0-80	Variable---------	---	---	---	---	---	---	---	---	---
OnD---------- Owens	0-5	Clay-------------	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	5-16	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-33
	16-40	Shale, clay	CL, CH	A-7-6	0-5	90-100	85-100	80-100	65-95	45-60	25-37
OrE*:											
Owens----------	0-7	Very stony clay	CL, CH	A-7-6	15-35	80-100	75-100	70-100	65-95	45-60	22-32
	7-17	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-10	80-100	80-100	80-100	75-95	45-60	22-33
	17-26	Shale, clay.	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	25-37
Harpersville----	0-9	Stony clay-------	CL, CH	A-7-6	5-15	85-100	80-100	75-100	70-95	45-60	22-32
	9-60	Shale, clay, weathered bedrock.	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	22-32

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OsE*:											
Owens	0-8	Stony clay	CL, CH	A-7-6	5-15	85-100	80-100	75-100	70-95	45-60	22-32
	8-30	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-10	80-100	80-100	80-100	75-95	45-60	22-33
	30-36	Shale, clay.	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	25-37
Lueders	0-7	Cobbly clay loam	CL, SC	A-4, A-6, A-7	5-25	75-90	75-90	50-85	45-75	25-49	8-25
	7-15	Extremely cobbly loam, extremely cobbly clay loam, extremely gravelly clay loam.	CL, GC, SC	A-2, A-4, A-6, A-7	30-50	35-70	30-65	25-60	25-55	25-49	8-25
	15-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PaC Palopinto	0-8	Very stony loam	CH, CL	A-7-6, A-6	10-25	85-100	85-100	75-100	70-95	39-58	17-31
	8-14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PtC Pitzer	0-10	Gravelly clay loam.	CL, SC, GC	A-4, A-6	0-3	65-95	60-90	55-85	40-70	25-40	8-21
	10-16	Cemented	---	---	---	---	---	---	---	---	---
	16-50	Very gravelly sandy loam, very gravelly loam, very gravelly sandy clay loam.	GC, GP-GC	A-2	0-5	30-60	20-50	15-45	8-35	25-40	8-21
	50-65	Clay	CL, CH	A-6, A-7-6	0	90-100	85-100	65-100	65-96	30-60	15-38
RcB Rochelle	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-2	90-100	90-100	65-85	25-45	<25	NP-7
	7-12	Sandy clay loam, gravelly sandy clay loam, gravelly fine sandy loam.	SC, CL	A-2-6, A-6, A-4, A-2-4	0-2	80-95	75-95	60-80	30-55	20-30	8-18
	12-53	Gravelly sandy clay loam, gravelly clay loam, stony sandy clay.	SC, GC	A-2-6, A-6	0-5	50-85	50-85	30-65	20-45	25-35	11-20
	53-65	Stratified very gravelly coarse sand to extremely gravelly sandy clay loam.	GM-GC, GM, GC, GP-GC	A-1, A-2-4	0-5	10-40	5-30	5-25	5-20	<25	NP-10
RdA Rowden	0-12	Clay loam	CL	A-6, A-7-6	0-5	90-100	75-100	70-100	60-80	32-46	12-23
	12-31	Clay, clay loam	CH, CL	A-7-6	0-5	85-100	75-100	75-100	60-80	41-60	20-35
	31-39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ReA--- Rowena	0-7	Clay loam---	CL	A-6, A-7-6	0	99-100	98-100	90-100	70-90	30-50	12-30
	7-38	Clay, clay loam, silty clay.	CH, CL	A-7-6	0	98-100	96-100	90-100	75-98	41-60	25-40
	38-46	Clay, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	80-100	75-100	65-95	30-50	15-30
	46-65	Clay, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	80-100	75-100	65-95	30-50	15-30
ReB--- Rowena	0-7	Clay loam---	CL	A-6, A-7-6	0	99-100	98-100	90-100	70-90	30-50	12-30
	7-32	Clay, clay loam, silty clay.	CH, CL	A-7-6	0	98-100	96-100	90-100	75-98	41-60	25-40
	32-38	Clay, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	80-100	75-100	65-95	30-50	15-30
	38-62	Clay, clay loam, silty clay loam.	CL	A-6, A-7-6	0	85-100	80-100	75-100	65-95	30-50	15-30
SaA--- Sagerton	0-6	Clay loam---	CL	A-6, A-4	0	95-100	95-100	90-100	55-80	25-35	8-18
	6-34	Clay loam, clay	CL	A-6, A-7-6	0	95-100	95-100	90-100	65-95	36-50	18-30
	34-80	Clay loam, silty clay loam, clay.	CL	A-6, A-4, A-7-6	0	90-100	90-100	80-100	60-85	25-50	8-30
SaB--- Sagerton	0-9	Clay loam---	CL	A-6, A-4	0	95-100	95-100	90-100	55-80	25-35	8-18
	9-38	Clay loam, clay	CL	A-6, A-7-6	0	95-100	95-100	90-100	65-95	36-50	18-30
	38-60	Clay loam, silty clay loam, clay.	CL	A-6, A-4, A-7-6	0	90-100	90-100	80-100	60-85	25-50	8-30
SpB--- Speck	0-5	Silty clay loam	CL, CH	A-6, A-7-6	0-2	90-100	90-100	80-100	70-90	30-54	13-30
	5-12	Clay, clay loam, silty clay.	CL, CH	A-7-6	0	95-100	90-100	80-100	75-95	45-65	25-40
	12-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SsB--- Speck	0-7	Stony silty clay loam.	CL	A-6, A-7-6	2-10	90-100	75-100	70-95	50-85	30-50	15-30
	7-15	Clay loam, clay, silty clay.	CL, CH	A-7-6	0-10	95-100	85-100	80-95	70-90	45-65	25-40
	15-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
StB--- Springcreek	0-9	Clay loam---	CL, CH	A-6, A-7	0	85-100	75-100	70-90	50-75	35-55	18-34
	9-30	Gravelly loam, gravelly clay loam, cobbly clay loam.	SC, GC, CL, CH	A-6, A-7	5-15	65-95	50-75	45-70	35-55	34-59	16-38
	30-40	Unweathered	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ThC--Throck	0-8	Silty clay loam	CL	A-6, A-7-6	0-2	80-100	80-100	75-100	70-98	30-45	15-28
	8-16	Silty clay, silty clay loam, clay.	CL	A-6, A-7-6	0-2	80-100	75-100	75-100	70-98	35-50	18-31
	16-39	Silty clay, clay	CL	A-6, A-7-6	0	95-100	95-100	90-100	78-98	35-50	18-31
	39-62	Clay, silty clay loam, shale.	CL	A-6, A-7-6	0	95-100	95-100	90-100	70-98	28-50	12-30
TrA--Thurber	0-4	Clay loam--------	CL	A-4, A-6	0	98-100	96-100	90-100	60-90	25-40	8-20
	4-22	Clay, clay loam	CL, CH	A-7-6, A-6	0	98-100	96-100	90-100	70-95	37-65	22-45
	22-80	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
TtA--Tillman	0-6	Clay loam--------	CL	A-6	0	100	100	98-100	70-90	25-40	11-23
	6-12	Clay, clay loam	CL, CH	A-6, A-7-6	0	98-100	93-100	90-98	70-95	38-60	20-38
	12-46	Clay, clay loam	CL, CH	A-6, A-7-6	0	98-100	93-100	90-98	70-95	38-60	20-38
	46-62	Clay, clay loam	CL, CH	A-6, A-7-6	0-5	95-100	90-100	80-97	60-90	28-55	13-35
	62-80	Clay, clay loam	CL, CH	A-6, A-7-6	0-5	95-100	90-100	80-97	60-90	28-55	13-35
TuB--Truce	0-5	Fine sandy loam	CL-ML, SC-SM, SM, SC	A-4	0	95-100	90-100	75-100	40-70	20-30	3-10
	5-42	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
	42-60	Clay, shale.	CL, CH	A-6, A-7-6	0	88-100	85-100	75-100	60-95	30-52	15-32
VnC--Vernon	0-6	Clay-------------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	6-28	Clay, silty clay	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-40
	28-36	Clay, shale.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-96	30-60	15-38
	36-65	Clay, shale.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-96	30-60	15-38
We--Westola	0-6	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	90-100	36-60	15-26	NP-7
	6-30	Fine sandy loam, loam, very fine sandy loam.	SM, ML, CL, SC	A-4	0	100	95-100	90-100	36-85	15-30	NP-10
	30-60	Stratified loam to loamy fine sand.	SM, ML, CL, SC	A-2, A-4	0	100	95-100	90-100	15-85	15-30	NP-10
Wh--Wheatwood	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	98-100	90-100	65-95	20-35	5-18
	7-40	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	70-98	20-40	5-22
	40-80	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	70-95	20-35	5-18

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SwA-------------- Swenson	0-4	Clay loam---------	CL	A-6, A-7-6	0	90-100	75-100	70-95	55-75	32-46	12-23
	4-25	Clay loam, clay	CL, CH	A-7-6	0-5	85-100	75-100	70-95	65-85	41-60	20-35
	25-32	Gravelly silt loam, gravelly silty clay loam, gravelly clay loam.	CL, SC	A-6, A-7-6	5-15	75-90	70-85	50-70	40-70	34-44	14-22
	32-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WtB-------------- Wichita	0-5	Clay loam---------	CL	A-6	0	98-100	96-100	90-100	70-90	28-40	11-20
	5-21	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	98-100	96-100	90-100	70-98	36-50	20-30
	21-80	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 15.--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. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
AbA	0-7	28-35	1.30-1.65	0.6-2.0	0.17-0.20	6.6-8.4	0-2	Moderate	0.37	5	6	1-3
Abilene	7-40	35-45	1.30-1.60	0.2-0.6	0.14-0.18	6.6-8.4	0-2	Moderate	0.28			
	40-80	22-45	1.40-1.60	0.2-0.6	0.12-0.15	7.9-8.4	0-2	Moderate	0.32			
AsC	0-10	27-35	1.40-1.55	0.6-2.0	0.12-0.18	7.9-8.4	<2	Moderate	0.37	4	4L	.5-2
Aspermont	10-20	18-35	1.40-1.60	0.6-2.0	0.12-0.18	7.9-8.4	<2	Moderate	0.37			
	20-38	18-35	1.45-1.65	0.6-2.0	0.10-0.18	7.9-8.4	<2	Moderate	0.37			
	38-65	18-35	1.45-1.65	0.6-2.0	0.10-0.18	7.9-8.4	<2	Moderate	0.37			
BeB	0-7	10-20	1.35-1.50	2.0-6.0	0.10-0.15	5.6-7.3	0	Low	0.32	3	3	.5-3
Bluegrove	7-29	35-55	1.35-1.60	0.2-0.6	0.15-0.20	6.1-8.4	0	Moderate	0.32			
	29-32	---	---	0.2-2.0	---	---	---	---	---			
BeD	0-2	10-25	1.35-1.50	0.6-2.0	0.12-0.16	5.6-7.3	0	Low	0.15	3	8	.5-3
Bluegrove	2-22	35-55	1.35-1.60	0.2-0.6	0.15-0.19	6.1-7.8	0	Moderate	0.24			
	22-30	---	---	0.2-2.0	---	---	---	---	---			
Cm	0-5	15-27	1.40-1.60	0.6-2.0	0.16-0.22	7.9-8.4	<2	Low	0.43	5	4L	<2
Clairemont	5-65	18-35	1.40-1.65	0.6-2.0	0.16-0.22	7.9-8.4	<2	Low	0.43			
Co	0-24	30-45	1.35-1.55	0.2-0.6	0.14-0.18	7.9-8.4	<2	High	0.32	5	4	1-4
Clearfork	24-62	27-45	1.45-1.65	0.2-0.6	0.14-0.18	7.9-8.4	<2	High	0.32			
CoB	0-4	6-18	1.30-1.50	2.0-6.0	0.10-0.15	6.1-7.3	0-2	Low	0.24	3-2	3	.5-2
Cobb	4-33	18-35	1.40-1.55	0.6-2.0	0.10-0.14	6.1-8.4	0-2	Low	0.32			
	33-50	---	---	0.01-0.2	---	---	---	---	---			
EnB	0-24	7-18	1.35-1.55	2.0-6.0	0.15-0.20	6.6-8.4	0-2	Low	0.43	5	3	.5-1
Enterprise	24-53	7-18	1.35-1.55	2.0-6.0	0.15-0.20	7.4-8.4	0-2	Low	0.43			
	53-65	7-18	1.35-1.55	2.0-6.0	0.15-0.20	7.4-8.4	0-2	Low	0.43			
Ga	0-22	18-27	1.40-1.55	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.28	5	5	1-3
Gageby	22-58	18-35	1.40-1.55	0.6-2.0	0.16-0.20	7.9-8.4	<2	Moderate	0.28			
	58-80	18-35	1.45-1.60	0.6-2.0	0.16-0.20	7.9-8.4	<2	Moderate	0.28			
GdB	0-6	5-10	1.35-1.50	2.0-6.0	0.07-0.11	6.1-7.8	0-0	Low	0.20	5-4	2	.5-1
Grandfield	6-28	18-30	1.50-1.70	0.6-2.0	0.11-0.17	6.1-7.8	0-0	Low	0.32			
	28-44	18-30	1.50-1.70	0.6-2.0	0.11-0.17	6.6-8.4	0-0	Low	0.32			
	44-80	10-25	1.50-1.70	2.0-6.0	0.11-0.15	6.6-8.4	0-0	Low	0.28			
GfB	0-7	10-18	1.30-1.60	2.0-6.0	0.11-0.15	6.1-7.8	0-0	Low	0.24	5-4	3	.5-1
Grandfield	7-58	18-30	1.50-1.70	0.6-2.0	0.11-0.17	6.6-8.4	0-0	Low	0.32			
	58-80	10-25	1.50-1.70	2.0-6.0	0.11-0.15	6.6-8.4	0-0	Low	0.28			
JoC	0-4	8-18	1.40-1.55	2.0-6.0	0.10-0.14	5.6-7.3	0-0	Low	0.32	2	3	.5-2
Jolly	4-14	20-35	1.50-1.65	0.6-2.0	0.12-0.16	6.1-7.3	0-0	Low	0.32			
	14-17	15-35	1.50-1.65	0.6-2.0	0.12-0.16	6.1-7.3	0-0	Low	0.32			
	17-23	---	---	0.2-2.0	---	---	---	---	---			
JrD*:												
Jolly	0-3	8-18	1.35-1.45	0.6-2.0	0.11-0.16	5.6-7.3	0-0	Low	0.20	2	8	.5-1
	3-9	20-35	1.40-1.60	0.6-2.0	0.12-0.16	6.1-7.3	0-0	Low	0.32			
	9-15	15-35	1.45-1.65	0.6-2.0	0.12-0.16	6.1-7.3	0-0	Low	0.32			
	15-18	---	---	0.2-2.0	---	---	---	---	---			
Rock outcrop	0-80	---	---	0.01-20	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
KrE*:												
Knoco	0-11	40-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	<2	High	0.37	3	4	<1
	11-32	40-60	1.45-1.70	<0.06	0.05-0.10	7.9-8.4	<2	High	0.32			
Vernon	0-5	40-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	0-2	High	0.32	3-2	4	.5-2
	5-26	40-60	1.50-1.65	<0.06	0.10-0.15	7.9-8.4	0-2	High	0.37			
	26-42	40-60	1.60-1.75	<0.06	0.06-0.10	7.9-8.4	2-8	High	0.37			
	42-65	40-60	1.70-2.00	<0.06	0.01-0.06	7.9-8.4	2-8	High	0.32			
LeA	0-19	40-60	1.10-1.40	<0.06	0.12-0.18	6.6-7.8	0-2	Very high	0.32	5	4	1-5
Leeray	19-54	40-60	1.10-1.40	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32			
	54-70	40-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	0-4	Very high	0.32			
	70-80	35-50	1.35-1.60	<0.06	0.10-0.15	7.9-8.4	4-16	High	0.32			
Ln	0-7	10-18	1.30-1.60	6.0-20	0.10-0.15	7.4-8.4	0-0	Low	0.20	5	3	.5-1
Lincoln	7-80	5-15	1.30-1.60	6.0-20	0.02-0.08	7.9-8.4	0-0	Low	0.17			
LrC	0-4	20-35	1.10-1.35	0.6-2.0	0.12-0.17	7.9-8.4	<2	Low	0.15	1	8	1-6
Lueders	4-12	20-35	1.35-1.55	0.6-2.0	0.06-0.12	7.9-8.4	<2	Low	0.10			
	12-16	---	---	0.06-2.0	---	---	---	---	---			
LsD*:												
Lueders	0-6	20-35	1.10-1.35	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low	0.10	1	8	1-6
	6-12	20-35	1.35-1.55	0.6-2.0	0.06-0.12	7.9-8.4	<2	Low	0.10			
	12-30	---	---	0.06-2.0	---	---	<2	---	---			
Springcreek	0-8	22-40	1.20-1.50	4.0-14.0	0.11-0.18	7.4-8.4	0-2	3.0-5.9	0.32	2	4L	1-3
	8-26	25-40	1.20-1.50	4.0-14.0	0.06-0.14	7.4-8.4	0-2	3.0-5.9	0.17			.3-1
	26-30	---	---	0.0-14.0	---	---	---	---	---			
LtD*:												
Lueders	0-5	20-35	1.10-1.35	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low	0.10	1	8	1-6
	5-14	20-35	1.35-1.55	0.6-2.0	0.06-0.12	7.9-8.4	<2	Low	0.10			
	14-30	---	---	0.06-2.0	---	---	<2	---	---			
Throck	0-7	30-40	1.20-1.60	0.2-0.6	0.10-0.16	7.9-8.4	0-2	High	0.17	3	8	.5-2
	7-32	40-60	1.45-1.65	0.06-0.2	0.09-0.15	7.9-8.4	0-8	High	0.32			
	32-50	25-60	1.55-1.90	0.06-0.2	0.05-0.12	7.9-8.4	2-8	High	0.32			
LuC	0-7	10-20	1.50-1.65	0.2-2.0	0.06-0.10	6.1-7.8	0-2	Low	0.10	3	8	.5-1
Lusk	7-36	35-50	1.40-1.55	0.06-0.2	0.04-0.09	6.1-8.4	0-2	Moderate	0.10			
	36-52	---	---	0.2-6.0	---	---	---	---	---			
AnB	0-6	1-5	1.30-1.50	6.0-20	0.05-0.10	5.6-7.3	0-2	Low	0.17	5	1	.1-1
Anson	6-28	1-10	1.30-1.50	6.0-20	0.05-0.11	5.6-7.3	0-2	Low	0.17			
	28-58	20-35	1.30-1.60	0.2-0.6	0.10-0.15	5.1-6.0	0-2	Low	0.24			
	58-80	10-30	1.40-1.65	0.2-0.6	0.06-0.15	5.1-6.5	0-2	Low	0.24			
NuB	0-6	38-40	1.30-1.45	0.06-0.2	0.15-0.20	7.9-8.4	<2	High	0.32	5	4	1-3
Nukrum	6-36	38-60	1.35-1.50	0.06-0.2	0.15-0.20	7.9-8.4	<2	High	0.32			
	36-66	30-55	1.35-1.50	0.06-0.2	0.13-0.18	7.9-8.4	<2	High	0.32			
NvA	0-13	30-45	1.10-1.40	0.6-2.0	0.14-0.20	7.9-8.4	0-0	High	0.24	5	4L	1-3
Nuvalde	13-23	30-45	1.20-1.45	0.6-2.0	0.12-0.18	7.9-8.4	0-0	High	0.28			
	23-80	24-40	1.25-1.45	0.6-2.0	0.12-0.18	7.9-8.4	0-0	Moderate	0.32			
NvB	0-11	30-45	1.10-1.40	0.6-2.0	0.14-0.20	7.9-8.4	0-0	High	0.24	5	4L	1-3
Nuvalde	11-24	30-45	1.20-1.45	0.6-2.0	0.12-0.18	7.9-8.4	0-0	High	0.28			
	24-80	24-40	1.25-1.45	0.6-2.0	0.12-0.18	7.9-8.4	0-0	Moderate	0.32			

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
Od* Oil-waste land	0-80	---	---	0.01-20	---	---	---				---	---
OnD Owens	0-5 5-16 16-40	40-60 35-60 40-60	1.35-1.55 1.45-1.65 1.70-2.00	<0.06 <0.06 <0.06	0.13-0.17 0.13-0.17 0.01-0.04	7.9-8.4 7.9-8.4 7.9-8.4	<2 <4 2-8	High High High	0.32 0.37 0.32	1	4	.5-2
OrE*:												
Owens	0-7 7-17 17-26	35-60 35-60 35-60	1.35-1.55 1.45-1.65 1.70-2.00	<0.06 <0.06 <0.06	0.10-0.17 0.13-0.17 0.01-0.05	7.9-8.4 7.9-8.4 7.9-8.4	<2 <4 2-8	Moderate High High	0.10 0.32 0.37	1	8	.5-2
Harpersville	0-9 9-60	35-60 35-60	1.25-1.35 1.45-1.75	<0.06 <0.06	0.07-0.13 0.03-0.07	7.9-8.4 7.9-8.4	0-2 0-2	High High	0.17 0.37	1	8	.5-2
OsE*:												
Owens	0-8 8-30 30-36	35-60 35-60 35-60	1.35-1.55 1.45-1.65 1.70-2.00	<0.06 <0.06 <0.06	0.10-0.17 0.13-0.17 0.01-0.05	7.9-8.4 7.9-8.4 7.9-8.4	<2 <4 2-8	Moderate High High	0.17 0.32 0.37	1	8	.5-2
Lueders	0-7 7-15 15-20	20-35 20-35 ---	1.10-1.35 1.35-1.55 ---	0.6-2.0 0.6-2.0 0.06-2.0	0.12-0.17 0.05-0.10 ---	7.9-8.4 7.9-8.4 ---	<2 <2 ---	Low Low	0.15 0.10	1	8	1-6
PaC Palopinto	0-8 8-14	18-35 ---	1.25-1.45 ---	0.6-2.0 0.06-2.0	0.10-0.15 ---	6.1-8.4 ---	0-2 ---	Moderate 	0.05 	1	8	1-4
PtC Pitzer	0-10 10-16 16-50 50-65	10-35 --- 10-35 40-60	1.45-1.60 --- 1.50-1.70 1.70-2.00	0.6-2.0 0.01-0.6 0.6-2.0 <0.06	0.10-0.15 --- 0.05-0.10 0.01-0.02	7.9-8.4 --- 7.9-8.4 7.9-8.4	0-2 --- 0-2 0-2	Low Low High	0.15 0.10 0.32	2	8	1-3
RcB Rochelle	0-7 7-12 12-53 53-65	10-24 18-35 25-40 5-20	1.40-1.55 1.35-1.60 1.35-1.60 1.45-1.80	0.6-2.0 0.6-2.0 0.2-0.6 2.0-6.0	0.10-0.15 0.10-0.15 0.05-0.10 0.01-0.05	6.6-7.8 6.6-7.8 6.6-7.8 7.9-8.4	<2 <2 <2 <2	Low Low Low Low	0.37 0.32 0.32 0.17	4	3	<1
RdA Rowden	0-12 12-31 31-39	27-35 35-60 ---	1.30-1.45 1.35-1.50 ---	0.6-2.0 0.06-0.2 0.2-2.0	0.12-0.17 0.12-0.17 ---	6.6-8.4 6.6-8.4 ---	<2 <2 ---	Moderate High 	0.32 0.32 	2	6	1-3
ReA Rowena	0-7 7-38 38-46 46-65	35-40 35-50 35-50 35-50	1.35-1.50 1.35-1.50 1.35-1.50 1.35-1.50	0.2-0.6 0.2-0.6 0.2-0.6 0.2-0.6	0.15-0.20 0.14-0.18 0.11-0.15 0.11-0.15	7.9-8.4 7.9-8.4 7.9-8.4 7.9-8.4	0-2 0-2 0-2 0-4	Moderate High High High	0.32 0.32 0.32 0.32	4	6	2-4
ReB Rowena	0-7 7-32 32-38 38-62	35-40 35-50 35-50 35-50	1.35-1.50 1.35-1.50 1.35-1.50 1.35-1.50	0.2-0.6 0.2-0.6 0.2-0.6 0.2-0.6	0.15-0.20 0.14-0.18 0.11-0.15 0.11-0.15	7.9-8.4 7.9-8.4 7.9-8.4 7.9-8.4	0-2 0-2 0-2 0-4	Moderate High High High	0.32 0.32 0.32 0.32	4	6	2-4
SaA Sagerton	0-6 6-34 34-80	20-35 35-45 35-50	1.25-1.45 1.35-1.55 1.35-1.60	0.6-2.0 0.2-0.6 0.2-0.6	0.15-0.20 0.14-0.19 0.10-0.17	6.6-7.8 6.6-8.4 7.9-8.4	0-2 0-2 0-2	Moderate Moderate Moderate	0.32 0.32 0.32	5	6	1-3
SaB Sagerton	0-9 9-38 38-60	20-35 35-45 35-50	1.25-1.45 1.35-1.55 1.35-1.60	0.6-2.0 0.2-0.6 0.2-0.6	0.15-0.20 0.14-0.19 0.10-0.17	6.6-7.8 6.6-8.4 7.9-8.4	0-2 0-2 0-2	Moderate Moderate Moderate	0.32 0.32 0.32	5	6	1-3

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
SpB	0-5	20-39	1.20-1.45	0.2-0.6	0.15-0.20	6.1-7.8	0-2	Moderate	0.32	1	6	1-3
Speck	5-12	35-60	1.20-1.40	0.06-0.2	0.12-0.18	6.1-7.8	0-2	High	0.32			
	12-20	---	---	0.06-2.0	---	---	---	---	---			
SsB	0-7	20-39	1.40-1.65	0.2-0.6	0.10-0.18	6.1-7.8	0-0	Moderate	0.17	1	8	1-3
Speck	7-15	35-60	1.20-1.50	0.06-0.2	0.10-0.15	6.1-7.8	0-0	High	0.32			
	15-20	---	---	0.06-2.0	---	---	---	---	---			
StB	0-9	15-35	1.30-1.50	0.6-2.0	0.10-0.15	7.9-8.4	0-0	Moderate	0.28	2	4L	1-2
Springcreek	9-30	---	---	0.01-2.0	---	---	0-0	---	---			
	30-40	20-35	1.40-1.60	0.6-2.0	0.05-0.10	7.9-8.4	0-0	Low	0.15			
SwA	0-4	27-35	1.30-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.32	2	6	1-3
Swenson	4-25	35-50	1.30-1.40	0.2-0.6	0.12-0.16	7.4-8.4	<2	High	0.32			
	25-32	25-35	1.30-1.45	0.6-2.0	0.09-0.15	7.9-8.4	<2	Moderate	0.17			
	32-36	---	---	0.06-2.0	---	---	---	---	---			
ThC	0-8	30-40	1.20-1.60	0.2-0.6	0.12-0.17	7.9-8.4	<2	High	0.32	3	4L	.5-2
Throck	8-16	35-60	1.45-1.65	0.06-0.2	0.12-0.17	7.9-8.4	<4	High	0.32			
	16-39	40-60	1.45-1.65	0.06-0.2	0.12-0.17	7.9-8.4	<8	High	0.32			
	39-62	25-60	1.55-1.90	0.06-0.2	0.05-0.12	7.9-8.4	2-8	High	0.32			
TrA	0-4	27-35	1.40-1.65	0.2-0.6	0.11-0.14	6.1-7.8	0-2	Moderate	0.43	5	7	1-2
Thurber	4-22	35-55	1.40-1.65	0.00-0.06	0.09-0.13	6.6-8.4	0-2	High	0.32			
	22-80	25-45	1.40-1.70	0.00-0.06	0.09-0.13	7.4-8.4	0-2	High	0.32			
TtA	0-6	27-35	1.30-1.45	0.2-0.6	0.12-0.18	6.6-8.4	0-2	Moderate	0.32	5	6	1-3
Tillman	6-12	35-50	1.45-1.65	0.06-0.2	0.12-0.18	7.4-8.4	0-2	High	0.32			
	12-46	35-50	1.45-1.65	0.06-0.2	0.12-0.18	7.4-8.4	0-2	High	0.32			
	46-62	35-50	1.45-1.70	0.06-0.2	0.11-0.17	7.9-8.4	0-8	High	0.32			
	62-80	35-45	1.45-1.90	0.06-0.2	0.02-0.09	7.9-8.4	0-8	High	0.32			
TuB	0-5	8-20	1.45-1.62	0.6-2.0	0.07-0.12	5.6-7.3	<2	Low	0.37	3	3	1-3
Truce	5-42	35-55	1.50-1.65	0.06-0.2	0.09-0.12	6.1-8.4	<2	Moderate	0.32			
	42-60	35-55	1.60-1.80	<0.06	0.05-0.09	6.6-8.4	<2	Moderate	0.28			
VnC	0-6	40-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	0-2	High	0.32	3-2	4	.5-2
Vernon	6-28	40-60	1.50-1.65	<0.06	0.10-0.15	7.9-8.4	0-2	High	0.37			
	28-36	40-60	1.60-1.75	<0.06	0.06-0.10	7.9-8.4	2-8	High	0.37			
	36-65	40-60	1.70-2.00	<0.06	0.01-0.06	7.9-8.4	2-8	High	0.32			
We	0-6	10-18	1.30-1.60	2.0-6.0	0.11-0.15	7.4-8.4	0-0	Low	0.20	5	3	.5-1
Westola	6-30	5-18	1.40-1.70	2.0-6.0	0.11-0.20	7.9-8.4	0-0	Low	0.32			
	30-60	5-18	1.40-1.70	2.0-6.0	0.07-0.20	7.9-8.4	0-0	Low	0.32			
Wh	0-7	15-27	1.30-1.50	0.6-2.0	0.15-0.20	7.9-8.4	0-2	Low	0.43	5	6	1-4
Wheatwood	7-40	20-35	1.35-1.55	0.6-2.0	0.15-0.22	7.9-8.4	0-4	Low	0.43			
	40-80	15-27	1.30-1.50	0.6-2.0	0.15-0.20	7.9-9.0	0-4	Low	0.43			
WtB	0-5	28-35	1.30-1.45	0.6-2.0	0.15-0.20	6.6-7.8	<2	Moderate	0.32	5	6	.5-1
Wichita	5-21	35-45	1.30-1.45	0.2-0.6	0.15-0.20	6.6-8.4	<2	Moderate	0.32			
	21-80	35-45	1.35-1.50	0.2-0.6	0.12-0.18	7.9-8.4	<2	Moderate	0.32			

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 16.--Soil and Water Features

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
AbA--Abilene	C	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
AsC--Aspermont	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
BeB, BeD--Bluegrove	C	None	---	---	>6.0	---	---	20-40	Soft	---	---	Moderate	Low.
Cm--Clairmont	B	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	---	---	Moderate	Low.
Co--Clearfork	D	Occasional	Brief	Apr-Oct	>6.0	---	---	>60	---	---	---	High	Low.
NeB--Newcastle	B	None	---	---	>6.0	---	---	20-40	Soft	---	---	Moderate	Low.
EnB--Enterprise	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
Ga--Gageby	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---	---	---	Moderate	Low.
GdB, GfB--Grandfield	B	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
JoC--Jolly	C	None	---	---	>6.0	---	---	12-20	Soft	---	---	Low	Low.
JrD*:													
Jolly	C	None	---	---	>6.0	---	---	12-20	Soft	---	---	Low	Low.
Rock outcrop	D	None	---	---	>6.0	---	---	0-2	Hard	---	---	High	Low.
KrE*:													
Knoco	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
Vernon	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
LeA Leeray	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
Ln Lincoln	A	Occasional	Very brief to brief.	Apr-Oct	5.0-8.0	Apparent	Nov-May	>60	---	---	---	Low	Low.
LrC Lueders	C	None	---	---	>6.0	---	---	7-20	Hard	---	---	Moderate	Low.
LsD*:													
Lueders	C	None	---	---	>6.0	---	---	7-20	Hard	---	---	Moderate	Low.
Springcreek	C	None	---	---	>6.0	---	---	20-40	Hard	---	---	High	Low.
LtD*:													
Lueders	C	None	---	---	>6.0	---	---	7-20	Hard	---	---	Moderate	Low.
Throck	C	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
LuC Lusk	C	None	---	---	>6.0	---	---	20-40	Soft	---	---	High	Moderate.
AnB Anson	B	None	---	---	>6.0	---	---	>60	---	---	---	High	Moderate.
NuB Nukrum	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
NvA, NvB Nuvalde	B	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
Od* Oil-waste land	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Moderate.
OnD Owens	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
OrE*:													
Owens	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
Harpersville-----	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
OsE*:													
Owens------------	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
Lueders----------	C	None--------	---	---	>6.0	---	---	7-20	Hard	---	---	Moderate	Low.
PaC--------------- Palopinto	D	None--------	---	---	>6.0	---	---	6-20	Hard	---	---	High-----	Low.
PtC--------------- Pitzer	C	None--------	---	---	>6.0	---	---	>60	---	4-14	Thin	Moderate	Low.
RcB--------------- Rochelle	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
RdA--------------- Rowden	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	High-----	Low.
ReA, ReB---------- Rowena	C	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
SaA, SaB---------- Sagerton	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
SpB, SsB---------- Speck	D	None--------	---	---	>6.0	---	---	14-20	Hard	---	---	High-----	Low.
StB--------------- Springcreek	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	High-----	Low.
SwA--------------- Swenson	D	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	High-----	Low.
ThC--------------- Throck	C	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
TrA---------- Thurber	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
TtA---------- Tillman	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
TuB---------- Truce	C	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
VnC---------- Vernon	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
We---------- Westola	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---	---	---	Low------	Low.
Wh---------- Wheatwood	B	Occasional	Brief-----	Mar-Oct	>6.0	---	---	>60	---	---	---	High-----	Low.
WtB---------- Wichita	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 17.--Physical Analyses of Selected Soils

(Analysis by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas)
(Dash indicates data not available)

Soil name and sample number	Depth	Horizon	Particle size Distribution (mm)								COLE	Bulk density	Water content
			Sand							Clay			
			Very Coarse (2-1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)	Total (2-0.05)	(0.05-0.002)	(<0.002)		1/3 bar	1/3 bar
	In		Percentage								Cm/cm	G/cc	Pct(wt)
Leeray*	0-6	Ap	0.4	0.3	0.8	4.2	9.2	14.9	42.8	42.3	0.096	1.10	37.2
(S89TX-447-003)	6-19	A	0.5	0.4	0.8	3.8	8.3	13.8	38.9	47.3	0.105	1.34	30.6
	19-37	Bkss	1.1	0.9	0.9	3.3	8.0	14.2	38.4	47.4	0.088	1.39	29.1
	37-54	Bkssy1	0.3	0.5	0.8	3.8	8.7	14.1	42.0	43.9	0.098	1.39	32.4
	54-65	2Bkssy2	0.3	0.5	0.8	3.8	8.5	13.9	43.8	42.4	0.068	1.43	26.5
	65-73	2Bkssy3	0.4	0.6	0.7	3.9	9.1	14.7	47.5	37.8	0.053	1.48	26.8
	73-91	2Bssy	1.1	0.6	0.5	2.8	8.1	13.1	44.4	42.5	0.068	1.47	26.1
	91-157	3BC	1.2	1.4	1.3	2.2	3.6	9.7	48.7	41.6	--	-	-
Lueders*	0-6	A	2.8	2.3	4.1	7.8	12.2	29.2	49.9	20.9	0.062	1.12	34.9
(S89TX-447-004)	6-12	Bk	3.4	5.4	5.0	6.5	8.7	29.0	45.1	25.9	-	-	-
Rowden*	0-5	Ap	0.3	0.3	1.0	6.2	16.2	24.0	42.7	33.3	0.064	1.37	25.0
(S89TX-447-002)	5-12	A	0.2	0.4	1.1	6.3	15.8	23.8	42.2	34.0	0.072	1.38	28.3
	12-19	Bt1	0.3	0.2	1.3	5.7	14.4	21.9	35.4	42.7	0.070	1.42	26.1
	19-31	Bt2	0.2	0.5	1.0	6.0	14.7	22.4	34.6	43.0	0.069	1.40	27.1
	39-47	3BCk	1.6	1.4	5.2	11.4	18.4	38.0	42.7	19.3	-	-	-
Speck*	0-5	A	0.0	0.2	0.4	1.2	8.7	10.5	57.8	31.7	0.061	1.19	31.2
(S89TX-447-005)	5-12	Bt	0.1	0.1	0.2	0.9	6.4	7.7	49.2	43.1	0.090	1.26	37.8
Throck*	0-8	A	1.3	0.4	2.1	5.6	11.7	21.1	45.2	33.7	0.086	1.18	31.5
(S87TX-447-001)	8-16	Bw	0.9	0.7	1.8	3.9	7.8	15.1	41.8	43.1	0.081	1.44	27.2
	16-27	Bk1	0.4	0.8	2.3	3.9	8.1	15.5	40.4	44.1	0.084	1.46	27.0
	27-39	Bk2	1.0	1.8	1.7	2.9	7.0	14.4	40.5	45.1	0.080	1.51	28.5
	39-49	BcKy	3.8	4.3	3.5	3.7	7.1	22.4	44.5	33.1	0.056	1.46	25.4
	49-62	2Ck	1.0	1.2	1.1	3.8	26.5	33.6	41.4	25.0	0.016	1.84	14.3

* Location of Pedon Sample is the same as the pedon given as typical for series in "Soil Series and Their Morphology".

Table 18.--Chemical Analyses of Selected Soils

(Dash indicates data not available.) (Analysis by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas

Soil name and sample number	Depth	Horizon	Extractable base				Total	CEC	Base saturation	Organic Carbon	pH (water 1:1)	CaCO3 Equiv	ESP	SAR	Elec. Cond.
			Ca	Mg	Na	K									
			Millequivalents per 100 grams of soil						Pct	Pct		Pct	Pct		Mmhos/cm
Leeray*	0-6	Ap	61.6	6.6	0.7	1.5	70.4	32.3	100	1.25	8.3	1.4	2	1	0.5
(S89TX-447-003)	6-19	A	55.8	11.6	3.0	0.7	71.2	33.8	100	0.91	8.5	4.1	8	5	0.6
	19-37	Bkss	48.3	13.8	7.9	0.7	70.8	32.4	100	0.82	8.4	4.6	19	14	2.4
	37-54	Bkssy1	72.8	13.6	10.0	0.6	97.0	28.7	100	0.57	8.1	7.6	19	14	10.3
	54-65	2Bkssy2	77.1	11.8	9.1	0.6	98.6	25.8	100	0.42	8.0	13.2	17	14	10.2
	65-73	2Bkssy3	178.6	9.8	7.7	0.5	196.7	21.1	100	0.33	8.0	14.7	17	14	10.0
	73-91	2Bssy	78.5	11.8	9.6	0.5	100.4	22.6	100	0.40	8.0	17.8	22	14	10.1
	91-157	3BC	47.6	19.6	11.7	0.4	29.3	34.9	100	0.24	8.3	4.6	18	21	7.4
Lueders*	0-6	A	56.7	1.5	0.2	0.7	59.2	25.3	100	3.80	8.1	22.6	1	-	-
(S89TX-447-004)	6-12	Bk	54.4	0.8	0.1	0.2	55.5	22.6	100	2.45	8.3	42.5	0	-	-
Rowden*	0-5	Ap	20.7	2.1	0.4	3.4	26.5	25.1	100	1.21	7.8	0.2	2	-	-
(S89TX-447-002)	5-12	A	19.8	2.2	0.1	1.3	23.4	23.9	98	1.08	7.6	0.2	0	-	-
	12-19	Bt1	21.2	3.4	0.1	0.8	25.6	26.9	95	0.80	7.4	0.8	0	0	1.1
	19-31	Bt2	20.7	4.2	0.1	0.7	25.7	26.9	96	0.75	7.6	0.3	0	-	-
	39-47	3Bck	37.5	4.1	0.1	0.2	42.0	9.7	100	0.87	8.7	39.3	1	-	-
Speck*	0-5	A	11.1	3.1	0.2	1.0	15.4	26.0	59	1.38	6.9	0.7	1	-	-
(S89TX-447-005)	5-12	Bt	10.6	4.6	0.2	1.1	16.5	34.1	48	1.41	7.4	0.1	1	-	-
Throck*	0-8	A	46.6	5.0	0.4	0.8	52.9	33.5	100	2.02	8.2	4.2	1	1	0.7
(S87TX-447-001)	8-16	Bw	61.7	9.2	3.4	0.5	74.9	34.8	100	1.22	8.8	10.6	9	8	0.6
	16-27	Bk1	43.3	11.6	7.9	0.5	63.3	33.2	100	0.89	8.8	13.5	21	22	1.3
	27-39	Bk2	42.2	11.4	11.8	0.6	66.1	28.2	100	1.67	8.4	14.5	28	18	5.9
	39-49	BcKy	65.6	7.0	6.5	0.3	79.4	17.7	100	0.18	8.1	39.3	22	12	8.1
	49-62	2Ck	28.3	5.2	4.9	0.2	38.5	11.2	100	0.40	8.8	5.8	32	20	2.3

* Location of Pedon Sample is the same as the pedon given as typical for series in "Soil Series and Their Morphology".

Table 19.--Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Abilene	Fine, mixed, thermic Pachic Argiustolls
Aspermont	Fine-silty, mixed, thermic Typic Ustochrepts
Bluegrove	Fine, mixed, thermic Typic Haplustalfs
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Clearfork	Fine, mixed, thermic Cumulic Haplustolls
Newcastle	Fine-loamy, siliceous, thermic Typic Haplustalfs
Enterprise	Coarse-silty, mixed, thermic Typic Ustochrepts
Gageby	Fine-loamy, mixed, thermic Cumulic Haplustolls
Grandfield	Fine-loamy, mixed, thermic Typic Haplustalfs
Harpersville	Fine, mixed (calcareous), thermic Ustic Torriorthents
Jolly	Loamy, siliceous, thermic, shallow Typic Haplustalfs
Knoco	Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents
Leeray	Fine, montmorillonitic, thermic Typic Haplusterts
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Lueders	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Lusk	Clayey-skeletal, mixed, thermic Typic Paleustalfs
Anson	Loamy, siliceous, thermic Arenic Paleustalfs
Nukrum	Fine, montmorillonitic, thermic Vertic Haplustolls
Nuvalde	Fine-silty, mixed, thermic Typic Calciustolls
Oil-waste land.	
Owens	Fine, mixed, thermic Typic Ustochrepts
Palopinto	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Pitzer	Loamy, mixed, thermic, shallow Petrocalcic Calciustolls
Rochelle	Fine-loamy, mixed, thermic Typic Haplustalfs
Rock outcrop.	
Rowden	Fine, mixed, thermic Typic Argiustolls
Rowena	Fine, mixed, thermic Vertic Calciustolls
Sagerton	Fine, mixed, thermic Typic Argiustolls
Speck	Clayey, mixed, thermic Lithic Argiustolls
Springcreek	Fine-loamy, carbonatic, thermic Typic Calciustolls
Swenson	Fine, mixed, thermic Typic Argiustolls
Throck	Fine, mixed, thermic Vertic Ustochrepts
Thurber	Fine, montmorillonitic, thermic Typic Haplustalfs
Tillman	Fine, mixed, thermic Typic Paleustolls
*Truce	Fine, mixed, thermic Udic Paleustalfs
Vernon	Fine, mixed, thermic Typic Ustochrepts
Westola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents
Wheatwood	Fine-silty, mixed, thermic Fluventic Ustochrepts
Wichita	Fine, mixed, thermic Typic Paleustalfs

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