United States
Department of
Agriculture

Natural
Resources
Conservation
Service

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

Soil Survey of Burleson 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.

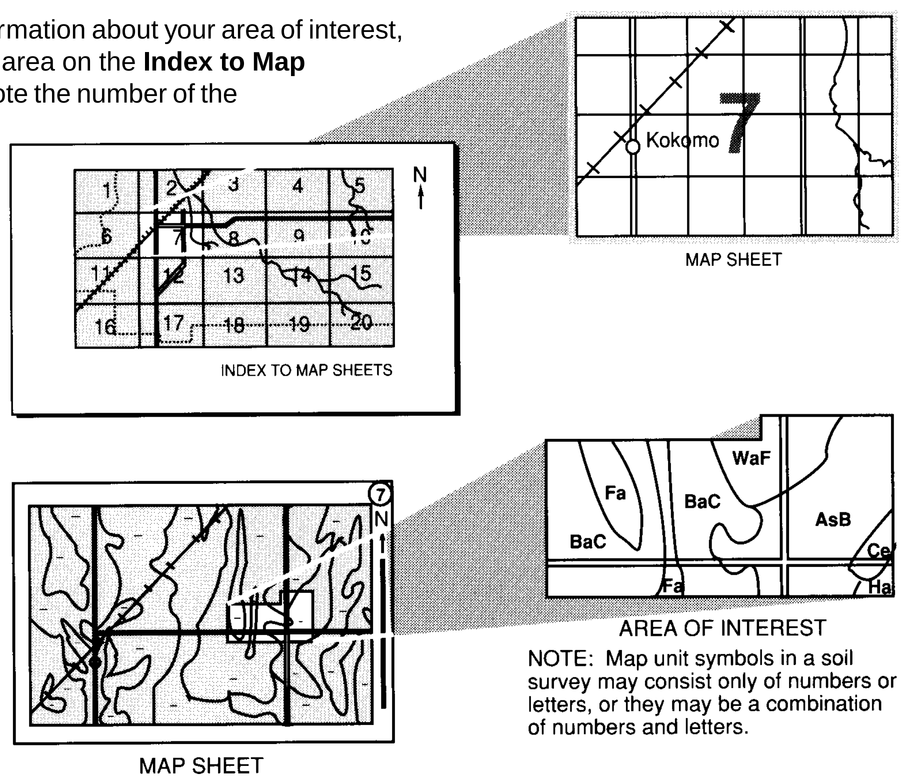
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

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.

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 has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. The survey is part of the technical assistance furnished to the Burleson-Lee Soil and Water Conservation District.

Cover: Harvesting cotton in an area of Coarsewood silt loam, 0 to 1 percent slopes, rarely flooded. Soils of the Brazos River flood plain are highly productive for growing crops.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

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April 2005

Foreword

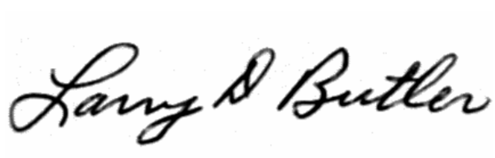
This soil survey contains information that can be used in land-planning programs in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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 Texas Cooperative Extension.



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Soil Survey of
Burleson County, Texas

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

Burleson County is in the southeast part of central Texas (fig. 1). The total area, which includes water areas, is 433,644 acres or 678 square miles. Caldwell is the county seat. Other small towns in the county include Deanville, Lyons, Snook, and Somerville. The county is irregularly shaped and is about 30 miles long and 34 miles wide. The elevation ranges from about 500 feet above sea level in the northern part of the county to about 190 feet above sea level in the southeast part of the county. The topography is mostly gently sloping to strongly sloping, but some parts are nearly level. Numerous creeks and streams that flow into the Brazos River drain the county, which generally slopes to the southeast. The river bounds the county on the east.

Figure 1.—Location of Burleson County, Texas.

Burleson County is in parts of two Major Land Resource Areas (MLRAs). Major Land Resource Areas are geographic areas of the United States that have particular patterns of soils, potential natural vegetation, water resources, climate, and land uses. About 75 percent of the county is in the Texas Claypan Major

Land Resource Area and about 25 percent is in the Texas Blackland Prairie Major Land Resource Area. Loamy and sandy soils, mostly light in color, formed under an oak savannah in the Texas Claypan Area and loamy and clayey soils, mostly dark in color, formed in the Texas Blackland Prairie.

The major land uses in Burleson County are cattle ranching and farming. Most of the cropland is on either side of Texas Highway 21, which traverses the county, and in the Brazos River flood plain. In 1993, about 70 percent of the county was used as rangeland, 19 percent as pasture and hayland, and 11 percent as cropland.

General Nature of the Survey Area

This section gives general information about Burleson County. It discusses history, agriculture, natural resources, and climate.

History

Burleson County, named for General Edward Burleson, was created from Milam and Washington Counties in 1846. At one time, the Karankawa Indians occupied it as their hunting ground. In the 1700's, the Spanish built El Camino Real (Kings Highway) or Old San Antonio Road, now Texas Highway 21, from San Antonio to Nacogdoches(3). It was built following the Blackland Prairie belt that crosses the county. This area was selected because of tall grasses and few trees and streams, and because enemies could be seen from a distance.

In the 1830's, having won independence from Spain, Mexico established Fort Tenoxtitlan on the west bank of the Brazos River near the Rita community in northeastern Burleson County. It was abandoned in 1832 because of internal strife within the Mexican government.

About this time, Stephen F. Austin brought colonists in to settle the area. Farming was the main occupation with corn, cotton, and livestock being the main commodities.

In the late 1880's, European immigrants, mainly of Czech and German descent, began to arrive. They soon began to farm cotton as the main cash crop in most areas in the county.

Agriculture

Livestock, hay, and crops are the main agricultural enterprises in Burleson County. Crop production is confined mainly to areas along Texas Highway 21 and the Brazos River flood plain.

Livestock operations are mainly cow-calf, raised primarily for beef production. Cattle graze mainly pastures of improved bermudagrass and bahiagrass, during the spring, summer, and early fall. Areas of rangeland are also used for grazing; however, they are not as productive. During the winter months, cattle are fed hay and given feed supplements.

Hay production for livestock use or for sale consists mainly of improved bermudagrass, bahiagrass, or small grains. A few small areas of alfalfa are grown exclusively in the Brazos River flood plain.

Crop production is intensive in Burleson County, especially in the Brazos River flood plain. Most of these soils are rarely flooded and are very fertile. Cotton is the main cash crop. Some areas have been land-leveled for irrigation. Corn, grain sorghum, and a few areas of soybeans are also grown.

Natural Resources

Soil is the most important natural resource in Burleson County. The production of livestock, forages, and crops, which are sources of livelihood for many people in the county, depend on the soil.

Oil and natural gas production is significant in the county and is related to the underlying geology. Most oil and gas wells are drilled to recover oil and gas reservoirs in the Austin Chalk Formation. Horizontal drilling, a new drilling technique, has made recovery of oil and gas reservoirs more efficient. The oil field production and its many related services, provide employment for many county residents.

Water is an important natural resource. The sandy soils in the northern part of Burleson County are important recharge areas for underground aquifers. Lake Somerville, in the southern part of the county, provides flood control, water for municipal use, fishing, and other recreational activities. The Brazos River and numerous smaller streams, creeks, lakes, and farm ponds provide abundant water supplies for the county. Most of the county has ample supplies of good quality water for industrial, recreational, agricultural, and domestic uses.

Fish and wildlife are also important natural resources in Burleson County. Lake Somerville and its upper tributaries provide excellent fishing for catfish, crappie, and white bass. Deer and squirrel are still abundant in some areas.

Climate

Burleson County is hot in summer and cool in winter when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in the spring. Snowfall is infrequent. The total annual precipitation is usually adequate for cotton, feed grain, and small grain crops.

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Somerville Dam, Texas, in the period 1964 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 50 degrees F and the average daily minimum temperature is 39 degrees. The lowest temperature on record, which occurred on December 23, 1989, is 3 degrees. In summer, the average temperature is 82 degrees and the average daily maximum temperature is 93 degrees. The highest recorded temperature, which occurred on August 28, 1990, is 105 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 38 inches. Of this, 21 inches, or about 54 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 6.65 inches on April 13, 1969. Thunderstorms occur on about 41 days each year, and most occur in May.

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

Snowfall is rare. In 99 percent of the winters, there is no measurable snowfall. In 1 percent, the snowfall, usually of short duration, is less than 1 inch.

The average relative humidity in midafternoon is about 56 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 73 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in March.

How This Survey Was Made

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.

General Soil Map Units

The general soil map in 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.

The soils in Burleson County are grouped into 14 general soil map units. They make up about 98 percent of the total acres. The rest is covered by water.

Loamy and Clayey Prairie Soils on Uplands

This group of soils makes up about 28 percent of Burleson County. Benchley, Crockett, Lexton, Luling, Zack, and Zulch are the major soils. Most of these soils have a loamy surface layer and a clayey subsoil. The Luling soil is clayey throughout. These soils developed mainly in shale and weathered glauconitic material of the Claiborne Group. They are very gently sloping or gently sloping. All are moderately well drained or well drained. Permeability is moderately slow to very slow.

The soils in this group are used mainly as pasture and hayland or as rangeland. Some areas are used as cropland. Pasture grasses include improved bermudagrass, bahiagrass, and kleingrass. Native grasses are bluestem, indiangrass, paspalum, sideoats grama, and Texas wintergrass. The most dominant trees are scattered elm, oak, and hackberry. The main crops grown are corn, grain sorghum, cotton, and small grains. When used for crops, these soils need proper conservation practices, such as contour farming, terraces, or minimum tillage, to reduce the hazard of water erosion.

These soils have some limitations as sites for most urban uses, mainly high and very high potential for shrinking and swelling, very slow permeability, and low soil strength.

1. Zack-Zulch

Loamy, moderately deep, very gently sloping, moderately well drained soils

The Zack soils are mainly on convex ridges. The Zulch soils are on convex ridges and lower concave side slopes. Slopes range from 1 to 3 percent. The underlying material is stratified mudstone, sandstone, siltstone, and shale, which is mainly of the Yegua Formation.

This map unit makes up about 15 percent of the county. It is 40 percent Zack soils, 32 percent Zulch soils, and 28 percent soils of minor extent (fig. 2).

The Zack soils are moderately deep to mudstone and sandstone and they are very slowly permeable. Typically, the surface layer is brown fine sandy loam. The subsoil is dark brown clay that has mottles in shades of red in the upper part and mottles in shades of gray in the lower part. The underlying material is weakly consolidated mudstone and sandstone. These soils are strongly acid in the surface layer, moderately acid in the upper part of the subsoil, and slightly alkaline in the lower part.

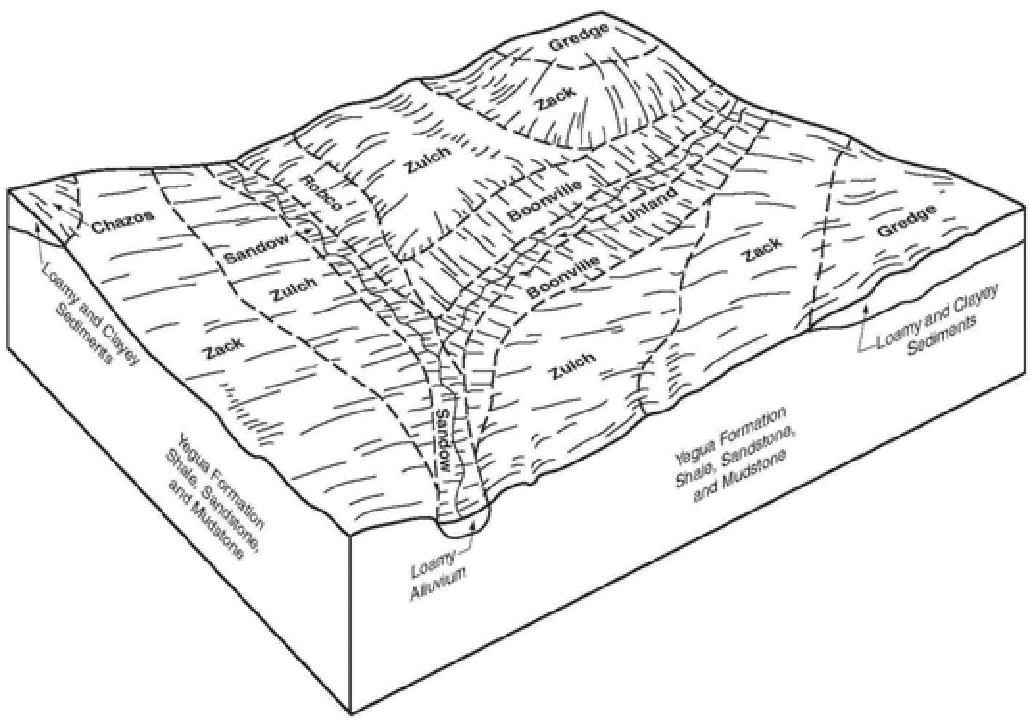

Figure 2.—Typical pattern of soils in the Zack-Zulch general soil map unit.

The Zulch soils are moderately deep to shale and siltstone and they are very slowly permeable. Typically, the surface layer is grayish brown fine sandy loam. The subsoil is gray or dark gray clay that has mottles in shades of brown in the upper part. The underlying material is weakly consolidated shale and siltstone. These soils are moderately acid in the surface layer and neutral in the subsoil and underlying material.

Of minor extent in this map unit are Boonville, Chazos, Gredge, Robco, Sandow, and Uhland soils. Boonville soils are in concave areas adjacent to small drainageways. Chazos and Robco soils are on convex, sandy ridges on stream terraces. Gredge soils are on relict Pleistocene terraces on uplands. Sandow and Uhland soils are on flood plains of small streams.

The soils of this map unit are used mainly as pasture and hayland. Some areas are used as rangeland. These soils generally are not used as cropland, although early settlers farmed them extensively. Most of the fields are either idle and invaded by mesquite or used for improved pasture or hayland. Most of the pasture and hayland is improved bermudagrass and bahiagrass.

Some small areas of rangeland are in climax condition; however, most are heavily grazed. Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly post oak and blackjack oak.

The major soils in this map unit have several limitations for most urban uses, including high potential for shrinking and swelling, very slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

2. Benchley-Crockett

Loamy, very deep and deep, very gently sloping or gently sloping, moderately well drained soils

The Benchley soils are on concave lower side slopes along small drainageways. The Crockett soils are on slightly convex ridges. Slopes range from 1 to 5 percent. The underlying material is shale that has thin strata of sandstone that is mainly of the Wheelock member of the Cook Mountain Formation.

This map unit makes up about 7 percent of the county. It is 35 percent Benchley soils, 34 percent Crockett soils, and 31 percent soils of minor extent (fig. 3).

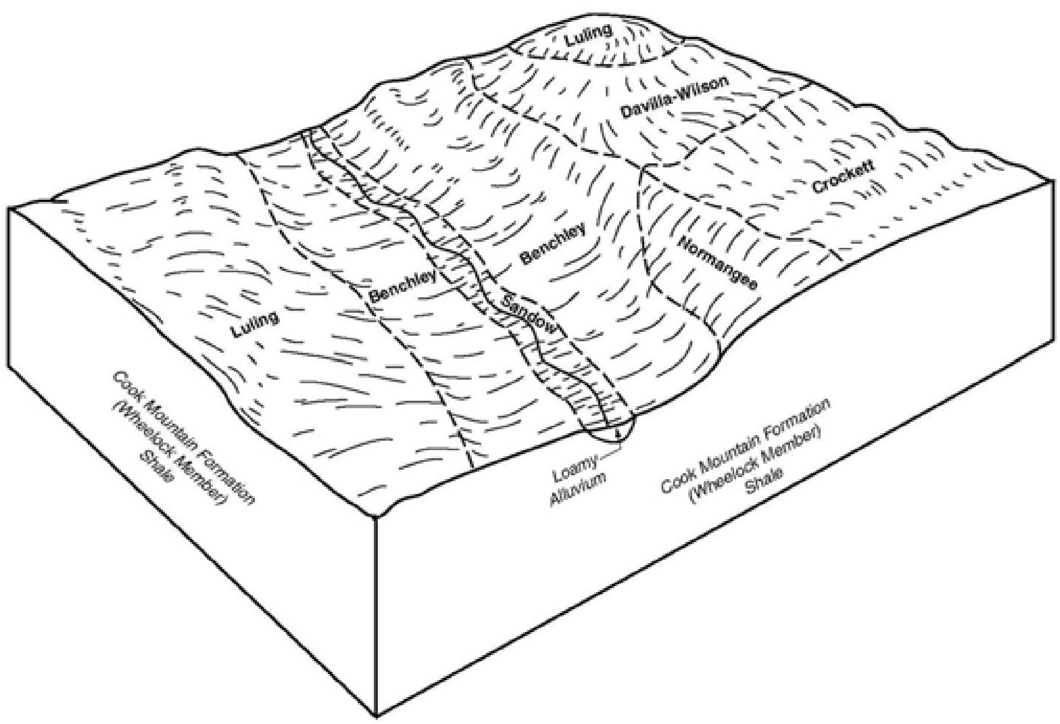

Figure 3.—Typical pattern of soils in the Benchley-Crockett general soil map unit.

The Benchley soils are very deep to shale and they are slowly permeable. Typically, the surface layer is very dark grayish brown loam. The clay subsoil is dark grayish brown in the upper part, light yellowish brown and pale olive in the middle part, and yellow in the lower part. It has mottles in shades of red. The underlying material is shale that has strata of sandstone. These soils are moderately acid in the surface layer and in the upper part of the subsoil, and slightly alkaline in the lower part of the subsoil.

The Crockett soils are deep to shale and they are very slowly permeable. Typically, the surface layer is pale brown loam. The upper part of the subsoil is dark brown clay that has mottles in shades of red and brown. The lower part is light olive brown and light brownish gray clay that has mottles in shades of brown. The underlying material is shale. These soils are moderately acid in the surface layer, moderately acid or slightly acid in the upper part of the subsoil, and neutral to moderately alkaline in the lower part of the subsoil.

Of minor extent in this map unit are Davilla, Gasil, Luling, Normangee, Sandow, Spiller, and Wilson soils. Gasil and Spiller soils are on slightly higher convex ridges of adjacent geologic formations. Davilla and Wilson soils are on nearly level terraces. Luling soils are on broad, gently sloping ridges. Normangee soils are on gently sloping side slopes. Sandow soils are on flood plains of small streams.

The soils of this map unit are used mainly as pasture and hayland. They are used as rangeland in some areas and as cropland in a few areas.

Most of the pasture and hayland is improved bermudagrass although a few areas are planted to kleingrass. Applications of fertilizer are needed to sustain yields.

Areas of rangeland in climax vegetation are small and scattered. Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly hackberry and elm. Some overgrazed areas have been invaded by mesquite. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

Corn, grain sorghum, cotton, and small grains are the main crops. Conservation practices, such as contour farming, terraces, and conservation tillage, are needed to prevent water erosion.

The major soils in this map unit have several limitations for most urban uses. High potential for shrinking and swelling, very slow permeability, and low soil strength can be overcome by proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets.

3. Lexton-Benchley

Loamy, very deep, very gently sloping or gently sloping, well drained and moderately well drained soils

The Lexton soils are on narrow, convex ridges. The Benchley soils are on concave lower side slopes along small drainageways. Slopes range from 1 to 5 percent. The underlying material is weathered glauconitic material and shale.

This map unit makes up about 4 percent of the county. It is 37 percent Lexton soils, 27 percent Benchley soils, and 36 percent soils of minor extent.

The Lexton soils are very deep to weathered glauconitic material and they are moderately slowly permeable. Typically, the surface layer is dark reddish brown sandy clay loam. The subsoil is dark reddish brown or dark red clay. The underlying material is weathered glauconite. These soils are moderately acid in the surface layer and slightly acid in the subsoil.

The Benchley soils are very deep to shale and they are slowly permeable. Typically, the surface layer is very dark grayish brown loam. The clay subsoil is dark grayish brown in the upper part, light yellowish brown and pale olive in the middle part, and yellow in the lower part. It has mottles in shades of red. The underlying material is shale that has strata of sandstone. These soils are moderately acid in the surface layer and in the upper part of the subsoil, and slightly alkaline in the lower part of the subsoil.

Of minor extent in this map unit are Gasil, Luling, Padina, Robco, Silawa, Silstid, and Uhland soils. Gasil soils are on footslopes. Luling soils are on convex ridges and upper side slopes. Padina and Silstid soils are on high, broad ridges on adjacent geologic formations, mainly the Queen City and Sparta Sand Formations. Robco soils are on concave lower side slopes on adjacent geologic formations, mainly of the Queen City and Sparta Sand Formations. Silawa soils are on stream terraces. Uhland soils are on flood plains of small streams.

The soils of this map unit are used mainly as pasture and hayland. They are used as rangeland in some areas and as cropland in a few areas.

Most of the pasture and hayland is improved bermudagrass and bahiagrass. Fertilization is necessary for optimum forage production.

A few areas of rangeland in climax condition exist; however, they are small and scattered. Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly hackberry, elm, and oak. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and prevent water erosion in sloping areas.

Some areas of these soils are cropped, although not as extensively as in the past. Cotton, corn, grain sorghum, and small grains are the main crops. Some areas of cropland that have remained idle for years have been invaded by mesquite.

The major soils in this map unit have several limitations for most urban uses, mainly high potential for shrinking and swelling, slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

4. Luling

Clayey, very deep, very gently sloping or gently sloping, well drained soils

The Luling soils are on broad, convex ridges and side slopes. Slopes range from 1 to 5 percent. The underlying material is shale of the Wheelock member of the Cook Mountain Formation.

This map unit makes up about 2 percent of the county. It is 66 percent Luling soils and 34 percent soils of minor extent.

The Luling soils are very deep to shale and they are very slowly permeable. Typically, the soil is clayey throughout. The surface layer is very dark grayish brown. The subsoil is dark grayish brown in the upper part and olive gray in the lower part. The underlying material is shale. These soils are neutral in the surface layer and in the upper part of the subsoil, and moderately alkaline in the lower part of the subsoil.

Of minor extent in this map unit are Benchley, Davilla, Gasil, Normangee, Sandow, and Wilson soils. Benchley soils are on concave lower side slopes along drainageways. Davilla and Wilson soils are on broad, nearly level terraces. Gasil soils are on higher ridges on adjacent geologic formations. Normangee soils are in positions on side slopes similar to those of the major soils. Sandow soils are on flood plains of small streams.

The soils of this map unit are used mainly as rangeland. Some areas are used as cropland and as pasture and hayland.

Bluestem, indiangrass, sideoats grama, paspalum, and Texas wintergrass are the main native plants. Trees are predominantly elm and hackberry. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

The main crops are corn, cotton, grain sorghum, and small grains. Cover crops, contour farming, and terraces are necessary to help control water erosion.

Most of the pasture and hayland is improved bermudagrass although a few areas are planted to kleingrass. Applications of nitrogen and phosphorous fertilizers are needed to sustain yields.

The major soils in this map unit have several limitations for most urban uses, including very high potential for shrinking and swelling, very slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

Sandy and Loamy Savannah Soils on Uplands

This group of soils makes up about 35 percent of Burleson County. Burlewash, Kurten, Padina, Silstid, Singleton, and Spiller are the major soils. They developed in sandy sediments, shale, sandstone, and mudstone of the Claiborne and Jackson Groups. They are very gently sloping to very steep and they are moderately well drained or well drained. Permeability is moderate to very slow.

The soils in this group are used mainly as rangeland. Some areas are used as pasture and hayland. Native grasses include bluestem, indiangrass, paspalum, and panicums. Trees are dominantly post oak and blackjack oak with an understory of yaupon. Pasture grasses include improved bermudagrass and bahiagrass. Watermelons and small grains are grown in a few areas.

These soils have some limitations for most urban uses, mainly high potential for shrinking and swelling, very slow permeability, low soil strength, and seepage.

5. Padina-Silstid

Sandy, very deep, very gently sloping to moderately steep, well drained soils

The Padina soils are on broad divides and side slopes. The Silstid soils are on broad convex ridges and side slopes. Slopes range from 1 to 15 percent. The underlying material is interbedded sandy and loamy materials and sandstone of the Queen City and Sparta Sand Formations. Areas of this map unit are an important aquifer source.

This map unit makes up about 22 percent of the county. It is 42 percent Padina soils, 26 percent Silstid soils, and 32 percent soils of minor extent (Fig. 4).

The Padina soils are very deep and moderately permeable. Typically, the surface layer is pale brown fine sand. The subsurface layer is fine sand that is yellow in the upper part and very pale brown in the lower part. The subsoil is reddish yellow fine sandy loam that has mottles in shades of red and gray. These soils are moderately acid in the surface layer, slightly acid in the subsurface layers, and strongly acid in the subsoil.

The Silstid soils are very deep and they are moderately permeable. Typically, the surface layer is light yellowish brown loamy fine sand and the subsurface layer is very pale brown loamy fine sand. The upper part of the subsoil is reddish yellow and yellow sandy clay loam, and the lower part is yellow fine sandy loam. These soils are moderately acid in the surface and subsurface layers and strongly acid in the subsoil.

Of minor extent in this map unit are Arenosa, Cadelake, Gasil, Jedd, Robco, Silawa, and Uhland soils. Arenosa soils are on broad, smooth divides. Cadelake soils are along poorly defined drainageways. Gasil soils are on convex ridges and side slopes. Jedd soils are on narrow ridgetops and side slopes. Robco soils are on concave side slopes. Silawa soils are on local stream terraces. Uhland soils are on flood plains of small streams.

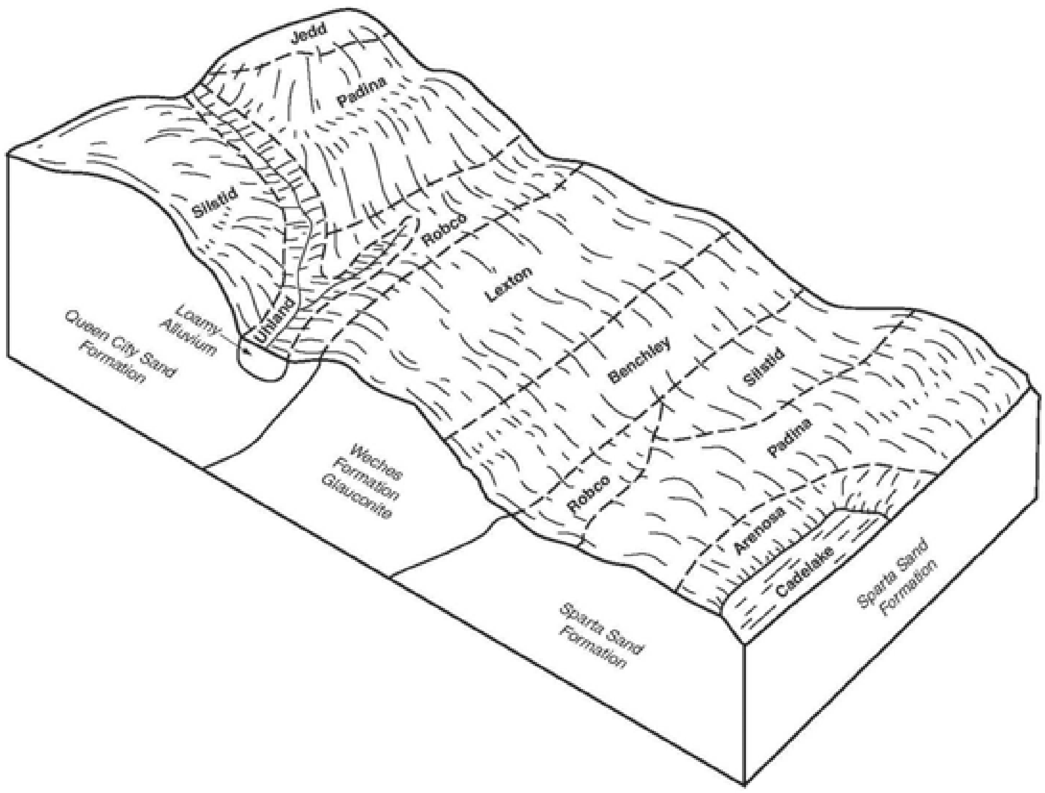

Figure 4.—Typical pattern of soils in the Padina-Silstid and Lexton-Benchley general soil map unit.

The soils of this map unit are used mainly as rangeland. Many areas are planted to pasture and hayland and a few areas are planted in watermelons.

Native grasses include bluestem, indiangrass, dropseed, and panicum. Most areas have a post oak and blackjack oak canopy with a dense yaupon understory that greatly decreases native plant growth.

Areas of pasture and hayland are planted mainly to improved bermudagrass. Applications of lime and fertilizer are needed to sustain yields.

The major soils in this map unit have some limitations for most urban uses, mainly steepness of slope and seepage. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

6. Singleton-Burlewash

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

The Singleton soils are on broad ridges and in concave areas along drainageways. The Burlewash soils are on convex ridges and upper side slopes. Slopes range from 1 to 50 percent. The underlying material is weakly cemented sandstone and mudstone that is mainly of the Jackson Group of geologic formations.

This map unit makes up about 8 percent of the county. It is 44 percent Singleton soils, 24 percent Burlewash soils, and 32 percent soils of minor extent (fig. 5).

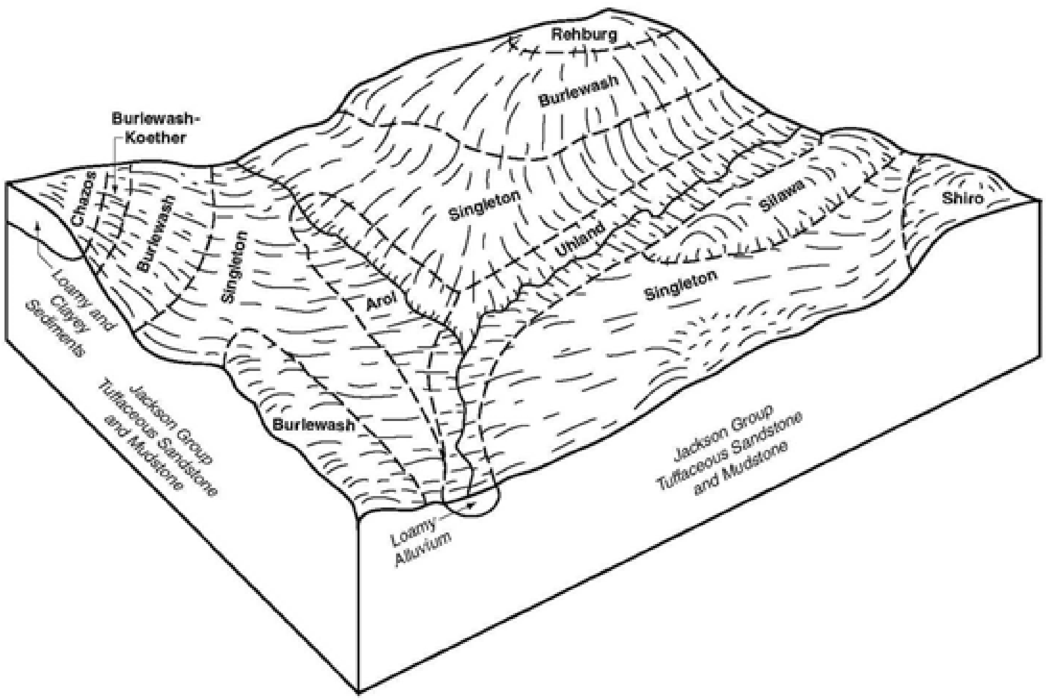

Figure 5.—Typical pattern of soils in the Singleton-Burlewash general soil map unit.

The Singleton soils are moderately deep to weakly cemented sandstone and they are very slowly permeable. Typically, the surface layer is light gray fine sandy loam. The subsoil is brown clay that has mottles in shades of red and brown. The underlying material is weakly cemented sandstone. These soils are strongly acid in the surface layer and very strongly acid in the subsoil.

The Burlewash soils are moderately deep to weakly cemented sandstone and mudstone and they are very slowly permeable. Typically, the surface layer is brown fine sandy loam. The clay subsoil is reddish brown in the upper part, red in the middle part, and light brown in the lower part. The underlying material is weakly cemented sandstone and mudstone. These soils are strongly acid in the surface layer and very strongly acid in the subsoil.

Of minor extent in this map unit are Arol, Chazos, Eufaula, Koether, Rehburg, Shiro, Silawa, Uhland, and Wilson soils. Arol soils are on concave lower side slopes. Chazos, Eufaula, and Silawa soils are on sandy, convex ridges on stream terraces. Koether soils are on very steep, narrow ridges and middle to upper side slopes. Rehburg and Shiro soils are on sandy, convex ridges. Uhland soils are on flood plains of small streams. Wilson soils are on nearly level stream terraces.

The soils of this map unit are used mainly as rangeland. In some areas, they are used as pasture and hayland. These soils generally are not used as cropland.

Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly post oak and blackjack oak with a yaupon understory.

Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and hazard of water erosion in sloping areas.

Areas of pasture and hayland are planted to improved bermudagrass and bahiagrass. Applications of lime and fertilizer are necessary to sustain yields.

The major soils in this map unit have some limitations for most urban uses, including high potential for shrinking and swelling, very slow permeability, depth to rock, slope, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

7. Kurten-Spiller

Loamy, deep and very deep, very gently sloping to moderately sloping, well drained and moderately well drained soils

These soils are on narrow ridges and side slopes. Slopes range from 1 to 8 percent. The underlying material is stratified shale, weakly cemented sandstone, and loamy materials mainly of the Landrum Shale, Spiller Sand, and Mount Tabor Shale members of the Cook Mountain Formation.

This map unit makes up about 5 percent of the county. It is 35 percent Kurten soils, 28 percent Spiller soils, and 37 percent soils of minor extent.

The Kurten soils are deep to shale and they are very slowly permeable. Typically, the surface layer is yellowish brown fine sandy loam. The clay subsoil is red with mottles in shades of gray in the upper part, light gray with mottles in shades of brown in the middle part, and light brownish gray with mottles in shades of red in the lower part. The underlying material is shale. These soils are strongly acid in the surface layer and very strongly acid in the subsoil.

The Spiller soils are very deep to stratified loamy materials and shale. They are slowly permeable. Typically, the surface layer is brown fine sandy loam. The subsoil is yellowish brown and brownish yellow clay that has mottles in shades of red and brown in the upper part and reddish yellow sandy clay loam that has mottles in shades of gray and red in the lower part. The underlying material is stratified loamy materials and shale. These soils are moderately acid in the surface layer, strongly acid in the upper part of the subsoil, and slightly acid in the lower part.

Of minor extent in this map unit are Axtell, Benchley, Chazos, Crockett, Gasil, Gredge, Normangee, Rader, Sandow, Silawa, Tabor, and Uhland soils. Axtell and Rader soils are in slightly convex and concave areas of stream terraces. Benchley, Crockett, and Normangee soils are on side slopes. Chazos and Silawa soils are on convex, sandy ridges of stream terraces. Gasil soils are on convex ridges. Gredge and Tabor soils are on convex ridges of relict Pleistocene terraces. Sandow and Uhland soils are on flood plains of small streams.

The soils of this map unit are used mainly as rangeland. Some areas are used as pasture and hayland. These soils generally are not used as cropland.

Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly post oak with a yaupon understory. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

Areas of pasture and hayland are planted to improved bermudagrass and bahiagrass. Low natural fertility requires the use of fertilizer and lime for sustained yields.

The major soils in this map unit have some limitations for most urban uses, including high potential for shrinking and swelling, very slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

Sandy, Loamy, and Clayey Soils on Stream Terraces

This group of soils makes up about 14 percent of Burleson County. Burleson, Chazos, Rader, Robco, and Tabor are the main soils. These soils developed in sandy, loamy, and clayey alluvium of Recent or Pleistocene age.

These soils are in nearly level to moderately sloping areas of stream terraces. They are moderately well drained and slowly or very slowly permeable.

The soils in this group are used mainly as pasture and hayland. Improved bermudagrass and bahiagrass are the main pasture plants. Some areas are in rangeland where bluestem, indiangrass, paspalum, and panicum are the main native plants. Trees are predominantly post oak and yaupon. Some areas are used as cropland. The main crops grown are corn, cotton, and grain sorghum.

These soils have some limitations for most urban uses, including very high and high potential for shrinking and swelling, very slow permeability, and low soil strength.

8. Robco-Chazos

Sandy, very deep, very gently sloping to moderately sloping, moderately well drained soils

The Robco soils are in concave areas along drainageways and convex sandy ridges. The Chazos soils are on convex, sandy ridges and side slopes adjacent to drainageways. Slopes range from 1 to 8 percent. The underlying material is sandy sediments.

This map unit makes up about 8 percent of the county. It is 39 percent Robco soils, 31 percent Chazos soils, and 30 percent soils of minor extent.

The Robco soils are very deep and they are slowly permeable. Typically, the surface layer is light yellowish brown loamy fine sand, and the subsurface layer is very pale brown loamy fine sand. The subsoil is brownish yellow sandy clay loam in the upper part. The middle part is light gray sandy clay loam that has mottles in shades of yellow and red, and the lower part is yellow sandy clay that has mottles in shades of red and gray. These soils are strongly acid in the surface and subsurface layers, strongly acid in the upper part of the subsoil, and moderately acid in the lower part.

The Chazos soils are very deep and they are slowly permeable. Typically, the surface layer is dark yellowish brown loamy fine sand, and the subsurface layer is yellowish brown loamy fine sand. The upper part of the subsoil is yellowish brown clay that has mottles in shades of red and gray, and the lower part is very pale brown sandy clay loam that has mottles in shades of yellow. These soils are strongly acid.

Of minor extent in this map unit are Axtell, Boonville, Eufaula, Gredge, Mabank, Rader, Silawa, Tabor, Uhland, Zack, and Zulch soils. Axtell, Mabank, Rader, and Tabor soils are in slightly lower positions on terraces. Boonville soils are in concave areas along small drainageways. Eufaula and Silawa are on sandy, convex stream terraces. Gredge soils are on convex ridges. Uhland soils are on flood plains of small streams. Zack and Zulch soils are on convex ridges and side slopes on uplands.

Soils of this map unit are used mainly as pasture and hayland. Some areas are used as rangeland. A few areas are used as cropland.

Most of the pasture and hayland is planted to improved bermudagrass and bahiagrass. Applications of fertilizer and lime are needed to sustain yields.

Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly post oak and blackjack oak with a yaupon understory.

Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

Corn, watermelons, and small grains are grown in some areas. Applications of fertilizer and lime are necessary for optimum yields.

The major soils in this map unit have some limitations for most urban uses, including moderate potential for shrinking and swelling, slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

9. Tabor-Rader

Loamy, very deep, nearly level or very gently sloping, moderately well drained soils

These soils are on modern stream terraces and on relict Pleistocene terraces on uplands. The Tabor soils are in broad, smooth areas. The Rader soils are on footslopes and at the head of drainageways. Slopes range from 0 to 3 percent. The underlying material is loamy and clayey sediments.

This map unit makes up about 4 percent of the county. It is 35 percent Tabor soils, 26 percent Rader soils, and 39 percent soils of minor extent.

The Tabor soils are very deep and they are very slowly permeable. Typically, the surface layer is very pale brown fine sandy loam. The upper part of the subsoil is yellow clay that has mottles in shades of red and brown. The middle part is light brownish gray clay that has mottles in shades of yellow. The lower part is yellow clay that has mottles in shades of gray. These soils are strongly acid in the surface layer, very strongly acid in the upper part of the subsoil, and neutral in the lower part of the subsoil.

The Rader soils are very deep and they are very slowly permeable. Typically, the surface and subsurface layers are very pale brown fine sandy loam. The subsoil is sandy clay in the upper part and sandy clay loam in the lower part. Subsoil layers are very pale brown, yellowish brown, light gray, brownish yellow, and reddish yellow with mottles in shades of brown, red, and gray. These soils are very strongly acid in the surface and subsurface layers, strongly acid in the upper part of the subsoil, and slightly acid in the lower part.

Of minor extent in this map unit are Axtell, Chazos, Eufaula, Gasil, Luling, Mabank, Robco, Sandow, Singleton, Spiller, Uhland, and Wilson soils. Axtell, Chazos, and Eufaula soils are on convex ridges on local stream terraces. Gasil, Luling, Singleton, and Spiller soils are on convex ridges and side slopes on adjacent uplands. Mabank and Wilson soils are on nearly level terraces. Robco soils are in sandy concave areas on terraces. Sandow and Uhland soils are on flood plains of small streams.

The soils of this map unit are used mainly as pasture and hayland. Some areas are used as rangeland. A few areas are used as cropland.

Most of the pasture and hayland is planted to improved bermudagrass and bahiagrass. Applications of fertilizer and lime are needed for sustained yields.

Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly post oak and blackjack oak with an understory of yaupon. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

Corn and small grains are grown in some areas. Applications of fertilizer and lime are necessary for optimum yields.

The major soils in this map unit have some limitations for most urban uses, including high potential for shrinking and swelling, very slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, roads, and streets can overcome these limitations.

10. Burleson

Clayey, very deep, nearly level to gently sloping, moderately well drained soils

The Burleson soils are on broad plane to convex stream terraces and on side slopes that merge onto the flood plain. Slopes range from 0 to 5 percent. The underlying material is alkaline clayey alluvium.

This map unit makes up about 2 percent of the county. It is 67 percent Burleson soils and 33 percent soils of minor extent.

The Burleson soils are very deep and they are very slowly permeable. Typically, the soil is clayey throughout. The surface layer is very dark gray and the subsoil is dark gray in the upper part and gray in the lower part. These soils are slightly alkaline in the surface layer and moderately alkaline in the subsoil.

Of minor extent in this map unit are Axtell, Chazos, Eufaula, Kaufman, Ships, Silawa, Uhland, and Wilson soils. Axtell soils are in slightly higher convex areas on terraces. Chazos, Eufaula, and Silawa soils are on convex, sandy ridges on stream terraces. Kaufman, Ships, and Uhland soils are on flood plains of streams. Wilson soils are in adjacent nearly level terrace areas.

The soils of this map unit are used mainly as cropland. Some areas are used as pasture and hayland. A few areas are used as rangeland.

Cotton, corn, grain sorghum, and small grains are the main crops. Root growth and water movement is restricted because of the very slow permeability. In nearly level areas, seed germination is impeded and field operations are delayed by prolonged wetness after heavy rains.

Common bermudagrass, improved bermudagrass, kleingrass, and dallisgrass are the main pasture and hayland plants. Applications of fertilizer are needed to sustain yields.

Bluestem, indiangrass, and paspalum are the main native plants. Trees are predominantly elm and live oak. Overgrazing by livestock should be avoided to prevent the increase of undesirable plants and to prevent the hazard of water erosion in sloping areas.

The major soils in this map unit have some limitations for most urban uses, including very high potential for shrinking and swelling, very slow permeability, and low soil strength. Proper design and careful installation of building foundations, septic tank absorption fields, and roads and streets can overcome these limitations.

Loamy and Clayey Soils on Flood Plains

This group of soils makes up about 21 percent of Burleson County. The major soils are the Belk, Coarsewood, Kaufman, Sandow, Ships, Uhland, Weswood, and Zilaboy soils. These soils developed in clayey and loamy sediments of Recent or Pleistocene age.

These nearly level to very gently sloping soils are on flood plains of the Brazos River and its tributaries. They are somewhat poorly drained to well drained and moderately rapidly permeable to very slowly permeable.

The soils in this group are used mainly as cropland and rangeland. A few areas are in pasture and hayland. Cotton, corn, and grain sorghum are the main crops grown in rarely flooded areas. Bluestem, Virginia wildrye, broadleaf uniola, panicum, and sedge are the main native plants. Trees are predominantly water oak, elm, cottonwood, and pecan. Improved bermudagrass, common bermudagrass, and dallisgrass are the main pasture and hayland plants.

These soils have some limitations for most urban uses, mainly the hazard of flooding and the very high potential for shrinking and swelling.

11. Ships-Belk

Clayey, very deep, nearly level or very gently sloping, moderately well drained and well drained soils

These soils are on the flood plain of the Brazos River. They are rarely flooded. Slopes range from 0 to 3 percent. The underlying material is clayey and loamy alluvial sediments.

This map unit makes up about 10 percent of the county. It is 61 percent Ships soils, 22 percent Belk soils, and 17 percent soils of minor extent (fig. 6).

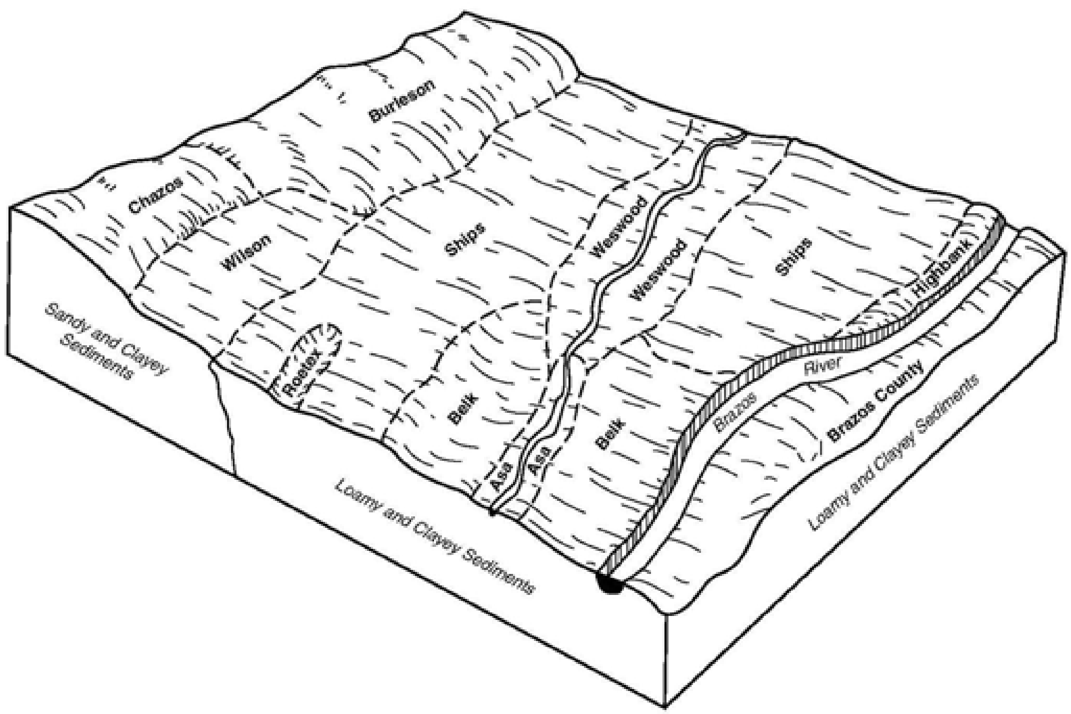

Figure 6.—Typical pattern of soils in the Ships-Belk and Burleson general soil map unit.

The Ships soils are very deep and they are very slowly permeable. Typically, the surface layer and subsoil are reddish brown clay underlain by dark gray silty clay loam. These soils are moderately alkaline and calcareous throughout.

The Belk soils are very deep and they are very slowly permeable. Typically, the surface layer is dark brown clay. The subsoil is brown clay in the upper part and reddish brown silty clay in the lower part and is underlain by strata of light brown and brown very fine sandy loam and silt loam. These soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Asa, Highbank, Roetex, Weswood, and Yahola soils. Asa, Highbank, Weswood, and Yahola soils are in slightly higher positions on flood plains. Roetex soils are in narrow swales and depressional areas.

The soils of this map unit are used mainly as cropland. Some areas are used as pasture and hayland. A few areas are in rangeland, primarily along drainageways within the Brazos River flood plain.

Cotton, corn, and grain sorghum are the main crops. Minor crops include soybeans, alfalfa, and small grains. The clayey surface layer may delay cultivation after periods of prolonged rainfall.

Common bermudagrass, improved bermudagrass, and dallisgrass are the main pasture and hayland plants. Applications of fertilizer are needed for high forage yields.

Virginia wildrye, broadleaf uniola, and sedge are the main native plants. Trees are predominantly elm and cottonwood.

The major soils in this map unit have some limitations for most urban uses, including flooding, very high potential for shrinking and swelling, and very slow permeability. These soils are not suitable for dwellings and are poorly suited to most other urban uses.

12. Zilaboy-Kaufman

Clayey, very deep, nearly level, moderately well drained soils

These soils are on flood plains, mainly of Yegua and Davidson Creeks. They are frequently flooded. Slope is 0 to 1 percent. The underlying material is loamy and clayey sediments.

This map unit makes up about 4 percent of the county. It is 41 percent Zilaboy soils, 35 percent Kaufman soils, and 24 percent soils of minor extent.

The Zilaboy soils are very deep, and they are very slowly permeable. Typically, the surface layer is dark gray clay. The subsoil is grayish brown clay in the upper part, dark grayish brown and dark gray clay in the middle part, and light brownish gray sandy clay loam in the lower part. These soils are moderately acid in the surface layer and moderately acid to neutral in the subsoil.

The Kaufman soils are very deep, and they are very slowly permeable. Typically, the surface layer is very dark gray, moderately acid clay. The subsoil is very dark gray, slightly acid clay in the upper part and gray, moderately acid clay in the lower part.

Of minor extent in this map unit are Eufaula, Gladewater, Robco, Sandow, Ships, and Uhland soils. Eufaula and Robco soils are on sandy ridges and in sandy concave areas on stream terraces. Gladewater soils are in somewhat poorly drained, slight depressions. Sandow and Uhland soils are in slightly higher positions on flood plains. Ships soils are on flood plains of the Brazos River.

The soils of this map unit are used mainly as rangeland, although some areas are used as pasture. These soils generally are not used as cropland because of frequent flooding.

Virginia wildrye, broadleaf uniola, eastern gamagrass, and sedge are the main native plants. Trees are predominantly elm, ash, and water oak.

Common bermudagrass and dallisgrass are the main pasture plants. Applications of fertilizer are needed for sustained yields.

The major soils in this map unit have some limitations for most urban uses, including the hazard of flooding, very high potential for shrinking and swelling, and very slow permeability. These soils are not suitable for most urban uses.

13. Weswood-Coarsewood

Loamy, very deep, nearly level or very gently sloping, well drained soils

These soils are on the flood plain of the Brazos River. They are rarely flooded. Most areas of the Weswood and Coarsewood soils are in broad, smooth areas. The more sloping areas are adjacent to drainageways within the flood plain. Slopes range from 0 to 3 percent. The underlying material is stratified, calcareous, loamy alluvial sediments.

This map unit makes up about 4 percent of the county. It is 48 percent Weswood soils, 24 percent Coarsewood soils, and 28 percent soils of minor extent.

The Weswood soils are very deep and they are moderately permeable. Typically, the surface layer is brown silt loam. The subsoil is stratified silt loam, silty clay loam, and very fine sandy loam. The soils generally are in various shades of brown. These soils are moderately alkaline and calcareous throughout.

The Coarsewood soils are very deep and they are moderately rapidly permeable. Typically, the surface layer is reddish brown silt loam. The subsoil is pink and reddish yellow very fine sandy loam. The underlying material is stratified yellowish red silt loam and reddish brown silty clay loam and very fine sandy loam. These soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Belk, Gaddy, Highbank, Roetex, Ships, and Yahola soils. The Belk and Ships soils are in slightly lower positions on flood plains. Gaddy soils are on sandbars adjacent to the Brazos River. Highbank soils are in positions on flood plains similar to those of the major soils. Roetex soils are in depressions. Yahola soils are on natural levees along drainageways.

The soils of this map unit are used mainly as cropland. Some areas are used as pasture and hayland. Areas in rangeland generally are along drainageways within the Brazos River flood plain.

Cotton, corn, and grain sorghum are the main crops. Minor crops include soybeans, alfalfa, and small grains. Large areas of these soils are irrigated. Also some areas are planted to pecan orchards. Cultivation while the soil is wet can result in compacted layers because of the high silt content.

Improved bermudagrass and common bermudagrass are the main pasture and hayland plants. Applications of fertilizer are necessary for sustained yields.

Bluestem, indiangrass, and Canada wildrye are the main native plants. Trees are predominantly cottonwood, elm, and pecan.

The major soils in this map unit have some limitations for most urban uses, including flooding and seepage. These soils are not suitable for dwellings and are poorly suited to most other urban uses.

14. Uhland-Sandow

Loamy, very deep, nearly level, moderately well drained soils

The Uhland soils are on narrow flood plains of small streams and Sandow soils are on broad flood plains of larger streams. They are frequently flooded. Slope is 0 to 1 percent. The underlying material is stratified sandy and loamy alluvial sediments.

This map unit makes up about 3 percent of the county. It is 52 percent Uhland soils, 21 percent Sandow soils, and 27 percent soils of minor extent.

The Uhland soils are very deep and they are moderately slowly permeable. Typically, the surface layer is pale brown fine sandy loam. The upper part of the subsoil is light yellowish brown fine sandy loam that has mottles in shades of brown and yellow. The lower part is light brownish gray loam that has mottles in shades of brown. These soils are slightly acid throughout.

The Sandow soils are very deep and they are moderately slowly permeable. Typically, the surface layer is brown loam. The subsoil is stratified fine sandy loam, loam, and sandy clay loam in shades of gray, brown, and yellow. These soils are moderately acid in the surface layer and moderately acid to slightly alkaline in the subsoil.

Of minor extent in this map unit are Eufaula, Kaufman, Padina, Robco, Silawa, and Zilaboy soils. Eufaula and Silawa soils are on sandy ridges of stream terraces. Kaufman and Zilaboy soils are in positions slightly lower on flood plains. Padina soils are on uplands. Robco soils are in sandy concave areas on stream terraces.

The soils of this map unit are used mainly as rangeland. Some areas are used as pasture. These soils generally are not used as cropland because of the hazard of flooding.

Virginia wildrye, bluestem, panicum, and eastern gamagrass are the main native plants. Trees are predominantly elm, water oak, willow, and pecan.

Common bermudagrass and dallisgrass are the main pasture plants. Applications of fertilizer and lime are necessary to sustain yields.

The major soils in this map unit have some limitations for most urban uses, including the hazard of flooding and wetness. These soils are not suitable for most urban uses.

Detailed Soil Map Units

The map units delineated on the detailed maps 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. If intensive use of small areas is planned, however, 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, Luling clay, 1 to 3 percent slopes, is a phase of the Luling series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

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. The Davilla-Wilson complex, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Burlewash-Koether soils, 8 to 50 percent slopes, is an undifferentiated group in this survey area.

This survey includes some map units that are *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example.

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

AaB—Arenosa fine sand, 1 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Interstream divides
Slope: Very gently sloping or gently sloping; slightly convex to convex surfaces have dominant slopes of 1 to 3 percent
Shape of areas: Irregular
Size of areas: 20 to 800 acres

Typical Profile

Surface layer:
0 to 5 inches—Pale brown, very strongly acid fine sand

Subsurface layer:
5 to 65 inches—Very pale brown, very strongly acid fine sand
65 to 80 inches—Very pale brown, very strongly acid fine sand that has few yellowish brown mottles

Soil Properties

Depth: Very deep
Drainage class: Somewhat excessively drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Very low
Permeability: Rapid
Available water capacity: Very low
Root zone: Very deep
Natural soil fertility: Very low
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Arenosa soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Poorly drained Cadelake soils in narrow drainageways.
- Moderately well drained Robco soils on lower side slopes in concave areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Very low available water capacity and rapid permeability limits growth of native vegetation to plants that are drought tolerant.
- Very low natural fertility limits growth of native plants.
- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:
- None

Pasture

Major limitations:
- Very low available water capacity and rapid permeability severely limits yield potential of most improved grasses.
- Because of seepage, construction of livestock ponds is not recommended.
- Very low natural fertility and rapid permeability promotes a high rate of leaching, requiring a more costly fertilization program.

Minor limitations:
- None

Cropland

Major limitations:
- Very low available water capacity and rapid permeability makes this soil unsuitable for growing most crops.

Minor limitations:
- The soil is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:
- Rapid permeability can cause effluents to seep into ground water when soil is used for septic tank absorption fields.
- The sandy soil makes excavation side walls unstable.

Minor limitations:
- Very low available water capacity and very low natural fertility makes establishing and maintaining lawn grasses and landscape plants more expensive.

Interpretive Groups

Land capability classification: 4s
Ecological site: Very Deep Sand
Pasture management group: 15

ArB—Arol fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Lower concave side slopes
Slope: Very gently sloping with plane and concave surfaces
Shape of areas: Oblong to irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 5 inches—Light brownish gray, moderately acid fine sandy loam

Subsoil:
5 to 10 inches—Dark gray, slightly acid clay
10 to 24 inches—Gray, moderately acid clay

Underlying material:
24 to 38 inches—Light gray, weakly cemented, tuffaceous sandstone

Soil Properties

Depth: Moderately deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Arol soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained, slowly permeable Shiro soils on slightly higher convex ridgetops.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Low available water capacity limits native plant growth during periods of drought.
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:
- Moderately deep soil restricts root development.

Pasture

Major limitations:
- Low available water capacity limits growth of improved grasses during periods of drought.
- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:
- Moderately deep soil restricts root development.

Cropland

Major limitations:
- Severe hazard of erosion when soil is cultivated.
- Low available water capacity limits plant growth.
- Very slow permeability restricts water movement through the soil and inhibits root development.

Minor limitations:
- Moderately deep soil inhibits root development.

Urban development

Major limitations:
- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability and depth to bedrock can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Savannah
Pasture management group: 14

AsB—Asa silty clay loam, 1 to 3 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Natural levees adjacent to drainageways within the flood plain of the Brazos River
Slope: Very gently sloping with convex surfaces
Shape of areas: Long and narrow
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 19 inches—Dark reddish gray, neutral silty clay loam

Subsoil:
19 to 34 inches—Reddish brown, moderately alkaline silty clay loam
34 to 67 inches—Reddish yellow, moderately alkaline silty clay loam
67 to 80 inches—Yellowish red, moderately alkaline silty clay loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting less than 2 days
Runoff: Very low
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Medium
Hazard of water erosion: Moderate

Composition

Asa soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained, very slowly permeable Belk soils on flood plains in positions similar to and slightly lower than the Asa soil.
- Somewhat poorly drained, very slowly permeable Roetex soils on flood plains in lower, depressional areas.
- Moderately well drained, very slowly permeable Ships soils on flood plains in positions similar to and slightly lower than the Asa soil.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion when soil is cultivated.
- Tillage operations can result in a compacted layer beneath the surface layer when the soil is wet.

Pasture

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when seedbed is prepared for improved grasses.
- Because of seepage, construction of livestock ponds is not recommended.

Rangeland

Major limitations:

- None

Minor limitations:

- Because of seepage, construction of livestock ponds is not recommended.

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for dwellings and poorly suited to most other urban uses.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Loamy Bottomland
Pasture management group: 1

AxB—Axtell fine sandy loam, 1 to 4 percent slopes

Setting

Landform: Stream terraces and relict Pleistocene terraces on uplands
Landscape position: Ridges adjacent to major streams
Slope: Very gently sloping or gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 5 inches—Brown, strongly acid fine sandy loam

Subsurface layer:
5 to 9 inches—Very pale brown, strongly acid fine sandy loam

Subsoil:
9 to 18 inches—Red, very strongly acid clay that has common light brownish gray mottles
18 to 31 inches—Light gray, strongly acid clay that has common red mottles
31 to 44 inches—Grayish brown, slightly acid clay that has few light reddish brown mottles
44 to 80 inches—Yellow to brownish yellow, slightly acid to slightly alkaline clay that has few light brownish gray and brownish yellow mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Axtell soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Slowly permeable Chazos soils in slightly higher convex areas.
- Well drained, moderately permeable Silawa soils in slightly higher convex areas.
- Mabank soils in slightly lower positions on terraces.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development.

Minor limitations:

- Moderate available water capacity restricts growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity restricts native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- Severe hazard of erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits crop root development.

Minor limitations:

- Moderate available water capacity restricts plant growth during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Savannah
Pasture management group: 8

BaA—Belk clay, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Adjacent to channels and swales within flood plain of Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Oval to elongated
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 6 inches—Brown, moderately alkaline clay

Subsoil:
6 to 16 inches—Brown, moderately alkaline clay
16 to 22 inches—Reddish brown, moderately alkaline silty clay

Underlying material:
22 to 77 inches—Brown and dark brown, moderately alkaline very fine sandy loam and silt loam
77 to 80 inches—Light brown, moderately alkaline loamy very fine sand

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting less than 2 days
Runoff: Low
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Belk soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Moderately permeable Asa soils on flood plains in positions similar to this Belk soil.
- Slowly permeable Highbank soils on flood plains in similar positions.
- Moderately permeable Weswood soils on flood plains in slightly higher positions.
- Moderately rapidly permeable Yahola soils on flood plains in slightly higher positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development.

Minor limitations:

- The clayey surface layer is difficult to till when soil is too wet or too dry.
- Extended wetness delays field operations.

Pasture

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- The clayey surface layer requires adequate seedbed preparation to establish improved grasses.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibit development of native plants.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes soil unsuitable for dwellings and poorly suited for most other urban uses.
- Low soil strength and potential for shrinking and swelling limit use for construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2s
Ecological site: Clayey Bottomland
Pasture management group: 7

BeB—Benchley loam, 1 to 3 percent slopes

Setting

Landform: Uplands
Landscape position: On toeslopes along small drainageways or in concave areas at heads of drainageways
Slope: Very gently sloping with concave surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 10 inches—Very dark grayish brown, moderately acid loam

Subsoil:
10 to 16 inches—Very dark grayish brown, moderately acid clay loam that has common yellowish red mottles
16 to 21 inches—Light yellowish brown, moderately acid clay that has common dark red mottles
21 to 49 inches—Pale olive, slightly acid clay that has common yellowish red mottles
49 to 62 inches—Yellow, slightly alkaline clay interbedded with gray shale

Underlying material:
62 to 80 inches—Stratified, neutral gray shale and brownish yellow sandstone

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Moderate

Composition

Benchley soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Well drained, very slowly permeable Luling soils in slightly higher convex areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland (fig. 7)

Management Concerns

Rangeland

Major limitations:
- None

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits development of native plants.

Pasture

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when seedbed is prepared for improved grasses.
- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when soil is cultivated.
- Slow permeability restricts water movement through the soil and inhibits root development.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Clay Loam
Pasture management group: 1

Figure 7.—Oats ready for harvest in an area of Benchley loam, 1 to 3 percent slopes.

BeC—Benchley loam, 3 to 5 percent slopes

Setting

Landform: Uplands
Landscape position: Side slopes along small drainageways or concave areas at heads of drainageways
Slope: Gently sloping with concave surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 12 inches—Very dark gray, moderately acid loam

Subsoil:
12 to 18 inches—Very dark gray, moderately acid clay that has common reddish brown mottles
18 to 33 inches—Light olive brown, moderately acid clay that has common red mottles
33 to 64 inches—Light olive brown, slightly acid clay that has few strong brown mottles

Underlying material:
64 to 80 inches—Yellowish brown, neutral stratified shale and sandstone

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Benchley soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Well drained, very slowly permeable Luling soils on side slopes in positions similar to this Benchley soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- None

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of native plants.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Cropland

Major limitations:

- Severe hazard of water erosion when soil is cultivated.

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of crops.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Clay Loam
Pasture management group: 1

BoB—Boonville fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Uplands
Landscape position: Footslopes adjacent to small drainageways
Slope: Very gently sloping with concave surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 17 inches—Strongly acid fine sandy loam, light gray in upper part and grayish brown loam in lower part

Subsoil:
17 to 26 inches—Dark gray, moderately acid clay that has common yellowish brown and few medium red mottles
26 to 39 inches—Grayish brown, neutral clay loam
39 to 54 inches—Light brownish gray, neutral clay loam that has common brownish yellow and very pale brown mottles
54 to 67 inches—Light gray, slightly alkaline loam that has common brownish yellow mottles

Underlying material:
67 to 80 inches—Pale olive, neutral shale

Soil Properties

Depth: Very deep
Drainage class: Somewhat poorly drained
Water table: A seasonal high water table is at a depth of 0.5 to 1.0 foot, mainly from December through February
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Boonville soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained Zack soils in adjacent, higher convex areas.
- Moderately well drained Zulch soils on concave slopes in positions similar to this Boonville soil and on adjacent convex slopes.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:

- Severe hazard of erosion during seedbed preparations for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity restricts growth of improved grasses during periods of drought.
- Moderate natural fertility limits yield potential of improved grasses.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity restricts native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- Severe hazard of water erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength and wetness limit use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Prairie
Pasture management group: 9

BuA—Burleson clay, 0 to 1 percent slopes

Setting

Landform: Stream terrace
Distinctive landscape features: Gilgai microrelief in native areas
Landscape position: Broad, smooth areas adjacent to Brazos River flood plain
Slope: Nearly level with plane surfaces
Shape of areas: Oblong
Size of areas: 100 to 500 acres

Typical Profile

Surface layer:
0 to 12 inches—Very dark gray, slightly alkaline clay

Subsoil:
12 to 39 inches—Dark gray, moderately alkaline clay
39 to 76 inches—Gray, moderately alkaline clay that has few streaks and spots of pink and reddish brown in lower part

Underlying material:
76 to 80 inches—Yellowish red, moderately alkaline silty clay

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Low
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Slight

Composition

Burleson soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Slowly permeable, sandy Chazos soils in slightly higher convex areas.
- Loamy Tabor soils in slightly higher convex areas.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:
- The clayey surface layer is difficult to till when soil is too wet or too dry.
- Extended wetness delays field operations.

Pasture

Major limitations:
- The clayey surface layer requires well prepared seedbed to establish improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:
- None

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- None

Urban development

Major limitations:
- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 2w
Ecological site: Blackland
Pasture management group: 6

BuB—Burleson clay, 1 to 3 percent slopes

Setting

Landform: Stream terrace
Distinctive landscape features: Gilgai microrelief in native areas
Landscape position: Side slopes adjacent to small drainageways
Slope: Very gently sloping with convex surfaces
Shape of areas: Elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—Very dark gray, moderately alkaline clay

Subsoil:
8 to 45 inches—Black, moderately alkaline clay
45 to 60 inches—Very dark gray, moderately alkaline clay that has few reddish yellow mottles

Underlying material:
60 to 80 inches—Yellowish red, moderately alkaline clay

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Moderate

Composition

Burleson soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Slowly permeable, sandy Chazos soils in slightly higher convex areas.
- Well drained, moderately permeable, sandy Silawa soils in slightly higher convex areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- The clayey surface layer requires well prepared seedbed to establish improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate hazard of erosion when seedbed is prepared for improved grasses.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- None

Cropland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:

- Moderate hazard of water erosion when soil is cultivated.
- The clayey surface layer is difficult to till when soil is too wet or too dry.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Blackland
Pasture management group: 6

BuC—Burleson clay, 3 to 5 percent slopes

Setting

Landform: Stream terrace
Distinctive landscape features: Gilgai microrelief in native areas
Landscape position: Side slopes adjacent to flood plains
Slope: Gently sloping with convex surfaces
Shape of areas: Elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 10 inches—Very dark gray, slightly alkaline clay

Subsoil:
10 to 27 inches—Very dark gray, slightly alkaline clay
27 to 54 inches—Dark gray, moderately alkaline clay
54 to 62 inches—Dark gray, moderately alkaline clay that has common pinkish gray mottles

Underlying material:
62 to 80 inches—Yellowish red, moderately alkaline clay

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Severe

Composition

Burleson soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Slowly permeable, sandy Chazos soils on slightly higher convex slopes.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.
- The clayey surface layer requires good seedbed preparation to establish improved grasses.

- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:
- None

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- None

Cropland

Major limitations:
- Severe hazard of water erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development.

Minor limitations:
- The clayey surface layer is difficult to till when soil is too wet or too dry.

Urban development

Major limitations:
- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Blackland
Pasture management group: 6

BwC—Burlewash fine sandy loam, 2 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Convex ridges and side slopes
Slope: Very gently sloping or gently sloping, convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 8 inches—Brown, strongly acid fine sandy loam

Subsoil:
8 to 18 inches—Reddish brown, very strongly acid clay
18 to 28 inches—Red, very strongly acid clay that has common red mottles
28 to 34 inches—Light brown, very strongly acid clay interbedded with gray mudstone

Underlying material:
34 to 45 inches—Stratified very pale brown, weakly cemented sandstone and gray mudstone

Soil Properties

Depth: Moderately deep to sandstone
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Burlewash soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained Rehburg soil in slightly higher convex areas.
- Slowly permeable Shiro soil in positions similar to the Burlewash soil and in slightly higher convex areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native plants.

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Limited soil depth can restrict root development of some native plants.

Pasture

Major limitations:

- Low available water capacity restricts growth of improved grasses during periods of drought.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Limited soil depth can restrict root development of some improved grasses.

Cropland

Major limitations:

- Severe hazard of water erosion when soil is cultivated.
- Low available water capacity limits crop growth during periods of drought.

Minor limitations:

- Limited soil depth can limit root development of some crops.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Depth to bedrock and very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 4e
Ecological site: Claypan Savannah
Pasture management group: 16

BwE2—Burlewash fine sandy loam, 5 to 15 percent slopes, eroded

Setting

Landform: Uplands
Distinctive landscape features: Eroded surface with subsoil exposed in places; some areas have few rills and shallow gullies.
Landscape position: Convex ridges and side slopes above drainageways
Slope: Moderately sloping to moderately steep; convex surfaces have dominant slopes of 8 to 12 percent
Shape of areas: Oval to oblong
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 3 inches—Brown, strongly acid fine sandy loam

Subsoil:
3 to 20 inches—Dark red clay, very strongly acid in upper part and extremely acid in lower part

Underlying material:
20 to 30 inches—Stratified very pale brown, weakly cemented sandstone and light reddish brown, tuffaceous clay

Soil Properties

Depth: Moderately deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Very high
Permeability: Very slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Burlewash soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Moderately well drained Singleton soils that are lower on the landscape.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Thin surface layer and extreme acidity of the subsoil severely restricts native plant growth.

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Low available water capacity limits native plant growth during periods of drought.
- Very low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderately deep root zone inhibits root development of some native plants.

Pasture

Major limitations:

- Thin surface layer and extreme acidity of the subsoil severely restricts plant growth of improved grasses, making this soil unsuitable for use as pasture.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.

Minor limitations:

- Moderate rooting depth inhibits root development of some improved grasses.

Cropland

Major limitations:

- Steepness of slope and severe hazard of water erosion makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in the construction of local roads and streets.
- Slope limits use in the construction of small commercial buildings.
- Depth to bedrock and very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:

- Absence of top soil and extreme acidity of the subsoil make establishment and maintenance of lawn grasses and landscape plants difficult.

Interpretive Groups

Land capability classification: 6e
Ecological site: Claypan Savannah
Pasture management group: 17

BxG—Burlewash-Koether soils, 8 to 50 percent slopes

Setting

Landform: Uplands
Distinctive landscape features: Stone and boulder outcrops on upper side slopes of the Koether soil.
Landscape position: Burlewash soils occur on lower convex side slope; Koether soils occur on narrow ridges and middle to upper side slopes
Slope: Strongly sloping to very steep convex surfaces with dominant slopes of 20 to 45 percent; Burlewash soils have slopes of mainly 8 to 20 percent; Koether soils have slopes of mainly 20 to 45 percent.
Shape of areas: Rounded to elongated
Size of areas: 20 to 100 acres

Typical Profile

Burlewash
Surface layer:
0 to 8 inches—Yellowish brown, moderately acid fine sandy loam

Subsoil:
8 to 29 inches—Brown, very strongly acid clay

Underlying material:
29 to 40 inches—Light yellowish brown, weakly cemented sandstone

Koether
Surface layer:
0 to 18 inches—Pale brown, strongly acid very stony loamy fine sand

Underlying material:
18 to 20 inches—Strongly cemented sandstone

Soil Properties

Depth: Burlewash—moderately deep; Koether—shallow
Drainage class: Burlewash—well drained; Koether—somewhat excessively drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Very high
Permeability: Burlewash—very slowly permeable; Koether—rapidly permeable
Available water capacity: Burlewash—low; Koether—very low
Root zone: Burlewash—moderately deep; Koether—shallow
Natural soil fertility: Low
Shrink-swell potential: Burlewash—high; Koether—low
Hazard of water erosion: Severe

Composition

Burlewash soil and similar inclusions: 35 percent
Koether soil and similar inclusions: 30 percent
Contrasting inclusions: 35 percent

Contrasting Inclusions

- Moderately well drained Rehburg soils on lower side slopes.

Land Uses

Major land use: Rangeland
Other land uses: None

Management Concerns

Rangeland

Major limitations:

- Low natural fertility limits yield potential of native plants.
- Low and very low available water capacity limits native plant growth during periods of drought.
- Large stones on the surface of the Koether soil and slope limit use of native forage plants by livestock.
- Shallow and moderately deep root zone can inhibit root development of native plants.

Minor limitations:

- None

Pasture

Major limitations:

- Large stones on the surface of the Koether soil and slope make these soils unsuitable for pasture.

Minor limitations:

- None

Cropland

Major limitations:

- Severe hazard of water erosion, large stones on the surface of the Koether soil and slope make these soils unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Depth to bedrock, very slow permeability in the Burlewash soil, rapid permeability in the Koether soil, and slope can interfere with proper functioning of septic tank absorption fields.
- Low soil strength in the Burlewash soil and slope limits use in the construction of local roads and streets.
- Slope can limit use in construction of residential and small commercial buildings.
- High potential for shrinking and swelling in the Burlewash soil can cause structural damage to residential and small commercial buildings.
- High risk for corrosion of uncoated steel and concrete in the Burlewash soil, and high risk for corrosion of concrete in the Koether soil.

Minor limitations:

- None

Interpretive Groups

Land capability classification: Burlewash soil—6e; Koether soil—7s
Ecological site: Burlewash—Claypan Savannah; Koether—Claypan Savannah
Pasture management group: 17

CaA—Cadelake fine sandy loam, 0 to 2 percent slopes

Setting

Landform: Upland
Landscape position: Depressions on toeslopes and in poorly defined drainageways
Slope: Nearly level with concave surfaces
Shape of areas: Long and narrow
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 4 inches—Very dark grayish brown, extremely acid fine sandy loam

Subsurface layer:
4 to 15 inches—Black, extremely acid loamy fine sand

Subsoil:
15 to 20 inches—Gray, extremely acid fine sand
20 to 33 inches—Light gray, very strongly acid fine sand that has common brownish yellow mottles
33 to 80 inches—White, strongly acid fine sand that has many pale yellow mottles

Soil Properties

Depth: Very deep
Drainage class: Poorly drained
Water table: At a depth of 0 to 1.5 feet throughout the year
Flooding: None
Runoff: Negligible
Permeability: Rapid
Available water capacity: Low
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Cadelake soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Somewhat excessively drained Arenosa soils in higher convex areas.
- Moderately well drained, moderately permeable Padina soil in higher convex areas.
- Moderately well drained, slowly permeable Robco soils on adjacent footslopes.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Long periods of wetness make this soil poorly suited to rangeland.

Minor limitations:
- None

Pasture

Major limitations:
- Long periods of wetness make this soil unsuitable for pasture.

Minor limitations:
- None

Cropland

Major limitations:
- Long periods of wetness make this soil unsuitable for growing crops.

Minor limitations:
- None

Urban development

Major limitations:
- Long periods of wetness make this soil unsuitable for most urban uses.
- Wetness limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 6w
Ecological site: Wet Sandy Draw
Pasture management group: 17

ChB—Chazos loamy fine sand, 1 to 3 percent slopes

Setting

Landform: Stream terrace
Landscape position: Ridges adjacent to major streams
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 9 inches—Yellowish brown, moderately acid loamy fine sand

Subsurface layer:
9 to 15 inches—Light yellowish brown, moderately acid loamy fine sand

Subsoil:
15 to 38 inches—Upper part is light yellowish brown, moderately acid clay that has common red and grayish brown mottles; lower part is light brownish gray clay that has many red and brownish yellow mottles
38 to 54 inches—Light gray, moderately acid sandy clay that has yellowish red mottles
54 to 65 inches—Very pale brown, slightly acid sandy clay loam that has common reddish yellow mottles
65 to 80 inches—Light gray, neutral fine sandy loam that has common reddish yellow mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Medium
Hazard of water erosion: Slight

Composition

Chazos soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Somewhat excessively drained, rapidly permeable Eufaula soils in slightly higher convex areas.
- Very slowly permeable Mabank soils on slightly lower terraces.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of crops.
- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:
- Slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:
- Shrink and swell potential of the subsoil limits use in the construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 2e
Ecological site: Sandy Loam
Pasture management group: 2

ChD—Chazos loamy fine sand, 5 to 8 percent slopes

Setting

Landform: Stream terrace
Landscape position: Side slopes adjacent to drainageways
Slope: Moderately sloping with convex surfaces
Shape of areas: Elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—Brown, slightly acid loamy fine sand

Subsurface layer:
9 to 12 inches—Yellowish brown, slightly acid loamy fine sand

Subsoil:
12 to 25 inches—Yellowish red, moderately acid sandy clay that has common light brownish gray and red mottles
25 to 45 inches—Light gray, moderately acid sandy clay loam that has common red and strong brown mottles
45 to 80 inches—Very pale brown, slightly alkaline sandy clay loam that has common brownish yellow mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Medium
Hazard of water erosion: Severe

Composition

Chazos soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Somewhat excessively drained, rapidly permeable Eufaula soils on lower side slopes.

Land Uses

Major land use: Pasture
Other land uses: Rangeland

Management Concerns

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Moderate available water capacity limits yield potential of improved grasses during periods of drought.

Rangeland

Major limitations:

- None

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native plants.

Cropland

Major limitations:

- Severe hazard of erosion when soil is cultivated.

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of crops.
- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:

- Slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Potential for subsoil to shrink and swell limit use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 4e
Ecological site: Sandy Loam
Pasture management group: 2

CoA—Coarsewood silt loam, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Broad smooth areas within flood plain of the Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Oblong to irregular
Size of areas: 100 to 500 acres

Typical Profile

Surface layer:
0 to 11 inches—Reddish brown, moderately alkaline silt loam

Subsoil:
11 to 30 inches—Pink, moderately alkaline very fine sandy loam
30 to 43 inches—Reddish yellow, moderately alkaline very fine sandy loam

Underlying material:
43 to 70 inches—Yellowish red, moderately alkaline silt loam that has thin layers of reddish brown silty clay loam
70 to 80 inches—Reddish brown, moderately alkaline very fine sandy loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting less than 2 days
Runoff: Negligible
Permeability: Moderately rapid
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Coarsewood soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Belk soils on flood plains in slightly lower positions.
- Moderately well drained, very slowly permeable Ships soils on flood plains in slightly lower positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:

- None

Minor limitations:

- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.
- Moderate available water capacity limits plant growth during periods of drought.
- Moderately rapid permeability can require extra applications of water for irrigated crops (fig. 8).

Pasture

Major limitations:

- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most dwellings and other urban uses.

Minor limitations:

- Low soil strength limits use in construction of local roads and streets.

Interpretive Groups

Land capability classification: 1
Ecological site: Loamy Bottomland
Pasture management group: 4

Figure 8.—Furrow irrigation of cotton in an area of Coarsewood silt loam, 0 to 1 percent slopes, rarely flooded.

CrB—Crockett loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Broad smooth convex ridges
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—Pale brown, moderately acid loam

Subsoil:
6 to 13 inches—Dark brown, moderately acid clay that has common reddish brown and few red and yellowish brown mottles
13 to 23 inches—Dark grayish brown, slightly acid clay that has common yellowish brown mottles
23 to 37 inches—Light olive brown, neutral clay that has few brown mottles
37 to 48 inches—Light brownish gray, moderately alkaline clay that has common yellowish brown mottles

Underlying material:
48 to 60 inches—Light olive gray, moderately alkaline shale

Soil Properties

Depth: Deep to shale
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Crockett soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained Luling soil in slightly higher convex areas.
- Wilson soils in similar positions or slightly lower on the landscape than this Crockett soil.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- Severe water hazard of erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits growth of crops during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with the proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Prairie
Pasture management group: 8

DAM—Dams

A barrier built across a waterway to control the flow or raise the level of water.

DwA—Davilla-Wilson complex, 0 to 2 percent slopes

Setting

Landform: Relict Pleistocene terraces on uplands
Distinctive landscape features: A microrelief of low ridges and mounds in undisturbed areas. The Davilla soil is on ridges and mounds about 5 to 12 inches higher than the Wilson soil in low areas. The ridges average 15 to 30 feet across and extend 50 to 100 feet in length. The mounds are oval in shape and average 15 to 30 feet across. Where cropped, ridges and mounds are not discernable and the Wilson soils appear as dark areas on the landscape.
Landscape position: Broad areas between drainageways
Slope: Nearly level with plane and slightly convex surfaces
Shape of areas: Irregular
Size of areas: 50 to 300 acres

Typical Profile

Davilla
Surface layer:
0 to 8 inches—Dark grayish brown, slightly acid loam

Subsoil:
8 to 19 inches—Brown, slightly acid sandy clay loam that has common strong brown mottles
19 to 50 inches—Reddish yellow, slightly acid clay that has common red mottles and few light brownish gray mottles
50 to 80 inches—Brownish yellow, slightly acid clay that has common yellowish red mottles and few brownish gray mottles

Wilson
Surface layer:
0 to 8 inches—Very dark gray, slightly acid loam

Subsoil:
8 to 38 inches—Black, slightly acid clay
38 to 49 inches—Black, slightly acid clay that has common olive brown mottles
49 to 80 inches—Yellowish brown, slightly alkaline clay that has few strong brown mottles

Soil Properties

Depth: Davilla—very deep; Wilson—very deep
Drainage class: Moderately well drained.
Water table: Davilla—none within a depth of 6 feet; Wilson—none within a depth of 6 feet; however, surface layer and upper part of subsoil are seasonally wet during winter and spring for a period of 10 to 30 days
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Davilla—high, Wilson—moderate
Root zone: Very deep
Natural soil fertility: Davilla—high; Wilson—moderate
Shrink-swell potential: Davilla—medium; Wilson—high
Hazard of water erosion: Moderate

*Composition**

*Individual areas of these soils are so small and intricately mixed that mapping them separately was not practical.

Davilla soil and similar inclusions: 55 percent.
Wilson soil and similar inclusions: 40 percent.
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Well drained Luling soil in slightly higher, adjoining upland areas.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:
- Moderate hazard of erosion when soil is cultivated.

Pasture

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Moderate hazard of erosion when seedbed is prepared for improved grasses.

Minor limitations:
- None

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- None

Urban development

Major limitations:
- High potential for shrinking and swelling can cause structural damage to residential and small commercial building.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Prairie
Pasture management group: Davilla—1; Wilson—9

EuB—Eufaula loamy fine sand, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Broad, smooth areas
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—Brown, slightly acid loamy fine sand

Subsurface layer:
6 to 40 inches—Light yellowish brown, neutral fine sand

Subsoil:
40 to 80 inches—Very pale brown, slightly acid fine sand that has thin layers of strong brown fine sandy loam

Soil Properties

Depth: Very deep
Drainage class: Somewhat excessively drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Negligible
Permeability: Rapid
Available water capacity: Low
Natural soil fertility: Very low
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Eufaula soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, slowly permeable Chazos soils on slightly lower convex slopes.
- Moderately well drained, very slowly permeable Mabank and Rader soils in lower concave areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- Low available water capacity limits plant growth of improved grasses during periods of drought.
- Because of seepage, construction of livestock ponds is not recommended.
- Rapid permeability of the sandy soil promotes a high rate of leaching that requires a more costly fertilization program.

Minor limitations:

- None

Rangeland

Major limitations:

- Low available water capacity limits native plant growth during periods of drought.
- Very low natural fertility limits production of native forage.
- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- None

Cropland

Major limitations:

- Soil is poorly suited to commonly grown crops because of low available water capacity and rapid permeability; however, it is suited to watermelons and peanuts.

Minor limitations:

- The soil is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:

- Rapid permeability can cause effluents to seep into ground water when the soil is used for septic tank absorption fields.
- Sandy texture makes excavation sidewalls unstable.
- Low available water capacity makes establishment and maintenance of lawn grasses and landscape plants more difficult.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 4s
Ecological site: Deep Sand
Pasture management group: 15

Ga—Gaddy loamy fine sand, frequently flooded

Setting

Landform: Flood plain
Landscape position: Sandbars adjacent to Brazos River
Slope: Nearly level with slightly convex surfaces
Shape of areas: Oblong
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 11 inches—Brown, moderately alkaline loamy fine sand

Underlying material:
11 to 25 inches—Light brown, moderately alkaline loamy fine sand that has thin layers of brown loamy fine sand and fine sandy loam
25 to 80 inches—Light brown, moderately alkaline fine sand that has thin layers of brown loamy fine sand and fine sandy loam

Soil Properties

Depth: Very deep
Drainage class: Somewhat excessively drained
Water table: None within a depth of 6 feet
Flooding: Occurs more than 50 times in 100 years, usually lasting 2 to 7 days
Runoff: Negligible
Permeability: Moderately rapid
Available water capacity: Low
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Gaddy soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Somewhat poorly drained, very slowly permeable Roetex soils in narrow swales and depressional areas.
- Well drained Yahola soils on flood plains in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native plants.
- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- None

Pasture

Major limitations:

- Low available water capacity limits growth of improved grasses during periods of drought.
- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- Hazard of flooding can limit the use of equipment.

Cropland

Major limitations:

- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Sandy Bottomland
Pasture management group: 10

GbC—Gasil fine sandy loam, 2 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Broad ridges and side slopes
Slope: Very gently sloping or gently sloping with convex surfaces
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 13 inches—Brown, moderately acid fine sandy loam

Subsurface layer:
13 to 18 inches—Light yellowish brown, moderately acid fine sandy loam

Subsoil:
18 to 51 inches—Brownish yellow and yellow, strongly acid sandy clay loam
51 to 74 inches—Yellow, strongly acid sandy clay loam that has common red and few light brownish gray mottles
74 to 80 inches—Reddish yellow, strongly acid fine sandy loam that has common brown mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Low
Permeability: Moderate
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Medium
Hazard of water erosion: Moderate

Composition

Gasil soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Slowly permeable Jedd soils on side slopes in higher convex areas.
- Moderately well drained, very slowly permeable Rader soils in slightly lower concave areas.
- Moderately well drained, slowly permeable Robco soils in slightly lower concave areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion when seedbed is prepared for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- None

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when soil is cultivated.
- Moderate available water capacity limits crop growth during periods of drought.

Urban development

Major limitations:

- None

Minor limitations:

- Shrink and swell potential of the subsoil limits use in the construction of residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 5

Gd—Gladewater clay, frequently flooded

Setting

Landform: Flood plain
Landscape position: Slightly lower concave areas within major drainageways
Slope: Nearly level with concave and plane surfaces
Shape of areas: Oblong to elongated
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 9 inches—Dark gray, moderately acid clay

Subsoil:
9 to 25 inches—Gray, moderately acid clay that has common strong brown mottles
25 to 80 inches—Grayish brown, very strongly acid to moderately acid clay that has few dark yellowish brown and grayish brown mottles

Soil Properties

Depth: Very deep
Drainage class: Somewhat poorly drained
Water table: A seasonal high water table is at a depth of 1.5 to 3.5 feet, mainly from November through May
Flooding: Occurs more than 50 times in 100 years, usually lasting 7 to 30 days
Runoff: Negligible
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Slight

Composition

Gladewater soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, moderately slowly permeable Sandow and Uhland soils on flood plains in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- Flooding can disrupt livestock grazing for long periods.

Pasture

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Wetness limits the use of mechanical equipment when the water table is high or when flooding occurs.

Minor limitations:

- Flooding can disrupt livestock grazing for long periods.

Cropland

Major limitations:

- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength, potential for shrinking and swelling, and wetness limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Clayey Bottomland
Pasture management group: 17

GrB—Gredge fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Relict Pleistocene terraces on uplands
Landscape position: Ridgetops and upper side slopes
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 6 inches—Very pale brown, slightly acid fine sandy loam

Subsoil:
6 to 16 inches—Yellowish red, strongly acid clay that has common grayish brown mottles
16 to 31 inches—Light brownish gray, moderately acid clay loam that has few reddish yellow mottles
31 to 41 inches—Reddish yellow, moderately acid sandy clay loam that has few light brownish gray mottles
41 to 54 inches—Light gray, slightly alkaline sandy clay loam that has few brownish yellow and dark yellowish brown mottles
54 to 80 inches—Very pale brown, slightly alkaline fine sandy loam that has common yellow mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Gredge soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained Zulch soils on lower side slopes.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.

- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- Severe hazard of water erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits plant growth of crops during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3s
Ecological site: Claypan Savannah
Pasture management group: 8

HbA—Highbank silt loam, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Adjacent to natural levees on drainageways within flood plain of the Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Elongated to irregular
Size of areas: 20 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—Reddish yellow, moderately alkaline silt loam

Subsurface layer:
6 to 17 inches—Light brown, moderately alkaline silty clay loam

Subsoil:
17 to 32 inches—Light brown, moderately alkaline clay
32 to 60 inches—Reddish brown, moderately alkaline clay that has common dark red mottles

Underlying material:
60 to 80 inches—Thin layers of reddish yellow and strong brown, moderately alkaline very fine sandy loam, silt loam, and silty clay loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting less than 2 days
Runoff: Low
Permeability: Slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Highbank soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Belk soils on flood plains in positions similar to this Highbank soil.
- Moderately well drained, very slowly permeable Ships soils on flood plains in similar positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of crops.
- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.

Pasture

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Rangeland

Major limitations:
- None

Minor limitations:
- Slow permeability restricts water movement through the soil and inhibits root development of native plants.

Urban development

Major limitations:
- Hazard of flooding makes this soil unsuitable for most dwellings and other urban uses.
- Shrinking and swelling and low soil strength limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 2s
Ecological site: Loamy Bottomland
Pasture management group: 1

JeD—Jedd fine sandy loam, 5 to 8 percent slopes

Setting

Landform: Upland
Landscape position: Ridges and upper side slopes
Slope: Moderately sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—Brown, slightly acid fine sandy loam

Subsoil:
4 to 12 inches—Red, very strongly acid clay
12 to 20 inches—Reddish yellow, very strongly acid clay that has common red mottles
20 to 29 inches—Red, strongly acid clay stratified with brownish yellow weakly cemented sandstone and gray shale

Underlying material:
29 to 40 inches—Brownish yellow, weakly cemented sandstone stratified with gray shale and very pale brown fine sandy loam

Soil Properties

Depth: Moderately deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Moderately slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: Medium
Hazard of water erosion: Severe

Composition

Jedd soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Moderately permeable Gasil soils on lower side slopes.
- Moderately permeable Padina soils in convex areas in higher positions.
- Moderately permeable Silstid soils on side slopes in positions similar to this Jedd soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:

- Low natural fertility limits yield potential of native plants.
- Low available water capacity limits native plant growth during periods of drought.

Minor limitations:

- Depth to bedrock can restrict root development of some native plants.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.

Minor limitations:

- Depth to bedrock can restrict root development of some improved grasses.

Cropland

Major limitations:

- Severe hazard of water erosion makes this soil unsuitable for cultivation.

Minor limitations:

- None

Urban development

Major limitations:

- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Shrink and swell potential of the subsoil limits use in construction of residential and small commercial buildings.
- Moderately slow permeability and depth to bedrock can interfere with proper functioning of septic tank absorption fields.

Interpretive Groups

Land capability classification: 6e
Ecological site: Sandy Loam
Pasture management group: 16

JeE—Jedd fine sandy loam, 8 to 15 percent slopes

Setting

Landform: Upland
Landscape position: Side slopes above drainageways
Slope: Strongly sloping to moderately steep with dominant slopes of 8 to 12 percent
Shape of areas: Oblong to elongated
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—Light yellowish brown, slightly acid fine sandy loam

Subsoil:
4 to 22 inches—Yellowish red, very strongly acid clay

Underlying material:
22 to 30 inches—Yellowish red, weakly cemented sandstone stratified with gray shale

Soil Properties

Depth: Moderately deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Moderately slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: Medium
Hazard of water erosion: Severe

Composition

Jedd soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately permeable Silstid soils on lower side slopes.
- Moderately permeable Padina soils on side slopes in positions similar to this Jedd soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Low natural fertility limits yield potential of native plants.
- Low available water capacity limits native plant growth during periods of drought.

Minor limitations:

- Depth to bedrock can restrict root development of some native plants.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.

Minor limitations:

- Depth to bedrock can restrict root development of improved grasses.

Cropland

Major limitations:

- Severe hazard of water erosion makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Slope and depth to bedrock can interfere with proper functioning of septic tank absorption fields.
- Slope and low soil strength limit use in construction of local roads and streets.
- Slope limits use in construction of residential and small commercial buildings.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Potential for shrink and swell of the subsoil limit use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 6e
Ecological site: Sandy Loam
Pasture management group: 17

JsF—Jedd fine sandy loam, 12 to 20 percent slopes, very stony

Setting

Landform: Upland
Distinctive landscape features: Fragments of sandstone and ironstone from about 10 inches to 48 inches in diameter cover 5 to 10 percent of the surface
Landscape position: Side slopes above drainageways
Slope: Moderately steep with convex surfaces
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 4 inches—Dark brown, moderately acid fine sandy loam

Subsoil:
4 to 18 inches—Red, very strongly acid clay that has brownish yellow mottles
18 to 23 inches—Reddish yellow, very strongly acid sandy clay loam and yellowish red weakly cemented sandstone

Underlying material:
23 to 30 inches—Yellowish red, weakly cemented sandstone

Soil Properties

Depth: Moderately deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Moderately slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: Medium
Hazard of water erosion: Severe

Composition

Jedd soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately permeable Padina soils in convex areas in higher positions.

Land Uses

Major land use: Rangeland
Other land uses: None

Management Concerns

Rangeland

Major limitations:

- Large stones on the surface restrict growth of native plants.
- Low natural fertility limits yield potential of native plants.
- Low available water capacity limits native plant growth during periods of drought.

Minor limitations:

- Depth to bedrock can restrict root development of some native plants.

Pasture

Major limitations:

- Slope and large stones on the surface make this soil unsuitable for pasture.

Minor limitations:

- None

Cropland

Major limitations:

- Large stones on the surface, slope, and a severe hazard of water erosion make this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Slope and depth to bedrock can interfere with proper functioning of septic tank absorption fields.
- Slope and low soil strength limit use in construction of local roads and streets.
- Slope limits use in the construction of residential and small commercial buildings.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Shrink and swell potential of the subsoil limits use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 7e
Ecological site: Sandstone Hills
Pasture management group: 17

Ka—Kaufman clay, frequently flooded

Setting

Landform: Flood plain
Distinctive landscape features: Gilgai microrelief in undisturbed areas
Landscape position: Broad, smooth areas adjacent to major streams
Slope: Nearly level with plane surfaces
Shape of areas: Elongated
Size of areas: 500 to 1,000 acres

Typical Profile

Surface layer:
0 to 14 inches—Very dark gray, moderately acid clay

Subsoil:
14 to 42 inches—Very dark gray, slightly acid clay
42 to 80 inches—Gray, moderately acid clay

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 1.5 to 3.5 feet, mainly from November through April
Flooding: Occurs more than 50 times in 100 years, usually lasting less than 7 days
Runoff: Low
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Slight

Composition

Kaufman soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, moderately slowly permeable Sandow and Uhland soils on flood plains in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts water movement and root development of native plants.

Minor limitations:
- Flooding can disrupt livestock grazing for brief periods.

Pasture

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Wetness limits the use of mechanical equipment when the water table is high or when flooding occurs.

Cropland

Major limitations:

- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength, potential for shrinking and swelling, and the hazard of flooding limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Clayey Bottomland
Pasture management group: 13

KuC—Kurten fine sandy loam, 2 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Ridges and side slopes
Slope: Very gently sloping or gently sloping with convex surfaces
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 7 inches—Yellowish brown, strongly acid fine sandy loam

Subsoil:
7 to 37 inches—Red, very strongly acid clay that has common light brownish gray mottles in lower part
37 to 42 inches—Light gray, very strongly acid clay that has many dark yellowish brown mottles
42 to 53 inches—Light brownish gray, very strongly acid clay that has common yellowish red mottles

Underlying material:
53 to 60 inches—Grayish brown, very strongly acid shale that has common strong brown mottles

Soil Properties

Depth: Deep to shale
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: Moderate
Root zone: Deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Kurten soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Slowly permeable Spiller soils in convex areas on side slopes in positions similar to this Kurten soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Cropland

Major limitations:

- Severe hazard of water erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial building.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 4e
Ecological site: Claypan Savannah
Pasture management group: 12

KuD2—Kurten loam, 5 to 8 percent slopes, eroded

Setting

Landform: Upland
Distinctive landscape features: Subsoil exposed in spots and most areas have few rills and small gullies
Landscape position: Narrow convex ridges and side slopes
Slope: Moderately sloping with convex surfaces
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 3 inches—Dark grayish brown, strongly acid loam

Subsoil:
3 to 13 inches—Red, very strongly acid clay
13 to 22 inches—Red, very strongly acid clay that has common dark red and pale brown mottles
22 to 40 inches—Yellowish red, very strongly acid clay that has common strong brown and grayish brown mottles
40 to 48 inches—Grayish brown, very strongly acid clay that has many strong brown and yellowish red mottles

Underlying material:
48 to 60 inches—Stratified brown, very strongly acid shale and brown loam

Soil Properties

Depth: Deep to shale
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Very high
Permeability: Very slow
Available water capacity: Moderate
Root zone: Deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Kurten soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Slowly permeable Spiller soils in convex areas in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:

- Thin surface layer severely restricts native plant growth.
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Pasture

Major limitations:

- Thin surface layer severely restricts the establishment and production of improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Cropland

Major limitations:

- Slope and the severe hazard of water erosion make this soil unsuitable for cultivation.

Minor limitations:

- None

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial building.
- Low soil strength limits use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- Lawn and landscape plants are difficult to establish in eroded areas.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 6e
Ecological site: Claypan Savannah
Pasture management group: 12

LeB—Lexton sandy clay loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Narrow and broad smooth ridges
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—Dark reddish brown, moderately acid sandy clay loam

Subsoil:
6 to 23 inches—Dark reddish brown, slightly acid clay
23 to 36 inches—Dark red, slightly acid clay
36 to 50 inches—Mottled dark reddish brown and yellowish brown, slightly acid clay that has fragments of partly weathered glauconitic material

Underlying material:
50 to 80 inches—Stratified yellowish brown and dark reddish brown, clay loam and partly weathered glauconitic materials

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Very low
Permeability: Moderately slow
Available water capacity: High
Root zone: Deep
Natural soil fertility: High
Shrink-swell potential: Medium
Hazard of water erosion: Moderate

Composition

Lexton soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, slowly permeable Benchley soils in concave areas in slightly lower positions.
- Very slowly permeable Luling soils on convex ridges and side slopes in positions similar to the Lexton soil.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion when seedbed is prepared for improved grasses.
- Moderately slow permeability restricts water movement through the soil and inhibits root development of improved grasses.

Rangeland

Major limitations:

- None

Minor limitations:

- Moderately slow permeability restricts water movement through the soil and inhibits root development of native plants.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when soil is cultivated.
- Moderately slow permeability restricts water movement through the soil and inhibits root development of crops.

Urban development

Major limitations:

- Low soil strength limits use in the construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Moderately slow permeability can interfere with proper functioning of septic tank absorption fields.
- Shrink and swell potential of the subsoil limits use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 2e
Ecological site: Deep Redland
Pasture management group: 5

LuB—Luling clay, 1 to 3 percent slopes

Setting

Landform: Upland
Distinctive landscape features: Linear gilgai microrelief in undisturbed areas (fig. 9)
Landscape position: Broad smooth ridges
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to elongated
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 8 inches—Very dark grayish brown, neutral clay

Subsoil:
8 to 24 inches—Dark grayish brown, neutral clay
24 to 69 inches—Olive gray, moderately alkaline clay that has common olive mottles

Underlying material:
69 to 80 inches—White, moderately alkaline shale that has common brownish yellow mottles

Soil Properties

Depth: Very deep to shale
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Moderate

Composition

Luling soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained, slowly permeable Benchley soils in narrow drainageways.

Land Uses

Major land use: Rangeland
Other land uses: Cropland, pasture

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- None

Cropland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:
- Moderate hazard of erosion when soil is cultivated.
- The clayey surface layer is more difficult to till when too wet or too dry.

Pasture

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- The clayey surface layer requires a well prepared seedbed to establish improved grasses.

Minor limitations:
- Moderate hazard of erosion when seedbed is prepared for improved grasses.

Urban development

Major limitations:
- Very high potential for shrinking and swelling can cause structural damage to residential and small commercial building.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- The clayey texture of the soil makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Blackland
Pasture management group: 6

Figure 9.—An area of Luling clay, 1 to 3 percent slopes, showing gilgai microrelief with standing water in the microlows.

LuC—Luling clay, 3 to 5 percent slopes

Setting

Landform: Upland
Distinctive landscape features: Linear gilgai microrelief in undisturbed areas
Landscape position: Side slopes adjacent to drainageways
Slope: Gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 12 inches—Very dark grayish brown, slightly acid clay

Subsoil:
12 to 26 inches—Dark grayish brown, neutral clay
26 to 50 inches—Olive gray, slightly alkaline clay that has many light olive brown mottles
50 to 60 inches—Olive brown, moderately alkaline clay that has common dark olive gray mottles

Underlying material:
60 to 80 inches—Stratified yellow shale and brownish yellow, silty clay loam

Soil Properties

Depth: Very deep to shale
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Severe

Composition

Luling soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, slowly permeable Benchley soils in narrow drainageways.
- Moderately well drained Normangee soils on side slopes in positions similar to this Luling soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:
- None

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- The clayey surface layer requires a good seedbed preparation to establish improved grasses.

Minor limitations:
- None

Cropland

Major limitations:
- Severe hazard of water erosion when soil is cultivated.
- Very slow permeability restricts water movement through the soil and inhibits root development of crops.

Minor limitations:
- None

Urban development

Major limitations:
- Very high potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets (fig. 10).
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- The clayey soil texture makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Blackland
Pasture management group: 6

Figure 10.—Soil slippage along a roadside in an area of Luling clay, 3 to 5 percent slopes.

MaA—Mabank fine sandy loam, 0 to 1 percent slopes

Setting

Landform: Stream terrace and relict Pleistocene terrace on uplands
Landscape position: Broad, smooth areas between drainageways
Slope: Nearly level with plane surfaces
Shape of areas: Oblong to elongated
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—Grayish brown, moderately acid fine sandy loam

Subsoil:
6 to 25 inches—Very dark gray, moderately acid clay
25 to 45 inches—Dark gray, slightly acid clay that has common very dark grayish brown mottles
45 to 60 inches—Light gray, neutral clay
60 to 80 inches—Light gray, neutral clay loam

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet; surface layer and upper part of subsoil are seasonally wet and saturated during winter and spring for a period of 10 to 30 days
Flooding: None
Runoff: Low
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Mabank soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Axtell and Chazos soils on slightly higher convex slopes.
- Rader and Robco soils in positions similar to this Mabank soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Cropland

Major limitations:

- Seasonal wetness can hamper seed germination and can interfere with tillage operations.
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits growth of crops during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3w
Ecological site: Claypan Prairie
Pasture management group: 9

NoC—Normangee clay loam, 3 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Upper and lower side slopes
Slope: Gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 20 to 50 acres

Typical Profile

Surface layer:
0 to 5 inches—Brown, moderately acid clay loam

Subsoil:
5 to 22 inches—Yellowish brown, moderately acid clay that has few brown mottles
22 to 48 inches—Olive yellow, neutral clay

Underlying material:
48 to 60 inches—Stratified light gray shale and thin layers of weakly cemented sandstone

Soil Properties

Depth: Deep to shale
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: High
Permeability: Very slow
Available water capacity: High
Root zone: Deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Normangee soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Slowly permeable Benchley soils in narrow drainageways.
- Well drained Luling soils on side slopes in positions similar to this Normangee soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- None

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- None

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- None

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength and high potential for shrinking and swelling limit use in construction of local roads and streets.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 4e
Ecological site: Claypan Prairie
Pasture management group: 8

PaB—Padina fine sand, 1 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Broad, smooth ridges and side slopes
Slope: Very gently sloping or gently sloping convex surfaces with dominant slopes of 1 to 3 percent
Shape of areas: Irregular
Size of areas: 50 to 500 acres

Typical Profile

Surface layer:
0 to 8 inches—Pale brown, moderately acid fine sand

Subsurface layer:
8 to 27 inches—Yellow, neutral fine sand
27 to 67 inches—Very pale brown, slightly acid fine sand

Subsoil:
67 to 72 inches—Reddish yellow, moderately acid fine sandy loam that has common pale brown mottles
72 to 80 inches—Reddish yellow, strongly acid fine sandy loam that has common red and light gray mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Low
Permeability: Moderate
Available water capacity: Low
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Moderate

Composition

Padina soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Poorly drained Cadelake soils in small, narrow drainageways.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native forage plants.
- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:
- None

Pasture

Major limitations:
- Low available water capacity limits growth of improved grasses during periods of drought.
- Because of seepage, construction of livestock ponds is not recommended.
- Because of low fertility, acidity, and leaching of the soil, a more costly fertilization and liming program is needed to maintain optimum yields.

Minor limitations:
- Moderate hazard of erosion during seedbed preparation for improved grasses.

Cropland

Major limitations:
- Low available water capacity and droughtiness make this soil unsuitable for growing most crops; however, it is suited to growing peanuts and watermelons.

Minor limitations:
- Moderate hazard of water erosion when this soil is cultivated.
- The soil is loose when dry and provides poor traction for farm machinery.

Urban development

Major limitations:
- The sandy texture can cause effluents to seep into ground water when this soil is used for septic tank absorption fields.
- The sandy texture makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:
- Low available water capacity and low natural fertility make establishment and maintenance of lawn grasses and landscape plants more difficult.

Interpretive Groups

Land capability classification: 3e
Ecological site: Deep Sand
Pasture management group: 3

PaE—Padina fine sand, 5 to 15 percent slopes

Setting

Landform: Upland
Landscape position: Side slopes
Slope: Moderately sloping to moderately steep, concave and convex surfaces with dominant slopes of 8 to 12 percent
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—Light yellowish brown, moderately acid fine sand

Subsurface layer:
6 to 60 inches—Very pale brown, strongly acid fine sand in the upper part and moderately acid fine sand in the lower part

Subsoil:
60 to 80 inches—Yellowish red, strongly acid sandy clay loam that has common light gray mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Moderate
Available water capacity: Low
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Severe

Composition

Padina soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Poorly drained Cadelake soils in small narrow drainageways.
- Moderately deep, slowly permeable Jedd soils on side slopes in positions similar to this Padina soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native forage plants.

Minor limitations:
- None

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.
- Because of seepage, construction of livestock ponds is not recommended.
- Because of low fertility, acidity, and leaching of the soil, a more costly fertilization and liming program is needed to maintain optimum yields.

Minor limitations:
- None

Cropland

Major limitations:
- Slope and the severe hazard of water erosion make this soil unsuitable for growing crops.

Minor limitations:
- The surface layer is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:
- The sandy texture can cause effluents to seep into ground water when this soil is used for septic tank absorption fields.
- The sandy texture of the soil makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:
- Slope limits use in construction of residential, small commercial buildings, and local roads and streets.
- Low available water capacity and low natural fertility make establishment and maintenance of lawn and landscape plants more difficult.

Interpretive Groups

Land capability classification: 6e
Ecological site: Deep Sand
Pasture management group: 3

Pt—Pits

Pits are areas where the soils and the underlying strata have been removed to be used as sources of gravel, clay, crushed rock, or sand for road bases, building foundations, or embankments. The pits range in depth from about 2 feet to about 10 feet and range from about 5 to 100 acres in size. In the more shallow pits, the subsoil has not been excessively disturbed. These pits are used mostly as sources of surface gravel. Deeper pits are used as borrow pits for clay or the rock material that lies beneath the soil. These pits have steep vertical walls and are more difficult to reclaim. Some pits hold water during certain seasons.

RaB—Rader fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Stream terraces and relict Pleistocene terraces on uplands
Landscape position: Footslopes and head of drainageways
Slope: Very gently sloping with concave surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 50 acres

Typical Profile

Surface layer:
0 to 5 inches—Pale brown, very strongly acid fine sandy loam that has common dark yellowish brown mottles

Subsurface layer:
5 to 13 inches—Very pale brown, very strongly acid fine sandy loam that has few dark yellowish brown mottles

Subsoil:
13 to 18 inches—Very pale brown and yellowish brown, strongly acid loam
18 to 28 inches—Light gray, very strongly acid sandy clay that has common strong brown and few yellowish red mottles
28 to 43 inches—Brownish yellow, strongly acid sandy clay loam that has common light brownish gray and few red mottles
43 to 65 inches—Reddish yellow, slightly acid sandy clay loam that has common light gray and few dark red mottles
65 to 80 inches—Light gray, slightly acid sandy clay loam that has common reddish yellow and few red mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 2 to 4 feet, mainly from December through March
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Moderate

Composition

Rader soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Slowly permeable Chazos soils in slightly higher convex areas.
- Mabank soils in slightly lower smooth areas.
- Well drained, moderately permeable Silawa soils in slightly higher convex areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Moderate available water capacity limits growth of crops during periods of drought.

Urban development

Major limitations:

- Very slow permeability and seasonal wetness can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Seasonal wetness and potential for shrinking and swelling limit use in construction of local roads and streets.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 5

ReB—Rehburg loamy fine sand, 1 to 5 percent slopes

Setting

Landform: Uplands
Landscape position: Ridgetops and side slopes
Slope: Very gently sloping or gently sloping convex surfaces with dominant slopes of 1 to 3 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 15 inches—Light brownish gray, strongly acid loamy fine sand

Subsurface layer:
15 to 25 inches—Very pale brown, strongly acid loamy fine sand

Subsoil:
25 to 34 inches—Light brownish gray, moderately acid clay loam that has common red and yellowish brown mottles and few gray mottles
34 to 46 inches—Very pale brown, strongly acid sandy clay loam that has common brownish yellow and brown mottles and fragments of weakly cemented sandstone

Underlying material:
46 to 50 inches—Grayish brown and light yellowish brown, weakly cemented sandstone and tuffaceous clay

Soil Properties

Depth: Deep to sandstone and tuffaceous clay
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 3 to 4 feet, mainly from December through April
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Low
Root zone: Deep
Natural soil fertility: Low
Shrink-swell potential: Medium
Hazard of water erosion: Severe

Composition

Rehburg soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately deep Arol and Singleton soils in slightly lower positions in concave areas.
- Moderately deep, well drained Burlewash soils in higher positions in convex areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.

Minor limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.
- Low available water capacity limits plant growth during periods of drought.

Minor limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.
- The surface layer is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:

- Very slow permeability and seasonal wetness can interfere with proper functioning of septic tank absorption fields.
- The sandy texture makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Shrink and swell potential of the subsoil limits use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy
Pasture management group: 11

RoB—Robco loamy fine sand, 1 to 5 percent slopes

Setting

Landform: Uplands and stream terraces
Landscape position: Concave lower side slopes and broad, smooth stream divides
Slope: Very gently sloping or gently sloping slightly convex and concave surfaces with dominant slopes of 1 to 3 percent
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 5 inches—Light yellowish brown, strongly acid loamy fine sand

Subsurface layer:
5 to 24 inches—Very pale brown, strongly acid loamy fine sand that has few yellow and light gray mottles

Subsoil:
24 to 34 inches—Brownish yellow, strongly acid sandy clay loam mixed with very pale brown loamy fine sand
34 to 53 inches—Light gray, strongly acid sandy clay loam that has common brownish yellow and red mottles
53 to 80 inches—Yellow, moderately acid sandy clay that has common red and light brownish gray mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 1.5 to 3.5 feet, mainly from January through April
Flooding: None
Runoff: Medium
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Medium
Hazard of water erosion: Moderate

Composition

Robco soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Poorly drained Cadelake soils in small, narrow drainageways.
- Very slowly permeable Mabank soils in slightly lower smooth areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Pasture

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Moderate available water capacity limits plant growth of crops during periods of drought.
- The surface layer is loose when dry and offers poor traction for farm machinery.

Urban development

Major limitations:

- Slow permeability and seasonal wetness can interfere with proper functioning of septic tank absorption fields.
- The sandy texture makes excavation side walls unstable.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Seasonal wetness and potential for shrinking and swelling limit use in construction of residential and small commercial buildings.
- Seasonal wetness limits use in construction of local roads and streets.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy
Pasture management group: 2

RrA—Roetex clay, occasionally flooded

Setting

Landform: Flood plain
Landscape position: Depressional swales and channels within the flood plain of the Brazos River
Slope: Nearly level with concave surfaces
Shape of areas: Oval to oblong
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—Dark reddish gray, slightly alkaline clay

Subsoil:
8 to 15 inches—Dark reddish brown, moderately alkaline clay
15 to 72 inches—Reddish brown, moderately alkaline clay that has common dark gray and gray mottles

Underlying material:
72 to 80 inches— Thin layers of yellowish red and reddish gray, moderately alkaline silty clay

Soil Properties

Depth: Very deep
Drainage class: Somewhat poorly drained
Water table: A seasonal high water table is above a depth of 2 feet; soil is sometimes ponded, mainly from October through May
Flooding: Occurs 5 to 50 times in 100 years, usually lasting 2 to 7 days
Runoff: Negligible
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Slight

Composition

Roetex soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Well drained Belk soils on flood plains in slightly higher positions.
- Well drained, moderately permeable Weswood soils on flood plains in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Cropland, pasture

Management Concerns

Rangeland

Major limitations:
- Because of wetness, this soil is poorly suited to rangeland.

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- None

Cropland

Major limitations:

- Because of wetness, this soil is poorly suited for crops; however, some areas are used for cropland.
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- The clayey surface layer is difficult to till when too wet or too dry.

Pasture

Major limitations:

- Wetness and the clayey surface layer make establishment and maintenance of improved grasses difficult.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength, potential for shrinking and swelling, and wetness limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3w
Ecological site: Clayey Bottomland
Pasture management group: 13

Sa—Sandow loam, frequently flooded

Setting

Landform: Flood plain
Landscape position: Broad, smooth areas adjacent to major drainageways
Slope: Nearly level with plane surfaces
Shape of areas: Elongated
Size of areas: 50 to 500 acres

Typical Profile

Surface layer:
0 to 7 inches—Brown, moderately acid loam

Subsoil:
7 to 24 inches—Pale brown, moderately acid fine sandy loam that has many strong brown mottles
24 to 36 inches—Dark gray, slightly acid loam that has common dark yellowish brown mottles
36 to 50 inches—Light brownish gray, moderately acid fine sandy loam that has common dark yellowish brown mottles
50 to 64 inches—Light brownish gray, neutral sandy clay loam that has common brownish yellow mottles
64 to 80 inches—Reddish yellow, slightly alkaline sandy clay loam that has light brownish gray mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 3.5 to 6.0 feet, mainly from April through June
Flooding: Occurs more than 50 times in 100 years, usually lasting 2 to 7 days (fig. 11)
Runoff: Negligible
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Medium
Hazard of water erosion: Slight

Composition

Sandow soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Somewhat poorly drained, very slowly permeable Gladewater soils on flood plains in slightly lower positions.
- Very slowly permeable Kaufman and Zilaboy soils on flood plains in positions similar to this Sandow soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- None

Minor limitations:
- Flooding can disrupt livestock grazing for brief periods.

Pasture

Major limitations:
- None

Minor limitations:
- Wetness limits use of mechanical equipment when flooding occurs.
- Flooding can disrupt livestock grazing for brief periods.

Cropland

Major limitations:
- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:
- None

Urban development

Major limitations:
- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength and flooding limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Loamy Bottomland
Pasture management group: 1

Figure 11.—Flooding in an area of Sandow loam, frequently flooded.

ShA—Ships clay, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Distinctive landscape features: Gilgai microrelief in undisturbed areas
Landscape position: Broad, smooth areas within the flood plain of the Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Irregular
Size of areas: 50 to 500 acres

Typical Profile

Surface layer:
0 to 9 inches—Reddish brown, moderately alkaline clay

Subsoil:
9 to 20 inches—Reddish brown, moderately alkaline clay
20 to 73 inches—Reddish brown, moderately alkaline clay that has common brown mottles
73 to 80 inches—Dark gray, moderately alkaline silty clay loam

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting 2 to 7 days
Runoff: Low
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Slight

Composition

Ships soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained, moderately rapidly permeable Coarsewood soils on flood plains in slightly higher positions.
- Well drained, slowly permeable Highbank soils on flood plains in positions similar to this Ships soil.
- Well drained, moderately permeable Weswood soils on flood plains in slightly higher positions.

Land Uses

Major land use: Cropland (fig. 12)
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- The clayey surface layer is difficult to till when soil is too wet or too dry.
- Extended wetness delays field operations.

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.
- The clayey surface layer requires a well prepared seedbed for establishment of improved grasses.

Minor limitations:

- None

Rangeland

Major limitations:

- Very slow permeability restricts the movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for construction of most dwellings and poorly suited for other urban uses.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2s
Ecological site: Clayey Bottomland
Pasture management group: 7

Figure 12.—Harvesting corn in an area of Ships clay, 0 to 1 percent slopes, rarely flooded.

ShB—Ships clay, 1 to 3 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Side slopes adjacent to natural drainageways within the flood plain of the Brazos River
Slope: Very gently sloping with convex surfaces
Shape of areas: Elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—Reddish brown, moderately alkaline clay

Subsoil:
8 to 80 inches—Reddish brown, moderately alkaline clay

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting 2 to 7 days
Runoff: Medium
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Very high
Hazard of water erosion: Moderate

Composition

Ships soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained, moderately permeable Asa and Weswood soils on flood plains in positions similar to this Ships soil.

Land Uses

Major land use: Cropland
Other land uses: Rangeland, pasture

Management Concerns

Cropland

Major limitations:
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:
- Moderate hazard of erosion when this soil is cultivated.
- The clayey surface layer is difficult to till when soil is too wet or too dry.

Rangeland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- None

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.
- The clayey surface layer requires a well prepared seedbed for establishment of improved grasses.

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for construction of most dwellings and for other urban uses.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Clayey Bottomland
Pasture management group: 7

SkB—Shiro loamy fine sand, 1 to 5 percent slopes

Setting

Landform: Upland
Landscape position: Ridges and upper side slopes
Slope: Very gently sloping to gently sloping with convex surfaces and dominant slopes of 1 to 3 percent
Shape of areas: Oval to oblong
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—Brown, strongly acid loamy fine sand

Subsurface layer:
8 to 11 inches—Very pale brown, strongly acid loamy fine sand

Subsoil:
11 to 20 inches—Red, very strongly acid clay that has common light brownish gray mottles
20 to 30 inches—Light gray, very strongly acid clay that has common red and few brownish yellow mottles
30 to 36 inches—Light gray, very strongly acid clay that has common very pale brown and few reddish yellow mottles

Underlying material:
36 to 40 inches—Stratified light brownish gray and strong brown, weakly cemented sandstone and dark grayish brown shale

Soil Properties

Depth: Moderately deep to sandstone
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Shiro soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained, very slowly permeable Arol and Singleton soils on lower side slopes.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:

- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Slow permeability and depth to bedrock restricts movement of water through the soil and inhibits root development of native plants.

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Low available water capacity limits plant growth of improved grasses during periods of drought.

Minor limitations:

- Slow permeability and depth to bedrock restricts movement of water through the soil and inhibits root development of improved grasses.

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.
- Low available water capacity limits crop growth during periods of drought.

Minor limitations:

- Slow permeability and depth to bedrock restricts movement of water and inhibits root development of crops.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Very slow permeability and depth to bedrock can interfere with proper functioning of septic tank absorption fields.
- Low soil strength and high potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 11

SmC—Silawa loamy fine sand, 2 to 5 percent slopes

Setting

Landform: Stream terrace
Landscape position: Ridges and side slopes
Slope: Very gently sloping or gently sloping with convex surfaces
Shape of areas: Oval to oblong
Size of areas: 20 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—Brown, strongly acid loamy fine sand

Subsoil:
9 to 21 inches—Light red, very strongly acid sandy clay loam
21 to 35 inches—Light red, strongly acid sandy clay loam that has few brownish yellow mottles
35 to 47 inches—Reddish yellow, strongly acid fine sandy loam

Underlying material:
47 to 80 inches—Reddish yellow, strongly acid loamy fine sand

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Low
Permeability: Moderate
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Moderate

Composition

Silawa soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Somewhat excessively drained, rapidly permeable Eufaula soils in convex areas in positions similar to this Silawa soil.
- Moderately well drained, very slowly permeable Mabank soils in lower, smooth areas.
- Moderately well drained, very slowly permeable Rader and Tabor soils in concave and smooth areas in slightly lower positions.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Moderate available water capacity limits crop growth during periods of drought.

Urban development

Major limitations:

- None

Minor limitations:

- Moderate risk for corrosion of uncoated steel and concrete.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 2

SnB—Silstid loamy fine sand, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Broad ridges
Slope: Very gently sloping with convex surfaces
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 12 inches—Light yellowish brown, moderately acid loamy fine sand

Subsurface layer:
12 to 28 inches—Very pale brown, moderately acid loamy fine sand

Subsoil:
28 to 38 inches—Reddish yellow, strongly acid sandy clay loam that has common yellowish red mottles
38 to 70 inches—Yellow, strongly acid sandy clay loam that has common red mottles
70 to 80 inches—Yellow, strongly acid fine sandy loam that has common red mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Negligible
Permeability: Moderate
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Silstid soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained, slowly permeable Robco soils along drainageways in lower concave positions.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:
- Low natural fertility limits yield potential of native plants.

Minor limitations:
- Moderate available water capacity limits native plant growth during periods of drought.

Cropland

Major limitations:
- None

Minor limitations:
- Moderate available water capacity limits crop growth during periods of drought.
- Surface layer is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:
- Sandy soil makes excavation side walls unstable.

Minor limitations:
- Moderate available water capacity and the sandy texture make the establishment and maintenance of lawn grasses and landscape plants more difficult.
- Moderate risk for corrosion of uncoated steel and concrete.

Interpretive Groups

Land capability classification: 3s
Ecological site: Sandy
Pasture management group: 2

SnD—Silstid loamy fine sand, 3 to 8 percent slopes

Setting

Landform: Upland
Landscape position: Side slopes
Slope: Gently sloping or moderately sloping with convex surfaces and dominant slopes of 5 to 8 percent
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—Pale brown, moderately acid loamy fine sand

Subsurface layer:
8 to 24 inches—Yellow in the upper part and very pale brown in the lower part, moderately acid loamy fine sand

Subsoil:
24 to 48 inches—Brownish yellow, strongly acid sandy clay loam that has common yellowish red and red mottles
48 to 72 inches—Very pale brown, very strongly acid sandy clay loam that has few red and reddish yellow mottles
72 to 80 inches—Reddish yellow, very strongly acid sandy clay loam that has common yellowish red mottles

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Low
Permeability: Moderate
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Low
Shrink-swell potential: Low
Hazard of water erosion: Moderate

Composition

Silstid soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately deep, slowly permeable Jedd soils on convex side slopes in positions similar to this Silstid soil.
- Moderately well drained, slowly permeable Robco soils along drainageways in lower concave positions.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:
- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:
- Low natural fertility limits yield potential of native plants.

Minor limitations:
- Moderate available water capacity limits native plant growth during periods of drought.

Cropland

Major limitations:
- None

Minor limitations:
- Moderate hazard of erosion when this soil is cultivated.
- Moderate available water capacity limits crop growth during periods of drought.
- Sandy surface is loose when dry, providing poor traction for farm machinery.

Urban development

Major limitations:
- Sandy soil makes excavation side walls unstable.

Minor limitations:
- Slope limits use for construction of small commercial buildings.
- Moderate risk for corrosion of uncoated steel and concrete.
- Moderate available water capacity and the sandy texture make the establishment and maintenance of lawn grasses and landscape plants more difficult.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy
Pasture management group: 2

SoB—Singleton fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Broad ridges and along drainageways
Slope: Very gently sloping with convex and concave surfaces
Shape of areas: Irregular
Size of areas: 50 to 500 acres

Typical Profile

Surface layer:
0 to 10 inches—Light gray, strongly acid fine sandy loam

Subsoil:
10 to 22 inches—Brown, very strongly acid clay that has common yellowish red mottles
22 to 32 inches—Brown, very strongly acid clay that has few strong brown mottles

Underlying material:
32 to 40 inches—Very dark gray, weakly cemented sandstone

Soil Properties

Depth: Moderately deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Low
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Singleton soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Deep, very slowly permeable Rehburg soils in higher convex areas.
- Slowly permeable Shiro soils in slightly higher convex areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Very slow permeability and depth to bedrock restrict movement of water through the soil and inhibit root development of native plants.
- Low available water capacity limits native plant growth during periods of drought.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- None

Pasture

Major limitations:

- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability and depth to bedrock restrict movement of water through the soil and inhibit root development of improved grasses.
- Low available water capacity limits growth of improved grasses during periods of drought.

Minor limitations:

- None

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.
- Very slow permeability and depth to bedrock restrict movement of water through the soil and inhibit root development of crops.
- Low available water capacity limits plant growth during periods of drought.

Minor limitations:

- None

Urban development

Major limitations:

- Depth to bedrock and very slow permeability can interfere with proper functioning of septic tank absorption fields.
- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 4e
Ecological site: Claypan Savannah
Pasture management group: 16

SpB—Spiller fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Ridgetops and side slopes
Slope: Very gently sloping with convex surfaces
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 12 inches—Brown, moderately acid fine sandy loam

Subsoil:
12 to 32 inches—Yellowish brown and brownish yellow, strongly acid clay that has many red and few dark yellowish brown mottles
32 to 45 inches—Brownish yellow, strongly acid clay that has few yellowish red and grayish brown mottles
45 to 50 inches—Reddish yellow, slightly acid sandy clay loam that has common light brownish gray and few yellowish red mottles

Underlying material:
50 to 80 inches—Stratified strong brown loam and light gray shale

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Medium
Hazard of water erosion: Moderate

Composition

Spiller soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Kurten soils on ridges and side slopes in positions similar to this Spiller soil.
- Very slowly permeable Rader soils in lower concave areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Slow permeability restricts water movement through the soil and inhibits root development of improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- None

Minor limitations:

- Slow permeability restricts water movement through the soil and inhibits root development of native plants.
- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Cropland

Major limitations:

- None

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Slow permeability restricts movement of water through the soil and inhibits root development of crops.
- Moderate available water capacity limits crop growth during periods of drought.

Urban development

Major limitations:

- Slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- Shrinking and swelling potential limits use in construction of residential and small commercial buildings.

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 5

Su—Sumpf clay, frequently flooded

Setting

Landform: Flood plain
Landscape position: Depressional areas of abandoned river channels
Slope: Nearly level with concave surfaces
Shape of areas: Elongated
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 25 inches—Dark gray, slightly alkaline clay that has few strong brown mottles

Subsoil:
25 to 35 inches—Dark brown, slightly alkaline clay
35 to 50 inches—Dark gray, slightly alkaline clay

Underlying material:
50 to 80 inches—Brown, slightly alkaline clay that has thin layers of dark gray clay

Soil Properties

Depth: Very deep
Drainage class: Very poorly drained
Water table: A seasonal high water table is above a depth of 2 feet throughout the year, and the soil is usually ponded for several months.
Flooding: Occurs more than 50 times in 100 years, usually lasting more than 30 days
Runoff: Negligible
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Sumpf soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Moderately well drained Ships soils on flood plains in higher positions.
- Well drained, moderately permeable Weswood soils on flood plains in higher positions.

Land Uses

Major land use: Rangeland
Other land uses: None

Management Concerns

Rangeland

Major limitations:
- Extended periods of flooding make this soil poorly suited to rangeland.

Minor limitations:
- None

Pasture

Major limitations:
- Extended periods of flooding make this soil unsuitable for pasture.

Minor limitations:
- None

Cropland

Major limitations:
- Extended periods of flooding make this soil unsuitable for growing crops.

Minor limitations:
- None

Urban development

Major limitations:
- Extended periods of flooding make this soil unsuitable for most urban uses.
- Low soil strength, shrinking and swelling, and flooding limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 6w
Ecological site: Clayey Bottomland
Pasture management group: 17

TaA—Tabor fine sandy loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces and relict terraces on uplands
Landscape position: Broad, smooth areas between drainageways
Slope: Nearly level with plane to slightly convex surfaces
Shape of areas: Oblong to elongated
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 13 inches—Very pale brown, strongly acid fine sandy loam

Subsoil:
13 to 24 inches—Yellow, very strongly acid clay that has many grayish brown and common red mottles
24 to 48 inches—Light brownish gray, moderately acid clay that has common yellow mottles
48 to 80 inches—Yellow, neutral clay loam that has few light gray mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Moderate

Composition

Tabor soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Well drained, moderately permeable Silawa soils in slightly higher convex areas.
- Mabank and Wilson soils in slightly lower concave and smooth areas.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Cropland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Sandy Loam
Pasture management group: 5

Ua—Uhland fine sandy loam, frequently flooded

Setting

Landform: Flood plain
Landscape position: Broad, smooth areas adjacent to drainageways
Slope: Nearly level with plane surfaces
Shape of areas: Elongated
Size of areas: 100 to 500 acres

Typical Profile

Surface layer:
0 to 9 inches—Pale brown, slightly acid fine sandy loam that has few yellowish brown mottles

Subsoil:
9 to 28 inches—Light yellowish brown, slightly acid fine sandy loam that has common dark grayish brown and few yellow mottles
28 to 50 inches—Brown, slightly acid fine sandy loam that has few light brownish gray and brownish yellow mottles
50 to 80 inches—Light brownish gray, slightly acid loam that has few strong brown mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table is at a depth of 2.0 to 3.5 feet, mainly from March through May
Flooding: Occurs more than 50 times in 100 years, usually lasting 2 to 7 days
Runoff: Negligible
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Uhland soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Somewhat poorly drained, very slowly permeable Gladewater soils on flood plains in lower positions.
- Moderately well drained, very slowly permeable Zilaboy soils on flood plains in slightly lower positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:

- None

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.
- Moderate natural fertility limits yield potential of native forage plants.
- Flooding can disrupt livestock grazing for brief periods.

Pasture

Major limitations:

- None

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.
- Wetness limits use of mechanical equipment when flooding occurs.
- Flooding can disrupt livestock grazing for brief periods.

Cropland

Major limitations:

- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Hazard of flooding limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Loamy Bottomland
Pasture management group: 5

W—Water

Small, natural or constructed lake, pond, or pit that contains water most of the year.

WeA—Weswood silt loam, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Broad, smooth areas within the flood plain of the Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Irregular
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 9 inches—Brown, moderately alkaline silt loam

Subsoil:
9 to 54 inches—Light brown or light reddish brown, moderately alkaline silt loam
54 to 60 inches—Pink, moderately alkaline very fine sandy loam
60 to 73 inches—Light brown, moderately alkaline silt loam
73 to 80 inches—Reddish brown, moderately alkaline silty clay loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting 2 to 7 days
Runoff: Negligible
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Weswood soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Belk soil on flood plains in slightly lower positions.
- Moderately well drained, very slowly permeable Ships soils on flood plains in slightly lower positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- None

Minor limitations:
- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.

Pasture

Major limitations:

- None

Minor limitations:

- None

Rangeland

Major limitations:

- None

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 1
Ecological site: Loamy Bottomland
Pasture management group: 1

WwA—Weswood silty clay loam, 0 to 1 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Broad, smooth areas within the flood plain of the Brazos River
Slope: Nearly level with plane surfaces
Shape of areas: Irregular
Size of areas: 50 to 200 acres

Typical Profile

Surface layer:
0 to 7 inches—Brown, moderately alkaline silty clay loam

Subsoil:
7 to 80 inches—Light brown, moderately alkaline silt loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting 2 to 7 days
Runoff: Negligible
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Low
Hazard of water erosion: Slight

Composition

Weswood soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Belk soil on flood plains in similar and slightly lower positions than this Weswood soil.
- Moderately well drained, very slowly permeable Ships soils on flood plains in slightly lower positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- None

Minor limitations:
- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.

Pasture

Major limitations:

- None

Minor limitations:

- None

Rangeland

Major limitations:

- None

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 1
Ecological site: Loamy Bottomland
Pasture management group: 1

WwB—Weswood silty clay loam, 1 to 3 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Natural levees adjacent to drainageways within the flood plain of the Brazos River
Slope: Very gently sloping with convex surfaces
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—Dark brown, moderately alkaline silty clay loam

Subsoil:
8 to 48 inches—Reddish brown, moderately alkaline silt loam
48 to 70 inches—Brown, moderately alkaline silt loam

Underlying material:
70 to 80 inches—Reddish yellow, moderately alkaline very fine sandy loam

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting 2 to 7 days
Runoff: Low
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: Low
Hazard of water erosion: Severe

Composition

Weswood soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Very slowly permeable Ships soils on flood plains in positions similar to this Weswood soil.
- Moderately rapidly permeable Yahola soils on flood plains in similar positions.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.

Minor limitations:
- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.

Minor limitations:
- None

Rangeland

Major limitations:
- None

Minor limitations:
- None

Urban development

Major limitations:
- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 2e
Ecological site: Loamy Bottomland
Pasture management group: 1

WzA—Wilson loam, 0 to 1 percent slopes

Setting

Landform: Stream terraces and relict Pleistocene terraces on uplands
Landscape position: Broad, smooth ridges and terrace surfaces
Slope: Nearly level with plane surfaces
Shape of areas: Irregular to oblong
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 7 inches—Grayish brown, slightly acid loam

Subsoil:
7 to 19 inches—Very dark gray, neutral clay
19 to 33 inches—Dark gray, neutral clay
33 to 54 inches—Light brownish gray, neutral clay
54 to 80 inches—Light gray, neutral clay loam

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet; however, the soil is seasonally wet and the surface layer and upper part of the subsoil are saturated during winter and spring for a periods of 10 to 30 days
Flooding: None
Runoff: Low
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Wilson soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Slowly permeable Chazos soils on terraces in slightly higher convex areas.
- Tabor soils on terraces in positions similar and slightly higher than this Wilson soil.

Land Uses

Major land use: Rangeland
Other land uses: Pasture, cropland

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts water movement through the soil and inhibits root development of native plants.

Minor limitations:

- Moderate available water capacity limits yield potential of native forage plants during periods of drought.
- Moderate natural fertility limits growth of native plants.

Pasture

Major limitations:

- Very slow permeability restricts the movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits yield potential of improved grasses during periods of drought.

Cropland

Major limitations:

- Very slow permeability restricts the movement of water through the soil and inhibits root development of crops.

Minor limitations:

- Extended wetness delays field operations.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Low soil strength, potential for shrinking and swelling, and seasonal wetness limit use in construction of local roads and streets.
- Very slow permeability and seasonal wetness can interfere with proper functioning of septic tank absorption fields.
- High risk for corrosion of uncoated steel and concrete.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3w
Ecological site: Claypan Prairie
Pasture management group: 9

YaB—Yahola fine sandy loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plain
Landscape position: Natural levees adjacent to drainageways within the flood plain of the Brazos River
Slope: Nearly level with slightly convex surfaces
Shape of areas: Oblong to elongated
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 7 inches—Light brown, slightly alkaline fine sandy loam

Underlying material:
7 to 50 inches—Thin layers of brown, moderately alkaline fine sandy loam
50 to 80 inches—Thin layers of brown and light brown, moderately alkaline loamy fine sand

Soil Properties

Depth: Very deep
Drainage class: Well drained
Water table: None within a depth of 6 feet
Flooding: Occurs 1 to 5 times in 100 years, usually lasting less than 2 days
Runoff: Negligible
Permeability: Moderately rapid
Available water capacity: Moderate
Root zone: Very deep
Natural soil fertility: Moderate
Shrink-swell potential: Low
Hazard of water erosion: Moderate

Composition

Yahola soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Contrasting Inclusions

- Very slowly permeable Belk soil on flood plains in positions similar and slightly lower than this Yahola soil.
- Slowly permeable Highbank soils on flood plains in slightly lower positions.
- Somewhat poorly drained Roetex soils on flood plains in concave areas.

Land Uses

Major land use: Cropland
Other land uses: Pasture, rangeland

Management Concerns

Cropland

Major limitations:
- None

Minor limitations:

- Moderate hazard of erosion when this soil is cultivated.
- Performing tillage operations while the soil is wet can result in a compacted layer below the surface layer.
- Moderate available water capacity limits plant growth during periods of drought.

Pasture

Major limitations:

- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- Moderate hazard of erosion during seedbed preparation for improved grasses.
- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Because of seepage, construction of livestock ponds is not recommended.

Minor limitations:

- Moderate available water capacity limits growth of native plants during periods of drought.
- Moderate natural fertility limits yield potential of native plants.

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most dwellings and other urban uses.

Minor limitations:

- Hazard of flooding limits use in construction of local roads and streets.

Interpretive Groups

Land capability classification: 2e
Ecological site: Loamy Bottomland
Pasture management group: 4

ZaB—Zack fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Ridges and side slopes
Slope: Very gently sloping with convex surfaces
Shape of areas: Oblong to irregular
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 5 inches—Brown, strongly acid fine sandy loam

Subsoil:
5 to 13 inches—Dark brown, moderately acid clay that has common yellowish red mottles
13 to 30 inches—Dark grayish brown, slightly alkaline clay that has few brown mottles
30 to 37 inches—Dark brown, slightly alkaline sandy clay loam interbedded with very pale brown, weakly consolidated mudstone

Underlying material:
37 to 60 inches—Stratified very pale brown, slightly alkaline weakly consolidated mudstone and sandstone

Soil Properties

Depth: Moderately deep to weakly consolidated mudstone and sandstone
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Zack soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Somewhat poorly drained Boonville soils in lower positions in concave areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:
- Moderate available water capacity limits plant growth during periods of drought.

Rangeland

Major limitations:
- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:
- Moderate available water capacity limits native plant growth during periods of drought.

Cropland

Major limitations:
- Severe hazard of water erosion when this soil is cultivated.
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:
- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:
- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength limits use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:
- None

Interpretive Groups

Land capability classification: 3s
Ecological site: Claypan Prairie
Pasture management group: 14

Zb—Zilaboy clay, frequently flooded

Setting

Landform: Flood plain
Distinctive landscape features: Gilgai microrelief in undisturbed areas
Landscape position: Broad, smooth areas adjacent to major drainageways
Slope: Nearly level with plane surfaces
Shape of areas: Elongated
Size of areas: 100 to 1,000 acres

Typical Profile

Surface layer:
0 to 7 inches—Dark gray, moderately acid clay

Subsoil:
7 to 24 inches—Grayish brown, moderately acid clay that has common brown mottles
24 to 44 inches—Dark grayish brown, moderately acid clay that has few brownish yellow mottles
44 to 62 inches—Dark gray, moderately acid clay
62 to 80 inches—Light brownish gray, neutral sandy clay loam that has common strong brown mottles

Soil Properties

Depth: Very deep
Drainage class: Moderately well drained
Water table: A seasonal high water table can be from a depth of 0 to 3 feet, mainly from November through May
Flooding: Occurs more than 50 times in 100 years, usually lasting 2 to 7 days
Runoff: Low
Permeability: Very slow
Available water capacity: High
Root zone: Very deep
Natural soil fertility: High
Shrink-swell potential: High
Hazard of water erosion: Slight

Composition

Zilaboy soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Contrasting Inclusions

- Moderately well drained, moderately slowly permeable Sandow and Uhland soils on flood plains in slightly higher positions.

Land Uses

Major land use: Rangeland
Other land uses: Pasture

Management Concerns

Rangeland

Major limitations:
- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.

Minor limitations:

- Flooding can disrupt livestock grazing for brief periods.

Pasture

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.
- The clayey surface layer requires a well prepared seedbed for establishment of improved grasses.

Minor limitations:

- Wetness limits the use of mechanical equipment when flooding occurs.
- Flooding can disrupt livestock grazing for brief periods.

Cropland

Major limitations:

- Hazard of flooding makes this soil unsuitable for growing crops.

Minor limitations:

- None

Urban development

Major limitations:

- Hazard of flooding makes this soil unsuitable for most urban uses.
- Low soil strength, potential for shrinking and swelling, and wetness limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 5w
Ecological site: Clayey Bottomland
Pasture management group: 13

ZuB—Zulch fine sandy loam, 1 to 3 percent slopes

Setting

Landform: Upland
Landscape position: Ridges and side slopes
Slope: Very gently sloping with convex and concave surfaces
Shape of areas: Oblong to irregular
Size of areas: 50 to 300 acres

Typical Profile

Surface layer:
0 to 4 inches—Grayish brown, moderately acid fine sandy loam

Subsoil:
4 to 32 inches—Dark gray, neutral clay that has common strong brown mottles
32 to 40 inches—Gray, neutral clay

Underlying material:
40 to 60 inches—Light gray and light brownish gray, neutral weakly consolidated shale and siltstone

Soil Properties

Depth: Moderately deep to shale and siltstone
Drainage class: Moderately well drained
Water table: None within a depth of 6 feet
Flooding: None
Runoff: Medium
Permeability: Very slow
Available water capacity: Moderate
Root zone: Moderately deep
Natural soil fertility: Low
Shrink-swell potential: High
Hazard of water erosion: Severe

Composition

Zulch soil and similar inclusions: 95 percent
Contrasting inclusions: 5 percent

Contrasting Inclusions

- Somewhat poorly drained Boonville soils in lower positions in concave areas.
- Well drained Gredge soils in slightly higher positions in convex areas.

Land Uses

Major land use: Pasture
Other land uses: Rangeland, cropland

Management Concerns

Pasture

Major limitations:
- Severe hazard of erosion when seedbed is prepared for improved grasses.
- Very slow permeability restricts movement of water through the soil and inhibits root development of improved grasses.

Minor limitations:

- Moderate available water capacity limits growth of improved grasses during periods of drought.

Rangeland

Major limitations:

- Very slow permeability restricts movement of water through the soil and inhibits root development of native plants.
- Low natural fertility limits yield potential of native plants.

Minor limitations:

- Moderate available water capacity limits native plant growth during periods of drought.

Cropland

Major limitations:

- Severe hazard of erosion when this soil is cultivated.
- Very slow permeability restricts movement of water through the soil and inhibits root development of crops.

Minor limitations:

- Moderate available water capacity limits plant growth during periods of drought.

Urban development

Major limitations:

- High potential for shrinking and swelling can cause structural damage to residential and small commercial buildings.
- Very slow permeability can interfere with proper functioning of septic tank absorption fields.
- Low soil strength and potential for shrinking and swelling limit use in construction of local roads and streets.
- High risk for corrosion of uncoated steel.

Minor limitations:

- None

Interpretive Groups

Land capability classification: 3e
Ecological site: Claypan Prairie
Pasture management group: 14

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. 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.

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.

In Burleson County, about 150,489 acres, or nearly 35 percent of the total acreage meets the soil requirements for prime farmland. Areas of these soils are scattered throughout the county. General soil map units Benchley-Crockett, Luling, Robco-Chazos, Ships-Belk, and Weswood-Coarsewood, have the largest areas of prime farmland soils. General soil map units Lexton-Benchley, Tabor-Rader, and Burleson, have substantial areas. General soil map units Padina-Silstid and Kurten-Spiller have small scattered areas.

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. 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."

Crops

General management needed for crops and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained. The estimated yields of the main crops and hay and pasture plants are listed for each soil in table 6.

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 Texas Cooperative Extension.

Cropland comprises about 11 percent of Burleson County. The major crops grown are cotton, corn, and grain sorghum (fig. 13). Other crops include small grains, soybeans, watermelons, and other truck crops. Soils commonly used for cropland include Belk, Coarsewood, Highbank, Ships, and Weswood soils on the Brazos River flood plain. Most of the cotton, corn, and grain sorghum is grown on these soils. Most small grain and some cotton, corn, and grain sorghum are grown on the Benchley, Burleson, Davilla, Lexton, Luling, and Wilson soils on the uplands and terraces. Other soils are suitable for cropland; however, they are presently in other uses.

Soil erosion is the major problem where slopes are more than 2 percent. Productivity is reduced as the surface layer is lost and subsoil is incorporated into the plow layer. This is especially true on soils having a clayey subsoil. In addition, soil erosion causes sediment to flow into streams. Where erosion is controlled, sediment pollution is minimized and the quality of water for municipal use, recreation, fisheries, and wildlife is improved.

Management of crop residue helps control erosion and improve soil tilth. Leaving a crop residue cover of 30 percent or more on the soil surface protects against packing rains, reduces crusting, decreases runoff, and reduces evaporation of soil moisture. Crop residue should be protected from burning and overgrazing because it shades the soil, thereby reducing the soil temperature. In addition, the increased organic matter at the surface can help reduce soil compaction caused by farm machinery. Residue management and minimum tillage programs are effective on all cropland soil in the county. Tillage equipment that keeps residue on the surface is recommended.

Figure 13.—Crop rotation of cotton and corn in an area of Luling clay, 1 to 3 percent slopes.

Contour terraces reduce slope lengths and subsequent erosion on cropland. They are most practical on very deep to moderately deep, clayey to loamy soils that have more than 1 percent slope.

Land leveling of irrigated fields is essential to water conservation and management because it allows water to spread evenly over a field. Surface drains are used on nearly level, loamy and clayey soils to move excess surface water out of the field in order to reduce crop damage.

All crops respond well to commercial fertilizer. Where fertilizers are applied according to a current soil test, and erosion is controlled, fertility levels can be maintained. Proper pH must also be maintained to ensure that plants can use applied fertilizers. On sandy soils, fertilizer, especially nitrogen, should be applied in split applications to ensure the best plant use and to protect water quality. Split applications should also be used on any sloping fields where runoff potential is high.

Weed and insect control is needed on cropland. Type and extent of infestation varies within the growing season and from year to year. After the weed or insect is identified, control measures should be applied when the infestation reaches a level where the control cost is less than the cost of the damage inflicted. The best control measures are selected after considering all treatment options including mechanical, biological, and chemical treatments. When chemical controls are used, label instructions should be strictly followed as well as local, state, and federal laws regulating their use.

For sandy soils, applications of agricultural chemicals that have a high potential for leaching should be limited to situations where no suitable substitute is available. For clay soils, the use of chemicals that have a high runoff potential should be limited.

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 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.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of Texas Cooperative Extension 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 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, or 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 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation.

Class 7 soils have very severe limitations that make them unsuitable for cultivation.

Class 8 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, 2e. 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 1, there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

Pasture and Hayland

Land used for pasture and hay in Burleson County is mainly planted to introduced grasses that respond to recommended management practices. Some of the species used are common and improved varieties of bermudagrass, bahiagrass, and kleingrass. Established bermudagrass and many other kinds of grasses can be overseeded with winter annuals, such as adapted clovers, ryegrass, or small grain crops, for additional winter and early spring forage (fig. 14). Some cropland fields are used continuously for annual winter pasture production.

Well managed perennial warm-season pasture grasses typically produce more forage than is needed during the peak of the growing season. Excess pasture production is often harvested as hay for use during winter. Some perennial grass is managed strictly for hay production, as well as annual plantings of forage sorghum.

Planning land use and the kinds of forage to be grown can aid in developing year-round forage programs. Such a planned grazing system maximizes production by providing a guide to stocking rates, allowing timely rest periods from grazing, and providing a more efficient forage harvest.

Recommended pasture management practices include adequate fence arrangement for rotational grazing and efficient use of forage. Proper use of forage ensures that plant vigor remains high for continued production and soil erosion protection. Selection of the best-adapted plants that meet the yield and economic goals of the operation is important. In a well managed pasture, weeds and brush are controlled, fertilizer is applied at the proper time and in the recommended amount, and an adequate supply of water is available for livestock.

Figure 14.—Coastal bermudagrass overseeded with vetch in an area of Zulch fine sandy loam, 1 to 3 percent slopes.

Fertilizer should be applied in split applications throughout the growing season, in other words, after grazing cycles on pasture or after harvest on hayland. This practice is particularly important on sandy soils because of the potential of nitrogen and other nutrients leaching into ground water. Split applications should also be used on sloping clay soils because of their high potential for runoff. Some soils need applications of agricultural limestone to correct acidity problems and allow plants to better use the applied nutrients. Soil pH should be maintained at a minimum of 5.5 for most grasses. If legumes are to be overseeded, a pH of more than 5.5 must be maintained.

Hay production requires the same high management standards as pasture production. In addition, the forage needs to be cut at the proper interval and height based on species requirements in order to maintain stand vigor and promote timely regrowth.

Pasture Management Groups

A Pasture Management Group is a grouping of soils that have about the same level of productivity and similar management concerns. The soils of Burleson County are rated and grouped based on characteristics that affect plant establishment and growth. The major characteristics considered include texture and thickness of the topsoil, drainage, erosion, available water holding capacity, permeability, and soil depth.

The yields shown in the following pasture management groups are estimates developed in 1993 for established grasses. They are based on average climatic conditions with the assumption that recommended management practices are followed. Recommended management practices include setting economically feasible yield goals; establishing and maintaining proper fertility levels to attain goals based on current soil test results; using intensive rotational grazing; using weed, insect, and disease control; and using brush management.

The yield for pasture is expressed in animal unit months (AUM) for the grass most commonly grown in each group. An animal unit month is the length of time that the forage produced on 1 acre will feed one animal unit at a given rate of use. An animal unit is the equivalent of one 1,000-pound animal. For example, a yield of 8 animal unit months provides forage for one animal unit for 8 months. Or, expressed another way, it takes 1.5 acres producing at this rate to provide adequate forage for one animal unit for one year. Estimated forage yields are given in Table 6 for all soils suitable for pasture. They are based on a utilization rate of 60 percent. Utilization rate is the amount of the total forage produced that is actually consumed by the livestock. The remaining forage is not used for grazing because of trampling, fouling by manure, or it must be left to ensure erosion control and continued productivity. Utilization usually decreases as the rotation period lengthens. Hay yields in tons per acre can be estimated by multiplying the AUM's by 1.67.

The following description of each Pasture Management Group discusses the soil characteristics that affect forage production, major grass and legume adaptation, yield estimate of major grasses, and management problems associated with forage production. Additional information about the soils is in the sections, “Detailed Soil Map Units” and “Soil Series and Their Morphology.”

Pasture Management Group 1. This group includes Asa, Benchley, Davilla, Highbank, Sandow, and Weswood soils in map units AsB, BeB, BeC, DwA, HbA, Sa, WeA, WwA, and WwB. This group generally has no major limitations regarding production of forage; however, if adequate cover is not maintained in sloping areas, erosion can be a problem. The flooding on Asa, Highbank, Sandow, and Weswood soils does not limit their production, although it can briefly delay grazing or hay harvest. Potential production of this group is about 8 animal unit months of grazing in a normal year with recommended management.

Grasses adapted to all Group 1 soils include improved bermudagrass, common bermudagrass, kleingrass, old world bluestem, and switchgrass. Bahiagrass can be grown on Benchley, Davilla, and Sandow soils; however, it will not tolerate the high pH of the other soils in this group. Annual legumes adapted to Benchley, Davilla, and Sandow soils include crimson clover, arrowleaf clover, subterranean clover, rose clover, and hairy vetch. Bigbee berseem clover is suitable for the high pH soils of the group. Alfalfa, a perennial legume, is also adapted to high pH soils; however, intensive management is required.

Pasture Management Group 2. This group includes Chazos, Robco, Silawa, and Silstid soils in map units ChB, ChD, RoB, SmC, SnB, and SnD. A moderate capacity to hold water is a minor limitation for plant growth and affects the production of pasture. If adequate cover is not maintained on the steeper slopes, erosion can be a problem.

In some years, droughtiness can reduce production; however, the pastures recover well if they are not overgrazed and good fertility levels are maintained. Because of the coarse texture of the surface layer and the permeable subsoil, nutrient leaching, particularly nitrogen, can be a problem. Agricultural chemicals that have a high potential for leaching into the soil are not recommended for these soils unless no suitable substitute is available. The soils in this group can be expected to produce about 7 animal unit months of grazing in a normal year with recommended management.

Adapted grasses for the soils in this group include improved bermudagrass, bahiagrass, common bermudagrass, and switchgrass. Adapted annual legumes include crimson clover, arrowleaf clover, rose clover, and hairy vetch.

Pasture Management Group 3. This group consists of Padina soils in map units PaB and PaE. This soil has low capacity to hold water in the surface layer, a major limitation for plant growth. However, the loamy subsoil has a high capacity to hold water. This, combined with the good infiltration rate of the surface layer, favors the growth of established deep-rooted forage plants.

Droughtiness can be a major llimitation while plants are getting established, and may be a problem for established stands during dry periods in some years. The Padina soil recovers from drought well if not overgrazed and if adequate fertility is maintained. Erosion can be a problem on steep slopes if cover is not maintained.

The coarse texture of the surface soil and the permeable subsoil can cause nutrient leaching, particularly nitrogen, which can be a problem. Applying more nutrients than the plants need is not recommended. Agricultural chemicals having a high potential for leaching should not be used on the Padina soil unless no suitable substitute is available. This group can be expected to produce about 7 animal unit months of grazing in a normal year with recommended management.

Adapted grasses for this group include improved bermudagrass, lovegrass, and switchgrass. Adapted annual legumes include crimson clover, hop clover, rose clover, and hairy vetch.

Pasture Management Group 4. This group consists of Coarsewood and Yahola soils in map units CoA and YaB. They have a moderate capacity to hold water for plant growth, a minor limitation.

These soils may become droughty during long dry periods, reducing production in some years. They recover well if they are not overgrazed and good fertility levels are maintained. Group 4 soils can be expected to produce about 7 animal unit months of grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, common bermudagrass, old world bluestem, kleingrass, and switchgrass. Bigbee berseem clover is the best of the adapted annual legumes because of its tolerance of soils having a high pH value. Alfalfa, a perennial legume, is also adapted to high pH soils; however, intensive management is required.

Pasture Management Group 5. This group consists of Gasil, Lexton, Rader, Spiller, Tabor, and Uhland soils in map units GbC, LeB, RaB, SpB, TaA, and Ua.

In some years, droughtiness can reduce production; however, these soils recover well if they are not overgrazed and good fertility levels are maintained. Erosion can be a problem in sloping areas if adequate cover is not maintained. Group 5 soils are expected to yield 7 animal unit months of grazing in a normal year with recommended management.

Grasses adapted to this group include improved bermudagrass, bahiagrass, common bermudagrass, kleingrass, old world bluestem, and switchgrass. Adapted annual legumes include crimson clover, arrowleaf clover, subterranean clover, rose clover, and hairy vetch.

Pasture Management Group 6. This group includes Burleson and Luling soils in map units BuA, BuB, BuC, LuB, and LuC. Limitations include very slow permeability and the clayey surface layer. The potential production of this group is about 6 animal unit months of grazing in a normal year with recommended management.

Soils in group 6 are difficult to prepare for seeding or sprigging, especially if moisture conditions are not ideal. During dry periods these soils may become droughty, which reduces production. Care should be taken to avoid overgrazing during times of drought. If adequate cover is not maintained on steeper slopes, erosion can be a problem. Agricultural chemicals having high runoff potential should not be used on sloping clayey soils unless no suitable substitute is available.

Adapted grasses for these soils include improved bermudagrass, kleingrass, bahiagrass, common bermudagrass, old world bluestem, and switchgrass. Adapted annual legumes include crimson clover, subterranean clover, rose clover, and hairy vetch.

Pasture Management Group 7. This group consists of Belk and Ships soils in map units BaA, ShA, and ShB. Limitations include very slow permeability and the clayey surface layer. These limitations reduce this group's potential for production to about 6 animal unit months of grazing in a normal year with recommended management.

Group 7 soils are difficult to prepare for seeding or sprigging, especially if moisture conditions are not ideal. During dry periods these soils can become droughty. Care should be taken to avoid overgrazing during times of drought.

Adapted grasses include improved bermudagrass, common bermudagrass, old world bluestem, kleingrass, and switchgrass. Bigbee berseem clover is the best of the adapted annual legumes because of its tolerance of soils having a high pH value.

Pasture Management Group 8. This group includes Axtell, Crockett, Gredge, and Normangee soils in map units AxB, CrB, GrB, and NoC. Very slow permeability is a major limitation of the soils in this group. A moderate capacity to hold moisture for plant growth is a minor limitation.

Early in the growing season, excess water held in the surface layer can cause delays in seedbed preparation and in establishment of new stands. Droughtiness can affect establishment later in the season, reducing production of established stands in most years. These soils recover moderately well from drought if not overgrazed and fertility is maintained. The potential production of this group is about 6 animal unit months of grazing in a normal year with recommended management.

Adapted grasses for these soils include improved bermudagrass, kleingrass, bahiagrass, common bermudagrass, old world bluestem, and switchgrass. Adapted annual legumes include crimson clover, subterranean clover, rose clover, and hairy vetch.

Pasture Management Group 9. This group consists of Boonville, Mabank, and Wilson soils in map units BoB, MaA, WzA, and DwA. Very slow permeability is a major limitation. They have a moderate capacity to hold moisture for plant growth, which is a minor limitation.

During the time of year when the soils are wet, planting and establishing forage plants can be delayed, resulting in failure. In addition, the growth of established stands can be inhibited. These soils can become droughty during dry periods, however, they can recover moderately well from drought if not overgrazed and if adequate fertility is maintained. Potential annual production for group 9 is about 5 to 6 animal unit months of grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, bahiagrass, common bermudagrass, kleingrass, old world bluestem, and switchgrass. Adapted annual legumes include ball clover, subterranean clover, and hairy vetch.

Pasture Management Group 10. This group consists of Gaddy soils in map unit Ga. Gaddy soils are frequently flooded for brief periods. Flooding does not limit the production of pasture and hay; however, it can briefly delay grazing or hay harvest. Storing hay on these soils for extended periods is not recommended because of the risk of loss or damage in the event of flooding. A major limitation is a low capacity to hold water for plant growth.

Flooding or drought can delay planting or cause failure of a newly planted stand in some years. This soil is likely to be very droughty during dry periods throughout the year. In some years, droughtiness is offset by flooding. The coarse texture of the surface layer and the permeable subsoil can cause nutrient leaching, particularly nitrogen. Applying more nutrients than the plants need is not recommended. Agricultural chemicals having a high potential for leaching should not be used on these soils unless no suitable substitute is available. Gaddy soils can be expected to produce about 5 animal unit months of grazing in a normal year with recommended management.

Adapted grasses for this group include improved bermudagrass, common bermudagrass, and switchgrass. Adapted annual legumes include crimson clover, arrowleaf clover, rose clover, and hairy vetch.

Pasture Management Group 11. This group includes Rehburg and Shiro soils in map units ReB and SkB. These soils have low capacity to hold water for plant growth, a major limitation. Rehburg soils have very slow permeability and Shiro soils are moderately deep to bedrock. These are minor limitations.

Droughtiness slows establishment of new stands, occasionally causing failure. Droughty periods throughout the year affect production for established stands. These soils will recover from drought rapidly if not overgrazed and if adequate fertility is maintained. Potential annual production for group 11 is about 5 animal unit months of grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, common bermudagrass, bahiagrass, lovegrass, and switchgrass. Adapted annual legumes include arrowleaf clover, crimson clover, hairy vetch, and hop clover.

Pasture Management Group 12. This group consists of Kurten soils in map units KuC and KuD2. Very slow permeability and low capacity to hold water for plant growth are limitations for these soils. In addition, Kurten soil that is moderately sloping is subject to the hazard of erosion.

Droughtiness slows establishment of new stands and limits production during dry periods throughout the year. These soils can recover moderately well from drought if not overgrazed and fertility is maintained. Very strong acidity limits the availability of applied nutrients. Adequate applications of lime are needed during the time when plants are being established. Additional applications are applied as needed to maintain the minimum pH for the selected grass. Erosion can be a problem during establishment periods if adequate cover is not maintained on steeper slopes. The potential production for this group is 4 to 5 animal unit months grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, bahiagrass, common bermudagrass, kleingrass, and switchgrass. If pH is below 5.5, legumes will not grow well; therefore, overseeding these soils is probably not cost-effective unless a liming program has been followed.

Pasture Management Group 13. This group consists of Kaufman, Roetex, and Zilaboy soils in map units Ka, Rr, and Zb. The hazard of flooding and very slow permeability are limitations. Group 13 soils are marginal soils to manage for pasture.

These soils are difficult to prepare for seeding or sprigging, because they are often too wet to prepare a good seedbed. Wetness and flooding can cause slow establishment or failure of new seedlings. Long wet periods reduce productivity in some years. Delays of hay harvest and disruption of grazing operations are common during and after periods of flooding. Storing hay on these soils is not recommended because of the risk of loss or damage. The potential production for this group is about 4 animal unit months grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, common bermudagrass, bahiagrass, old world bluestem, dallisgrass, johnsongrass, tall fescue, and switchgrass. The legumes best adapted are white clover, bur clover, and singletary pea. Most other legumes require better drainage.

Pasture Management Group 14. This group includes Arol, Zack, and Zulch soils in map units ArB, ZaB, and ZuB. Their limitations are very slow permeability, low capacity to hold moisture for plant growth, and moderate soil depth.

Droughtiness causes slow establishment and possible failure of grass stands. It also reduces production of established stands during dry periods throughout the year. These soils will recover from drought moderately well if not overgrazed and fertility is maintained. Erosion can be a problem on slopes if adequate cover is not maintained. Production potential of this group is about 4 animal unit months grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, bahiagrass, common bermudagrass, kleingrass, old world bluestem, and switchgrass. Adapted legumes include crimson clover, arrowleaf clover, subterranean clover, rose clover, and hairy vetch.

Pasture Management Group 15. This group includes Arenosa and Eufaula soils in map units AaB and EuB. Low and very low capacity to hold water for plant growth and rapid permeability are major limitations.

Droughtiness slows establishment and occasionally causes failure of new stands. Production from established stands is affected by droughty periods throughout the year. These soils will recover from drought rapidly if not overgrazed and adequate fertility is maintained. Nutrient leaching, particularly nitrogen, can be a problem because of the coarse surface texture and permeable subsoil. Applying nutrients in excess of annual needs is not recommended. Agricultural chemicals having a high potential for leaching should not be used on these soils unless no suitable substitute is available. Potential annual production for this group is about 3 to 4 animal unit months grazing in a normal year with recommended management.

Grasses adapted to the soils in this group include improved bermudagrass, lovegrass, and switchgrass. Adapted annual legumes include crimson clover, hop clover, and hairy vetch.

Pasture Management Group 16. This group includes Burlewash, Jedd, and Singleton soils in map units BwC, JeD, and SoB. Major limitations for Burlewash and Singleton soils are very slow permeability, low capacity to hold water for plant growth, and low pH. Moderate soil depth is also a minor limitation. In addition, the hazard of erosion is a limitation for the Jedd soil. These soils are marginal for the production of pasture and hay. Establishing and maintaining pasture grasses on these soils can be economically unfeasible.

Droughtiness causes slow establishment or possible failure of new stands. Established stand production can be reduced during dry periods in most years. The very strong acidity of the soil can limit the availability of applied nutrients. Adequate applications of lime are needed while the grass is being established and additional applications are needed to maintain the minimum pH for the selected grass. The slope of some of these soils can make management difficult. Erosion can be a problem during the establishment period if adequate cover is not maintained on the steeper slopes. The potential production for this group is 3 animal unit months grazing in a normal year with recommended management.

Adapted grasses include improved bermudagrass, bahiagrass, common bermudagrass, kleingrass, and switchgrass. If pH is below 5.5 legumes do not grow well. Overseeding these soils may not be cost-effective unless a liming program has been followed.

Pasture Management Group 17. This group includes Burlewash, Cadelake, Gladewater, Jedd, Koether, and Sumpf soils in map units BwE2, BxG, CaA, Gd, JeE, JsF, and Su. These soils are not suitable for the production of pasture and hay. Their limitations make establishing and maintaining pasture grasses economically unfeasible. For the Burlewash, Jedd, and Koether soils very low and low available water capacity, slope, and hazard of erosion are major limitations. For the Jedd and Koether soils, stones is an additional major limitation. Wetness and long duration flooding are the main limitations for the Cadelake, Gladewater, and Sumpf soils.

Rangeland

Homer Sanchez, state range conservationist, Natural Resources Conservation Service, Temple, Texas, prepared this section.

Rangeland is the land on which the native vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. In areas that have similar climate and topography, the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between soils, vegetation, and water. Rangeland, or native grassland, receives no regular or frequent cultural treatment, such as fertilizer or tillage.

About 294,878 acres, or 70 percent of Burleson County, is classified as rangeland. Much of the acreage is abandoned cropland or pastureland. Native grasses were never properly restored in most of these areas and forage quality is poor. Areas that were never converted to other uses are mostly in small tracts of 25 acres or less. In most of these areas, productivity is reduced because past management practices caused a gradual decline in range condition. Most of the rangeland in Burleson County is in poor to fair condition. Some of the dominant grasses are Texas wintergrass, dropseed, windmillgrass, threeawn, little bluestem and some introduced grasses, such as King Ranch bluestem and common bermudagrass, which have invaded or survived prior management. Honey mesquite is the dominant woody invader in abandoned cropland or pastureland. Species of paspalum dominate many areas having loamy soils. Texas wintergrass and meadow dropseed are predominant in many areas of clayey soils.

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

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2	5	12	20	25	8	5	10	8	3	1

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

Few ranchers depend exclusively on rangeland to feed livestock. Range vegetation often contributes significant amounts of forage during winter months, but it is supplemented by protein concentrates and pastures of small grain crops.

Ecological Sites

Soils that produce about the same kinds, amounts, and proportions of forage are grouped into an ecological site. An ecological site is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff, that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of a site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index, rangeland trend, and rangeland health. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Rangeland health is a determination of how the ecological processes on an ecological site are functioning. Ecological processes evaluated include the water cycle, nutrient cycle, and energy flow. Further information about the range similarity index, rangeland trend, and rangeland health is available in chapter 4 of the "National Range and Pasture Handbook" (http://www.ftw.nrcs.usda.gov/glti/NRPH.html).

Nearly all plant communities have undergone changes over time. Many years of continuous livestock grazing, the absence of fire, the invasion of plants that were not originally in the plant community, and climatic events, such as major droughts, have all interacted to affect changes in the vegetation on rangeland.

Abnormal disturbances that change the potential natural plant community include repeated overuse by livestock, excessive burning, erosion, and plowing. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed at a severity that does not allow for recovery. Under these conditions, less desirable plants, such as annuals and weed-like plants, can increase. Usually, these degradation processes take place over many years. If the plant community and soils have not degraded significantly, high quality native plants may return, with proper grazing management.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Optimum production of livestock and forage on rangeland is obtained primarily by managing the time of grazing and limiting the amount of forage removed. The green parts of plants manufacture food for growth and store part of it for use in re-growth and seed production.

Seed sources of desirable vegetation are eliminated following years of prolonged overuse of rangeland. In such instances, vegetation can be reestablished by applying one or a combination of the following practices: mechanical or chemical treatment, range seeding, fencing, water development, prescribed burning, or other treatments to revitalize stands of native plants. Thereafter, deferred grazing, proper grazing use, and planned grazing systems must be applied to maintain and improve the range. Grazing management and follow-up brush control for the purpose of maintenance should follow the implementation of physical practices. Table 7 shows, for each soil, the ecological site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils used as rangeland or are suited to that use are listed. An explanation of the column headings in the table follows.

An *ecological site,* sometimes called a range site, is indicated for each soil map unit listed. A description of each ecological site is at the end of this section.

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 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, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperature make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

The two major kinds of rangeland in Burleson County are in two Major Land Resource Areas (MLRAs). The mostly dark-colored, loamy and clayey soils are in the Texas Blackland Prairie MLRA. The climax plant community is a tall grass prairie with trees mostly along drainageways and in scattered motts on the uplands.

Sandy and loamy soils, many of which have a dense clayey subsoil, are in the Texas Claypan Area MLRA. The climax plant community is a post oak, blackjack oak savannah. Trees shade 15 to 20 percent of the mid to tall grass understory on the uplands and form dense shade along drainageways.

Following is a description of the 15 ecological sites in Burleson County.

Blackland Ecological site

The Burleson and Luling soils are in this site, which occurs only in the Blackland Prairie MLRA. The climax vegetation is a tall grass prairie with a few large live oak, elm, and hackberry trees along drainageways and in motts. The composition by weight is 85 percent grasses, 5 percent woody plants, and 10 percent forbs. This site has high natural fertility. Little bluestem, indiangrass, and big bluestem produce 75 percent of the forage in climax. Other grasses, such as switchgrass, sideoats grama, Texas wintergrass, Texas cupgrass, tall dropseed, Florida paspalum, and Virginia wildrye, make up the other 10 percent. Woody plants are live oak, elm, hackberry, bumelia, and coralberry. Many palatable forbs and legumes are native to the site.

Overgrazing by cattle eventually kills out tall grasses, such as big bluestem, indiangrass, switchgrass, and eastern gamagrass. They are replaced by silver bluestem, Texas wintergrass, tall dropseed, and other mid grasses. If grazing pressure continues, buffalograss, Texas grama, tumblegrass, annual weeds, and annual grasses will dominate the site and noxious brush species, such as mesquite, winged elm, Retama, baccharis, and huisache, will invade.

Clay Loam Ecological site

The Benchley soils are in this site, which occurs only in the Blackland Prairie MLRA. In pristine condition, this true tall grass prairie site is highly productive. The composition by weight is 90 percent grasses, 5 percent woody plants, and 5 percent forbs. Little bluestem dominates the site, constituting 40 to 50 percent of the total annual yield. Indiangrass, big bluestem, switchgrass, Virginia and Canada wildrye, and Florida paspalum make up about 30 percent. Sideoats grama, silver bluestem, low panicum, and Texas wintergrass make up about 15 percent. Short grasses make up about 5 percent. Woody plants include hackberry, elm, pecan, and oak. The primary forbs are Maximilian sunflower, Englemann-daisy, penstemon, bundleflower, and numerous other legumes.

Overgrazing brings about retrogression where tall grasses, such as bluestem, indiangrass, switchgrass, and Florida paspalum, decrease and are replaced by sideoats grama, silver bluestem, low panicum, Texas wintergrass, and tall dropseed. In a deteriorated condition, invader plants, such as threeawn, hairy grama, red lovegrass, Texas grama, buffalograss, tumblegrass, western ragweed, broomweed, prairie coneflower; and woody plants, such as mesquite, baccharis, yaupon, and hawthorn, dominate and total production potential is reduced.

Clayey Bottomland Ecological site

The Belk, Gladewater, Kaufman, Roetex, Ships, Sumpf, and Zilaboy soils are in this site, which occurs on the flood plains of major drainageways throughout the county. The climax plant community is a tall grass savannah. Oak, elm, hackberry, cottonwood, ash, black willow, some pecan, and other large trees make up about 30 percent canopy cover. The canopy is generally heavier along streams or drainageways. Cool-season grasses and sedges grow under the canopy, and warm-season grasses and forbs dominate the open areas. The composition weight is 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Sedges, Virginia wildrye, Canada wildrye, and rustyseed paspalum produce 15 percent of the composition by weight. Beaked panicum, switchgrass, indiangrass, vine mesquite, and Florida paspalum and others produce 50 percent. Buffalograss, long leaf uniola, knotroot bristlegrass, and other grasses produce about 5 percent. The forbs are tickclover, snoutbean, lespedeza, and gayfeather.

For livestock grazing, this is a preferred ecological site. If the site is grazed heavily and fire is suppressed, the warm-season grasses and forbs are reduced, allowing brush to form a dense canopy. Shade-tolerant grasses then dominate the understory and total usable forage is drastically reduced. Bermudagrass and buffalograss often invade closely grazed open areas.

Claypan Prairie Ecological site

The Boonville, Crockett, Davilla, Mabank, Normangee, Wilson, Zack, and Zulch soils are in this ecological site, which occurs in both the Blackland Prairie and the Claypan MLRAs. In climax condition, this is a true tall grass prairie site or very open savannah. Oak, elm, and hackberry trees are along drainageways or in motts. The composition weight is 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Little bluestem and indiangrass compose 65 percent of the climax plant community. Switchgrass, big bluestem, Virginia wildrye, Canada wildrye, Florida paspalum, sideoats grama, meadow dropseed, Texas wintergrass, and vine mesquite produce 15 percent. Purpletop, brownseed paspalum, longspike tridens, buffalograss, low panicum, fall switchgrass, and sedge make up 5 percent. Live oak, elm, hackberry, bumelia, coralberry, and an occasional post oak make up 5 percent of the total production. Many forbs, such as Maximilian sunflower, Engelmann-daisy, halfshrub sundrop, western indigo, and prairie clover, produce 10 percent of the composition.

Continued overgrazing decreases big bluestem, little bluestem, indiangrass, and switchgrass. Meadow dropseed, silver bluestem, sideoats grama, and Texas wintergrass increase. Finally, mesquite and pricklypear invade and buffalograss, Texas wintergrass, Texas grama, windmillgrass, and weedy forbs dominate the site.

Claypan Savannah Ecological site

The Arol, Axtell, Burlewash, Koether, Gredge, Kurten, and Singleton soils are in this ecological site, which occurs only in the Texas Claypan MLRA. The climax plant community is a post oak, blackjack oak savannah with trees shading 15 to 20 percent of the ground. The composition by weight is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

About 60 percent of the climax vegetation is made up of little bluestem, indiangrass, and brownseed paspalum. The other grasses are switchgrass, Florida paspalum, purpletop, low panicum, low paspalum, silver bluestem, tall dropseed, and Texas wintergrass. Woody plants include post oak, blackjack oak, elm, yaupon, hawthorn, and American beautyberry. Forbs include dayflower, bundleflower, sensitivebrier, tickclover, wild bean, and lespedeza.

If the site is grazed heavily or fire is suppressed, or both occur, resulting in retrogression, little bluestem, indiangrass, and switchgrass are replaced by brownseed paspalum, silver bluestem, arrowfeather threeawn, tall dropseed, purpletop, and low panicum. Woody plants, such as post oak, elm, yaupon, and hackberry, increase and form a dense canopy that suppresses grass and forb production.

Deep Redland Ecological site

The Lexton soil makes up this ecological site, which occurs only in the Texas Claypan MLRA. In pristine condition, this site is an oak savannah. Post oak and blackjack oak shade about 20 percent of the ground. The climax plant community consists of about 80 percent grasses, 15 percent woody plants and 5 percent forbs.

Little bluestem dominates the understory and may produce as much as 40 to 50 percent of the total annual production. Indiangrass and beaked panicum are subdominants and will produce about 20 percent of the production. In lesser amounts are big bluestem, Florida paspalum, purpletop, and longleaf uniola.

As retrogression occurs, woody plants often increase along with shade-tolerant grasses, such as sedge and uniola. Invaders to this site are broomsedge bluestem, red lovegrass, arrowfeather threeawn, frogfruit, bitter sneezeweed, broomweed, winged elm, sesbania baccharis, and persimmon. Grazeable forage declines considerably and shrub and woody production increases. All or part of this production may be unpalatable or out of reach of grazing animals.

Deep Sand Ecological site

The Eufaula and Padina soils make up this site, which occurs only in the Texas Claypan MLRA. The climax vegetation is a post oak, blackjack oak savannah with a 20 to 25 percent canopy. The understory consists of mid to tall grasses. The composition by weight is 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

Little bluestem makes up about 50 percent of the composition and indiangrass makes up about 10 percent. Also present in lesser amounts are purpletop, switchgrass, and sand lovegrass. Other grasses are low panicum, purple lovegrass, sand dropseed, brownseed paspalum, and splitbeard bluestem. Woody plants, such as blackjack oak and post oak, make up 10 percent of the composition. Other woody plants include shrubs, such as yaupon, hawthorn, and American beautyberry, which are the understory plants. Forbs include legumes, such as lespedeza, tickclover, and partridge pea.

As retrogression occurs, little bluestem, sand lovegrass, indiangrass, and purpletop decrease and low panicum, low paspalum, purple lovegrass, and woolysheath threeawn increase on the site. Oak and yaupon increase to form a dense canopy. The decreasing and increasing plants are finally replaced by red lovegrass, tumble lovegrass, crabgrass, red sprangletop, sandbur, brackenfern pricklypear, and queensdelight. Production of forage plants is reduced to nothing.

Loamy Bottomland Ecological site

The Asa, Coarsewood, Highbank, Sandow, Uhland, Weswood, and Yahola soils are in this ecological site, which is on the flood plain of drainageways throughout the county. The climax plant community is a tall grass savannah with trees shading 30 to 40 percent of the ground. The overstory consists of oak, pecan, hackberry, elm, cottonwood, hickory, and ash trees. Understory plants are hawthorn, greenbrier, honeysuckle, grapes, and peppervine. Cool-season grasses and sedges dominate the shaded areas, while warm-season grasses dominate the open areas. The composition by weight is 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Virginia wildrye, sedge, and rustyseed paspalum grow in the shaded and wet areas. They make up 25 percent of the composition. Switchgrass, beaked panicum, indiangrass, big bluestem, little bluestem, eastern gamagrass, vine mesquite, and purpletop grow in the open areas and make up 40 percent of the plant community. Redtop panicum, gaping panicum, low panicum, uniola, buffalograss, knotroot bristlegrass, Texas wintergrass, and other grasses make up 10 percent. The forbs are tickclover, lespedeza, snoutbean, partridge pea, and gayfeather.

For livestock grazing, this is a preferred site. If the site is grazed heavily and fire is suppressed, warm-season grasses and forbs decrease and the tree and brush canopy increases. Shade-tolerant grasses and forbs then dominate the herbaceous production, and forage production is drastically reduced.

Sandy Ecological site

The Rehburg, Robco, and Silstid soils are in this ecological site, which occurs only in the Texas Claypan MLRA. The climax vegetation is an open savannah of post oak and blackjack oak, which shade 20 to 25 percent of the ground. Predominantly tall grasses cover the interspaces. The composition by weight is 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

About 50 percent of the composition is little bluestem. Indiangrass makes up 10 percent. Switchgrass, beaked panicum, sand lovegrass, purpletop, and brownseed paspalum total 10 percent. Other grasses are fringeleaf paspalum, purple lovegrass, tall dropseed, splitbeard bluestem, and low panicum. Post oak and blackjack oak make up about 10 percent of the total annual production. Woody plants in the understory are hawthorn, American beautyberry, greenbrier, yaupon, and berry vines. The forbs are lespedeza, tickclover, sensitivebrier, snoutbean, tephrosia, partridge pea, and western ragweed.

When the site is continuously overgrazed and natural fires are suppressed, taller grasses are grazed out or shaded out, or both, by an increasing canopy of woody plants. The little bluestem, indiangrass, and switchgrass are replaced by brownseed paspalum, tall dropseed, fall witchgrass, and other increasing plants. They, in turn, are grazed out and replaced by red lovegrass, yankeeweed, bullnettle, snakecotton, and croton. Other invading plants are broomsedge bluestem, smutgrass, sandbur, pricklypear, queensdelight, beebalm, pricklypoppy, baccharis, and waxmyrtle. Woody plants increase and invade to form dense thickets.

Sandy Loam Ecological site

The Chazos, Gasil, Rader, Shiro, Silawa, Spiller, and Tabor soils are in this ecological site, which occurs only in the Texas Claypan MLRA. The climax plant community is a post oak and blackjack oak savannah with a 20 to 25 percent canopy. The understory consists of mid and tall grasses and is dominated by little bluestem, which makes up 50 percent of the composition. The total composition by weight is 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

Little bluestem is the dominant grass and indiangrass is the next dominant grass, making up about 10 percent. Eastern gamagrass, switchgrass, big bluestem, beaked panicum, and longleaf uniola make up 10 percent of the total composition, and numerous other grasses make up another 10 percent. Post oak and blackjack oak make up about 10 percent of the total annual production, and numerous other woody plants include elm, yaupon, greenbrier, American beautyberry, and berry vines. The forbs include Englemann-daisy, gayfeather sensitivebrier, and native legumes.

If wildfires are suppressed and if overgrazing continues, this ecological site deteriorates. A woody canopy increases and tall grasses, such as little bluestem, indiangrass, big bluestem, and eastern gamagrass, decline. These plants are replaced by an increase in plants such as brownseed paspalum. If overgrazing persists, the site deteriorates to thickets of oak and brush, annual grasses, forbs, and carpetgrass.

Sandy Bottomland Ecological site

The Gaddy soil is in this site, which is on the flood plains of the Brazos River. The climax vegetation is a tall grass savannah with as much as a 20 percent canopy. Cottonwoods, sycamores and other large trees dominate the overstory. Little bluestem, indiangrass, and switchgrass make up about 60 percent of the herbaceous plant community. The composition by weight is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

If regression occurs as a result of heavy grazing, the better grasses are replaced by less palatable plants, such as Pan-American balsamscale, knotroot bristlegrass, and red lovegrass. If abuse continues for many years, mesquite, grassbur, bullnettle, willows, and short grasses, such as hairy grama, increase significantly.

Sandstone Hills Ecological site

The Jedd soils are in this ecological site, which occurs only in the Texas Claypan MLRA. The climax plant community is made up of a savannah of moderate-size post oak, blackjack oak, and hickory trees in association with an open stand of mid to tall grasses. The composition by weight is 70 percent grasses, 10 percent forbs, and 20 percent woody plants.

Open areas are dominated by grasses, such as little bluestem, sideoats grama, tanglehead, and silver bluestem. Forbs, legumes, woody vines, and shrubs add variety to the climax plant community.

As retrogression occurs, the surface soil is compacted, increasing the amount of bare ground and making it susceptible to sheet erosion. The tall grasses decrease and are replaced by less palatable and robust plants, such as annual threeawn, red lovegrass, and gummy lovegrass. Understory brush, such as American beautyberry and yaupon, can invade the more wooded areas. The landscape can be beautifully enhanced with flowering plants, such as bluebonnets, Indian paintbrush, Liatris, and primroses. Unique to the site is the abundance of odd, egg-shaped rocks on the soil surface.

Very Deep Sand Ecological site

The Arenosa soil is in this ecological site, which occurs only in the Texas Claypan MLRA (fig. 15). The climax plant community is a savannah. Bluejack oak, blackjack oak, and hickory produce as much as a 30 percent canopy. Scattered yaupon and other shrubs make up the secondary canopy. The composition by weight is 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

In open areas the grass composition consists of about 35 percent little bluestem and pinehill bluestem. Mid and short grasses, such as red lovegrass, purple lovegrass, sand lovegrass, dropseed, and threeawn, occupy the interspaces between tall grasses, such as bluestem and indiangrass. Slender indiangrass, purpletop tridens, and longleaf uniola are dominant under tree canopies.

Grazing pressure causes a decrease in the tall grass vegetation and an increase in the mid and short grass plants. Low panicum, low paspalum, and woollysheath threeawn continue to flourish as overgrazing occurs. As a final result of continuous overuse, the areas beneath tree canopies deteriorate to bare ground or a sparse cover of small forbs and invader grasses, such as red sprangletop, sandbur, purple sandgrass, and curly threeawn. Shrub vegetation can increase to produce as much as a 60 percent canopy.

Wet Sandy Draw Ecological site

The Cadelake soil is in this ecological site, which occurs only in the Texas Claypan MLRA. The climax plant community is prairie and is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

About 70 percent of the climax plant community is switchgrass, vaseygrass, maidencane, little bluestem, indiangrass, and big bluestem. Other grasses include sedge, broomsedge bluestem, arrowfeather threeawn, rushes, scribner panicum, and low panicum. Forbs include aster, goldenrod, smartweed, ironweed, berry vines, greenbrier, honeysuckle, and willow.

With continued overuse, the tall grasses, such as bluestems, switchgrass, and maidencane, decrease and are replaced by less palatable and productive plants, such as broomsedge bluestem, arrowfeather threeawn, and sedge. If heavy use continues, woody plants, such as waxmyrtle, berry vines, greenbrier, yaupon, and honeysuckle, increase to form a dense canopy, especially along the outer boundaries of the site.

Figure 15.—Native vegetation is sparse on droughty soils, such as Arenosa fine sand, 1 to 5 percent slopes. It is in the Very Deep Sand range site.

Horticulture

Bill Weiderhold, district conservationist, Natural Resources Conservation Service, Caldwell, Texas, helped to prepare this section.

With the exception of watermelons and pecans, commercial production of fruits, vegetables, and nuts is a minor enterprise in Burleson County. Almost all production of fruits and vegetables is limited to small home gardens and orchards. Urban and rural families use most of the produce. Small amounts of surplus production are sold to grocery stores and fruit stands. Some attempts at commercial vegetable and peach production have been successful; however, dependable markets have not been established. Commercial pecan and watermelon production is an exception. Several hundred acres of watermelon are planted each year and about 1,500 acres of pecans are in production (fig. 16).

Many of the soils and the climate of Burleson County are well suited to fruit and vegetable production. Most vegetables, such as sweet corn, okra, peas, beans, tomatoes, carrots, cabbage, and cucumbers, are well adapted to the loamy and clayey soils of the Backland Prairie Major Land Resource Area, the sandy loams and sandy soils of the Claypan Major Land Resource Area, and the clayey and loamy soils of the Brazos River flood plain. Most vegetables are best adapted to loams and loamy fine sands. Heavy clays and deep sands have soil properties that limit production. Watermelons are the exception and are best adapted to sandy soils. Because of fungus and soil-borne diseases, watermelons are usually rotated with idle cropland or pastureland on a 3- to 5-year rotation. Because most vegetables do not produce adequate biomass to maintain soil organic matter, they should be rotated with high residue-producing crops or cover crops. Maintaining soil fertility and desirable pH by adding lime, soil amendments, manure, mulch, and by using cover crops is a necessity for optimum production.

Figure 16.—An area of Coarsewood silt loam, 0 to 1 percent slopes, rarely flooded. These soils are valued as sites for pecan production.

The potential for fruit production, such as peaches, plums, pears, and blackberries, is moderate. The greatest hazard for fruit production in Burleson County is the climate. Mild winters are often not cold enough for peaches to meet the minimum chill requirement for bloom buds to fully develop. Varieties with 700 or less hours of chill requirement should be selected. Late frost in the spring can damage fruit set of peaches, plums, pears, and berries. The gently sloping loamy fine sands in the Claypan Major Land Resource Area that have good internal drainage are best suited for fruit production.

Pecans are adapted to most of the soils in Burleson County with the exception of the deep sands, such as Arenosa and Padina soils, and the poorly drained soils, such as Cadelake, Gladewater, and Roetex soils. They are also not well adapted to moderately deep claypan soils, such as Burlewash, Singleton, Zack, and Zulch soils. The best soils for commercial production are the Coarsewood and Weswood soils of the Brazos River flood plain. Pecan trees are also used to a great extent for landscaping on home sites.

For dependable quality production of any vegetable, fruit, or nut, supplemental irrigation is needed for both home gardens and commercial production. Texas Cooperative Extension can provide recommendations for varieties adapted to Burleson County.

Christmas trees also have good production potential for Burleson County. The Virginia pine can be planted in most sandy and sandy loam soils that have a slightly acid pH. The Afghanistan pine can be planted in calcareous clay and clay loam soils that have a pH of 7 or higher.

Recreation

John C. Copeland, area resource conservationist, Natural Resources Conservation Service, Bryan, Texas, prepared this section.

Burleson County, with its location, climate, topography, highways, and natural resources, has a high potential for numerous outdoor recreational activities. The county is a little more than a 1-hour drive from Austin and 1.5-hour drive from Houston. Pleasant daytime temperatures and cool nights contribute to summer activity. The mean temperature and rainfall of the county are favorable when compared to the two major metropolitan areas. Pleasant temperatures and little snowfall are typical characteristics of the winter. Several cold fronts that are severe enough to restrict outside recreational activity for a few days move through the region in the winter. Rolling terrain and variety of vegetative patterns contribute to the visual quality.

Lake Somerville, a 11,460-acre reservoir, bounds the county on the southwest corner and provides multiple recreational opportunities including fishing, boating, swimming, camping, hiking, biking, and nature study. The Birch Creek Unit of the Lake Somerville State Recreation Area is in Burleson County. Several Corps of Engineer recreation areas are around the lake, including the Lake Somerville Wildlife Management Area. Private recreational areas are also available near the lake.

Several private lakes in the county provide recreational opportunities as well as the Brazos River and Yegua Creek.

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 and interpretations for dwellings without basements and for local roads and streets.

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

Mike Stellbauer, biologist, Natural Resources Conservation Service, Bryan, Texas, prepared this section.

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

Texas Parks and Wildlife Department has identified three major kinds of habitat in Burleson County: Post oak woods/grassland mosaic habitat, post oak woods habitat, and cropland habitat. In addition to these major habitats, bottomland hardwoods provide habitat along the Brazos River and its drainageways. Lake Somerville, farm ponds, and the Brazos River and its major tributaries including East Yegua and Davidson Creeks, provide aquatic habitat.

The post oak woods/grassland mosaic habitat and the post oak woods habitat generally are on upland soils, such as Arenosa, Burlewash, Padina, Robco, Silstid and Singleton soils, and are not specific to topography. Post oak, blackjack oak, black hickory, winged elm, Eastern red cedar, yaupon, greenbrier, rattan, sparkleberry, and coralberry comprise the woodland component. The grassland component can include native plants, such as little bluestem, yellow indiangrass, arrowfeather threeawn, lespedeza, western ragweed, croton, and tickclover; introduced species, such as coastal bermudagrass and bahiagrass; or a combination of both. White-tailed deer, fox squirrel, raccoon, opossum, bobcat, bobwhite quail, mourning dove, owls, hawks, woodpeckers, and songbirds may be in these habitats.

The quality of the habitat in woodland is influenced by the density of the canopy in the overstory and midstory and by livestock grazing management practices. As canopy cover increases, the diversity and quantity of understory plants decrease. Continuous livestock grazing, especially during the winter, decreases the quality and quantity of understory plants, such as greenbrier, rattan, and yaupon. Using selective thinning, creating openings, planting supplemental food plots, and using prescribed burning and proper grazing management are practices that can improve the quality of this habitat.

The quality of the habitat in grassland is related to the structure and diversity of the grassland. When a mixture of native grasses, legumes, forbs, vines, and shrubs is in this habitat, it provides fawning cover and forage for white-tailed deer and nesting, feeding, and loafing cover for bobwhite quail. Introduced grasses, such as bermudagrass or bahiagrass, tend to limit the plant diversity and structure needed for deer, quail, and mourning dove. Introduced bunchgrasses, such as kleingrass or switchgrass, tend to provide better structure and plant diversity. Practices that can improve the structure and diversity of grassland include providing selective annual disking and selective control of shrubs and trees, creating supplemental food plots, using prescribed burning, and using planned grazing management.

Navasota ladies'-tresses, a federally listed endangered plant, has been associated with the Burlewash and Singleton soils in the post oak woods/grassland mosaic habitat.

The Houston toad, a federally listed endangered animal, has been found in the post oak woods/grassland mosaic habitat and is associated with deep, sandy soils, such as Padina and Arenosa soils, and in the wet, sandy Cadelake soil.

Wildlife habitat associated with cropland is on the Brazos River flood plain, on uplands and terraces east to west across the county following Highway 21, and on terraces in the vicinity of Snook, Texas. Soils used for cropland on the Brazos River flood plain are Asa, Belk, Coarsewood, Highbank, Ships, Weswood, and Yahola soils. Soils on the uplands used for cropland include Benchley and Luling soils. Terrace soils include the Davilla, Burleson, and Wilson soils. Waste grains and seeds from corn and grain sorghum, along with associated forbs, such as croton, ragweed, and partridge pea, provide food for dove, quail, songbirds, and waterfowl. White-tailed deer and rabbits also find food and cover in the habitats associated with cropland. Annual cool-season forage crops, such as wheat, oats, and rye grass, provide food for deer, rabbits, geese, and cranes.

Several improvement practices are applicable to cropland habitats. They include retaining crop residues on the soil surface through the winter months, maintaining forbs, grasses, and shrubs in fence lines and along turn rows, providing unharvested rows of grain crops through the winter months, establishing cover crops of small grains or legumes, and constructing shallow water impoundments.

The bottomland hardwood habitat occurs on the flood plains and associated terraces of the drainageways. Gladewater, Kaufman, Ships, Sandow, Uhland, and Zilaboy soils are characteristic of flood plain soils. Associated plants include pecan, cedar elm, water and willow oaks, water hickory, cottonwood, ash, hackberry, black willow, yaupon, wax myrtle, baccharis, Alabama supplejack, greenbrier, and peppervine. Representative terrace soils include Chazos, Eufaula, and Silawa soils. Plants associated with the terrace soils include post oak, ash, water oak, sycamore, hackberry, yaupon, and American beautyberry.

These flood plains and terraces are some of the most productive wildlife lands in the county and provide habitat to migratory and resident waterfowl, white-tailed deer, feral hogs, beaver, raccoon, bobcat, gray and fox squirrels, woodpeckers, and songbirds. Water snakes, frogs, toads, turtles, and salamanders are also on the flood plains and terraces.

Improvement practices applicable to this habitat include selectively thinning of hardwoods, reforesting hardwoods where needed, properly managing livestock grazing, creating food plots, and installing structures to create shallow water areas for waterfowl.

Lakes, rivers, and creeks, along with the many farm ponds in the county, provide aquatic habitat for largemouth bass; channel, blue, and yellow catfish; crappie; and bluegill sunfish. Beaver, raccoon, blue and green herons, common and cattle egrets, wood ducks, mallards, scaup, and redhead ducks also use these aquatic habitats. Farm ponds also provide aquatic habitat for upland wildlife. Soils suitable for farm pond construction include Benchley, Crockett, Luling, Tabor, Zack, and Zulch soils. These ponds are usually stocked with largemouth bass, channel catfish, fathead minnows, and bluegill sunfish.

Farm ponds in Burleson County may require the application of agricultural limestone to ensure good productivity. Other practices useful in maintaining or improving quality pond habitat include aquatic weed control, fertilization, proper fish stocking and harvest, the installation of siphon or trickle tubes, and proper grazing use in the pond watershed.

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, grain sorghum, wheat, oats, and ryegrass.

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

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 indiangrass, bluestem, paspalum, and panicum.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, hawthorn, persimmon, dogwood, hickory, pecan, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, wild plum, mustang grape, and yaupon.

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 Russian-olive, wild plum, mustang grape, and yaupon.

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, waxmyrtle, 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, meadowlark, field sparrow, cottontail, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodpeckers, squirrels, gray fox, raccoon, feral hogs, and deer.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, doves, bobwhite quail, 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.

The table 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.

The table 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 the table 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; or 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 drainage, 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. The underlying material is not rated and should be evaluated during an onsite investigation. Excessive slope can affect the storage capacity of the reservoir area.

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

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 soil characteristics. These results are reported in tables 17, 18, and 19.

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

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

Engineering Index Properties

Table 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. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

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.

Depth to the upper and lower boundaries of each layer is indicated.

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.

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*, 6 to 9 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.

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 chiefly of deep and very 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 to very 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 the table 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 the table.

An *apparent water table* is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

A *perched water table* is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

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

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

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

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

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. The clay mineralogy of selected soils is given in table 19. 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 *(21)*.

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).

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

Bulk density—of less than 2 mm material, saran-coated clods, 1/3 bar (4A1d).

Water content—pressure extraction, percentage of ovendry weight of less than 2 mm material; 1/3 bar (4B1).

Extractable cations—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).

Cation-exchange capacity—sodium acetate, pH 8.2, steam distillation (5A8b).

Base saturation—sodium acetate, pH 8.2 (5C1).

Reaction (pH)—1:1 water dilution (8C1f).

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

Electrical conductivity—saturation extract (8A3a).

Exchangeable sodium percentage—(5B5b).

Clay mineralogy—x-ray diffraction (7A2I).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20, 22)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. 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 humid, 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 a 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-loamy, siliceous, 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" *(23)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(20)* and in "Keys to Soil Taxonomy" *(22)*. 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."

Arenosa Series

The Arenosa series consists of very deep, somewhat excessively drained, rapidly permeable soils on uplands. These gently sloping soils formed in thick beds of sand. Slopes range from 1 to 5 percent. The soils of the Arenosa series are thermic, uncoated Ustic Quartzipsamments (fig. 17).

Typical pedon of Arenosa fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.3 miles southwest on Texas Highway 21, 3.4 miles northwest on Farm Road 908, 160 feet north of road, in an area of wooded rangeland:

A—0 to 5 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grained; loose; many fine and few medium and coarse roots; very strongly acid; clear smooth boundary.

C1—5 to 20 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine and few medium and coarse roots; very strongly acid; gradual smooth boundary.

C2—20 to 43 inches; very pale brown (10YR 8/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; few fine, medium and coarse roots; very strongly acid; diffuse boundary.

C3—43 to 65 inches; very pale brown (10YR 8/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine and medium roots; very strongly acid; gradual smooth boundary.

C4—65 to 80 inches; very pale brown (10YR 8/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; few fine distinct yellowish brown (10YR 5/8) masses of iron accumulation in clusters 6 to 10 inches in diameter; very strongly acid.

Fine sand with less than 5 percent silt and clay extends to a depth of more than 80 inches.

The A horizon is brown, yellowish brown, pale brown, or light yellowish brown. Reaction ranges from very strongly acid to slightly acid.

The C horizons are light yellowish brown, pale brown, or very pale brown. Some pedons have few iron concentrations in shades of brown or yellow. Reaction ranges from very strongly acid to moderately acid.

Figure 17.—Profile of Arenosa fine sand, which formed in thick, sandy deposits.

Arol Series

The Arol series consists of moderately deep, moderately well drained, very slowly permeable soils that formed in interbedded tuffaceous sandstone and mudstone. These very gently sloping soils are on uplands. Slopes range from 1 to 3 percent. The soils in the Arol series are fine, smectitic, thermic Udic Paleustalfs.

Typical pedon of Arol fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 1361 and Texas Highway 36 in Somerville, 4.7 miles northeast on Farm Road 1361, 1.4 miles southeast on County Road 433, 0.9 mile south on private farm road, 90 feet southwest in rangeland:

A—0 to 5 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; hard, friable; common fine roots; moderately acid; abrupt smooth boundary.

Bt1—5 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; very hard, very firm; common fine roots; cracks filled with A horizon material; thin continuous clay films on faces of peds; few distinct pressure faces; slightly acid; gradual smooth boundary.

Bt2—10 to 24 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium angular blocky structure; very hard, very firm; few fine roots; thin continuous clay films on faces of peds; few distinct pressure faces; moderately acid; clear smooth boundary.

Cr—24 to 38 inches; light gray (2.5Y 7/2) weakly cemented tuffaceous sandstone interbedded with mudstone; massive; extremely hard, extremely firm; few fractures filled with Bt horizon material and roots.

The thickness of the solum and the depth to a paralithic contact ranges from 20 to 40 inches. Clay content of the upper 20 inches of the Bt horizons is 40 to 45 percent.

The A horizon is grayish brown, light brownish gray, or gray. Reaction ranges from strongly acid to slightly acid.

The Bt horizons are very dark gray, dark gray, gray, or very dark grayish brown. Reaction ranges from strongly acid to slightly alkaline.

Some pedons have a BC horizon that is Bt horizon material mixed with fragments of strongly cemented tuffaceous sandstone. Reaction ranges from slightly acid to slightly alkaline.

The Cr horizon is weakly to strongly cemented tuffaceous sandstone and mudstone.

Asa Series

The Asa series consists of very deep, well drained, moderately permeable soils that formed in calcareous, loamy alluvial sediments. These very gently sloping soils are on natural levees adjacent to drainageways within the flood plain of the Brazos River. Slopes range from 1 to 3 percent. The soils of the Asa series are fine-silty, mixed, hyperthermic Fluventic Hapludolls.

The Asa soils in this survey area are a taxadjunct to the Asa series because they have an ustic moisture regime and a thermic temperature regime. Behavior and use and management of these soils are similar to that of the Asa series.

Typical pedon of Asa silty clay loam, 1 to 3 percent slopes, rarely flooded; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.4 miles southeast on Farm Road 2155, 1.3 miles east on Farm Road 1361, 400 feet northeast on County Road 276, 1.9 miles north on private road, in an area of cropland:

Ap—0 to 6 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, firm; common fine roots; common wormcasts; neutral; clear smooth boundary.

A—6 to 19 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, firm; common fine roots; common wormcasts; neutral; clear smooth boundary.

Bw1—19 to 34 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium angular blocky; slightly hard, friable; few very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—34 to 67 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; moderate coarse prismatic structure parting to weak medium angular blocky; slightly hard, friable; reddish brown (5YR 4/4) coatings on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw3—67 to 80 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine angular blocky; slightly hard, friable; few thin bedding planes of reddish yellow (5YR 6/6) very fine sandy loam; strongly effervescent; moderately alkaline.

The thickness of the solum is more than 80 inches. Organic matter decreases irregularly with depth. Clay content of the 10- to 40-inch control section ranges from 18 to 35 percent. Organic carbon content ranges from 0.3 to 0.5 at a depth of 50 inches.

The A horizon is very dark grayish brown, very dark gray, dark brown, or dark reddish brown. Reaction ranges from neutral to moderately alkaline. The soil is typically noneffervescent.

The Bw horizon is reddish brown or yellowish red silty clay loam or silt loam. Faint evidence of bedding planes is in some pedons. Reaction is moderately alkaline. The soil is strongly effervescent.

Axtell Series

The Axtell series consists of very deep, moderately well drained, very slowly permeable soils that formed in slightly acid to alkaline clayey sediments. These gently sloping soils are on convex stream terraces and on relict Pleistocene terraces on uplands. Slopes range from 1 to 4 percent. The soils of the Axtell series are fine, smectitic, thermic Udertic Paleustalfs.

Typical pedon of Axtell fine sandy loam, 1 to 4 percent slopes; from the intersection of Texas Highway 36 and Farm Road 1361 in Somerville, 1.5 miles northwest on Texas Highway 36, 3.7 miles northeast on County Road 423, 1 mile southeast on private road, 200 feet southwest of road, in an area of hayland:

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; common fine roots; strongly acid; clear smooth boundary.

E—5 to 9 inches; very pale brown (10YR 8/3) fine sandy loam, very pale brown (10YR 7/3) moist; weak fine granular structure; hard, very friable; common fine roots; few fine faint brownish yellow masses of iron accumulation; strongly acid; clear wavy boundary.

Bt—9 to 18 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium angular blocky structure; extremely hard, very firm; common fine roots; few continuous clay films on faces of peds; few pressure faces; common medium prominent light brownish gray (10YR 6/2) iron depletions; very strongly acid; gradual wavy boundary.

Btss1—18 to 31 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; moderate medium prismatic structure; extremely hard, very firm; continuous clay films on faces of peds; common small slickensides; few fine roots; few calcium carbonate concretions; common medium prominent red (2.5YR 4/8) iron accumulations; strongly acid; gradual wavy boundary.

Btss2—31 to 44 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; extremely hard, very firm; very few fine roots; few cracks as much as 0.5-inch wide; common pressure faces; common small slickensides; few medium distinct light reddish brown (2.5YR 6/4) iron accumulations; slightly acid; gradual wavy boundary.

Btss3—44 to 56 inches; yellow (2.5Y 8/6) clay, yellow (2.5Y 7/6) moist; weak medium prismatic structure; extremely hard, very firm; very few fine roots; few pressure faces; common small slickensides; few fine concretions of calcium carbonate; few fine faint brownish yellow (10YR 6/6) iron accumulations; slightly acid; gradual wavy boundary.

BCk—56 to 80 inches; brownish yellow (10YR 6/6), yellowish brown (10YR 5/6) clay, moist; weak fine angular blocky structure; extremely hard, very firm; common large masses of calcium carbonate; few fine distinct light brownish gray (10YR 6/2) iron depletions; slightly alkaline.

The thickness of the solum is more than 80 inches. Clay content of the upper 20 inches of the Bt horizon is 40 to 50 percent. COLE ranges from 0.07 to 0.10 in the upper 20 inches of the Bt horizon and the PLE is more than 2.5 inches in the upper 50 inches of the soil.

The combined thickness of the A and E horizons averages less than 10 inches in more than 50 percent of the pedon, but can be as much as 15 inches over subsoil troughs. The A horizon is dark brown, brown, or dark yellowish brown. The E horizon is light yellowish brown, pale brown, or very pale brown. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is red, reddish brown, or yellowish red. Redoximorphic features in shades of yellow, brown, or gray range from few to common. Reaction is very strongly acid or strongly acid.

The Btss horizons have a matrix in shades of red, brown, yellow, gray, or olive and are clay loam or clay. Reaction ranges from strongly acid to slightly acid. Calcium carbonate concretions or masses range from none to few.

The BCk horizon has a matrix in shades of gray, yellow, or brown clay loam or clay. Reaction ranges from moderately acid to moderately alkaline. Calcium carbonate concretions and masses range from none to common.

Belk Series

The Belk series consists of very deep, well drained, very slowly permeable soils on flood plains of the Brazos River. These nearly level soils formed in calcareous clayey sediments underlain by loamy sediments. Slopes are 0 to 1 percent. The soils of the Belk series are fine, mixed, thermic, Entic Hapluderts (fig. 18).

Typical pedon of Belk clay, 0 to 1 percent slopes, rarely flooded; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 3.4 miles northeast on Farm Road 60, 8.4 miles southeast on Farm Road 50, 2.1 miles northeast on County Road 440, 100 feet north, in an area of cropland:

Ap—0 to 6 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate coarse angular blocky structure; very hard, very firm; very few fine pores; few fine and medium roots; common pressure faces; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bss—6 to 16 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate very coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm; few fine pores; few fine and medium roots; few 0.5-inch wide cracks; common large slickensides; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—16 to 22 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure parting to moderate very fine subangular blocky; very hard, very firm; few fine pores; few fine and very fine roots; few wormcasts; 30 percent masses of brown (7.5YR 5/4) and 15 percent masses of dark brown (7.5YR 3/2); violently effervescent; moderately alkaline; clear wavy boundary.

2Bw/CB—22 to 28 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, friable; few fine pores; few very fine roots (2Bw part); about 25 percent brown (7.5YR 5/4) very fine sandy loam with weak coarse subangular blocky structure (CB part); fine bedding planes in CB material; violently effervescent; moderately alkaline abrupt wavy boundary.

2C1—28 to 33 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) moist; massive; soft, friable; few very fine pores; very few fine roots; common thin bedding planes; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C2—33 to 54 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; massive; soft, friable; very few very fine pores; very few fine roots; common thin and medium bedding planes composed of very fine sandy loam; few thin bedding planes composed of dark brown (7.5YR 3/2) silty clay loam; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C3—54 to 77 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; massive; thin and medium bedding planes composed of very fine sandy loam; few thin bedding planes composed of dark brown (7.5YR 3/2) silty clay loam; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C4—77 to 80 inches; light brown (7.5YR 6/4) loamy very fine sand, brown (7.5YR 5/4) moist; massive; soft, very friable; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 32 inches, which corresponds to the combined thickness of the A and B horizons. However, depth of alluvial sediments is more than 80 inches. Clay content of the upper clayey part ranges from 40 to 60 percent. The loamy lower part has an absolute decrease in clay of 25 percent or more. When dry, cracks as much as 1 inch wide extend from the surface to a depth of more than 12 inches. Slickensides begin at a depth of 6 to 16 inches. Reaction is moderately alkaline. The soil is slightly to violently effervescent throughout.

The A horizon is reddish brown, dark brown, or brown. Some pedons have a thin surface horizon less than 7 inches thick with value and chroma less than 3.5.

The Bss horizon is brown or dark brown clay or silty clay. Slickensides range from few to common.

The Bw horizons are dark brown, dark reddish brown, or reddish brown. Some pedons do not have a Bw horizon.

The 2C horizons are mainly very fine sandy loam, loam, or silt loam in shades of brown. Bedding planes, as much as 4 inches thick of fine sandy loam, silty clay loam, or silty clay are common in some subhorizons. Some pedons have buried A or B horizons that may or may not be calcareous below a depth of 40 inches.

Figure 18.—Profile of Belk clay.

Benchley Series

The Benchley series consists of very deep, moderately well drained, slowly permeable soils that formed in clayey sediments. These gently sloping soils are on uplands. Slopes range from 1 to 5 percent. The soils of the Benchley series are fine, smectitic, thermic Udertic Argiustolls.

Typical pedon of Benchley loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.85 miles northeast on Texas Highway 21, 0.65 mile northwest and west on County Road 212, 0.38 mile west on private farm road and 1,200 feet north of road, in an area of rangeland:

A—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; hard, firm; common fine roots; about 1 percent rounded ironstone pebbles; moderately acid; clear smooth boundary.

Bt1—10 to 16 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm; common fine roots; few pressure faces; common fine wormcasts; common fine iron-manganese concretions; about 3 percent rounded ironstone pebbles; common fine distinct yellowish red (5YR 4/6) masses of iron accumulation; moderately acid; gradual smooth boundary.

Bt2—16 to 21 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; few clay films on faces of peds; few small slickensides; common fine prominent dark red (2.5YR 3/6) masses of iron accumulation; moderately acid; gradual smooth boundary.

Btss—21 to 49 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; cracks 0.5-inch wide extend through the layer; few fine concretions of calcium carbonate; few fine concretions of iron-manganese; very few fine roots; continuous clay films on faces of peds; common medium slickensides; common medium prominent yellowish red (5YR 4/6) masses of iron accumulation; slightly acid; gradual smooth boundary.

BCk—49 to 62 inches; yellow (2.5Y 7/8) clay, olive yellow (2.5Y 6/8) moist; interbedded with thin layers of gray (10YR 6/1) shale; weak medium prismatic structure parting to weak medium angular blocky; extremely hard, very firm; common fine concretions of calcium carbonate; less than 1 percent rounded ironstone pebbles; few small slickensides; slightly alkaline; gradual smooth boundary.

C—62 to 80 inches; gray (10YR 6/1) stratified shale and thin discontinuous layers of brownish yellow (10YR 6/8) sandstone; massive; extremely hard, very firm; few calcium sulfate crystals; common medium prominent red (2.5YR 4/8) masses of iron accumulation; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. Ironstone pebbles range from 0 to 5 percent in the upper part. Cracks at least 0.5-inch wide extend to a depth of 20 inches or more when the soil is dry. The clay content in the upper 20 inches of the Bt horizon is 40 to 55 percent.

The A horizon is very dark gray, dark grayish brown, very dark grayish brown, or dark brown. Reaction ranges from moderately acid to neutral.

The Bt horizons are very dark gray, dark grayish brown, dark brown, brown, light yellowish brown, or olive brown. Redoximorphic features in shades of brown, gray, red, or yellow range from few to many. These horizons are clay loam or clay. Slickensides range from none to few. Reaction ranges from moderately acid to neutral.

The Btss horizon has a matrix in shades of yellow, brown, or olive. Redoximorphic features in shades of red, yellow, brown, olive, or gray range from few to many. Slickensides range from few to common. Reaction ranges from moderately acid to neutral.

The BCk horizon, or BCtk horizon in some pedons, has a matrix in shades of yellow, brown, or olive. Redoximorphic features in shades of red or gray range from few to common. This horizon is clay loam or clay. Reaction ranges from slightly acid to moderately alkaline. Calcium carbonate concretions and calcium sulfate crystals range from none to common.

The C horizon is stratified shale and sandstone. Redoximorphic features in shades of yellow, brown, gray, or olive range from few to many. Reaction ranges from slightly acid to moderately alkaline.

Boonville Series

The Boonville series consists of very deep, somewhat poorly drained, very slowly permeable soils that formed in colluvium and alluvium derived from slightly weathered materials of the Yegua Formation. These very gently sloping, slightly concave soils are on uplands. Slopes range from 1 to 3 percent. The soils of the Boonville series are fine, smectitic, thermic Ruptic-Vertic Albaqualfs.

Typical pedon of Boonville fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 60 and Farm Road 111 in Deanville, 2.85 miles southeast on Farm Road 60, 200 feet east, in an area of improved pasture:

Ap—0 to 5 inches; light gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; common fine roots; few fine distinct yellowish brown (10YR 5/4) masses of iron accumulations; strongly acid; clear smooth boundary.

A—5 to 17 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; common fine roots; strongly acid; abrupt wavy boundary.

Btg1—17 to 26 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; very hard, very firm; common fine roots; continuous clay films on faces of peds; few cracks 0.5-inch wide; common pressure faces; few small slickensides; common fine distinct yellowish brown (10YR 5/8) and few medium prominent red (2.5YR 4/8) masses of iron accumulation; moderately acid; clear smooth boundary.

Btg2—26 to 39 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; continuous clay films on faces of peds; common pressure faces; few small slickensides; neutral; clear smooth boundary.

Btg3—39 to 54 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm; few fine roots; continuous clay films on faces of peds; few pressure faces; grayish brown (10YR 5/2) fine sandy loam on faces of peds; common fine distinct brownish yellow (10YR 6/8) and common medium distinct very pale brown (10YR 7/3) iron accumulations; neutral; clear smooth boundary.

BCtg—54 to 67 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; weak medium subangular blocky structure; hard, firm; few fine roots; few clay films; common medium distinct brownish yellow (10YR 6/8) iron accumulations; slightly alkaline; clear smooth boundary.

2C—67 to 80 inches; pale olive (5Y 6/4) shale; massive; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. The combined thickness of the Ap and A horizons ranges from 3 to 24 inches because of the waviness of the upper boundary of the argillic horizon.

The A horizon is light gray, light brownish gray, grayish brown, dark grayish brown, dark brown, or brown. Siliceous pebbles range from 1 to 5 percent in some pedons. Reaction ranges from strongly acid to neutral.

The Btg horizons are dark gray, dark grayish brown, or grayish brown. Iron concentrations in shades of brown, yellow, and red range from few to common. These horizons are clay loam or clay. Clay content is 35 to 55 percent in the upper 20 inches of the Bt horizons. The reaction of the Btg1 horizon ranges from strongly acid to neutral. The Btg2 and Btg3 horizons range from slightly acid to moderately alkaline.

The BCtg horizon is grayish brown, light brownish gray, or brown. Redoximorphic features in shades of yellow, red, or gray range from few to common. This horizon is loam, sandy clay loam, or clay loam. Reaction is slightly alkaline or moderately alkaline.

In some pedons, a 2C horizon that is sandy clay loam, clay loam, or clay is below a depth of 60 inches. It has a matrix in shades of olive, yellow, or brown. It is stratified loamy materials or shale of the Yegua Formation. Reaction ranges from moderately acid to moderately alkaline.

Burleson Series

The Burleson series consists of very deep, moderately well drained, very slowly permeable soils that formed in alkaline clayey sediments. These nearly level to gently sloping soils are on plane and convex stream terraces. Slopes range from 0 to 5 percent. The soils of the Burleson series are fine, smectitic, thermic Udic Haplusterts.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 0.7 mile southwest on Farm Road 60, 220 feet south on private road, in an area of native pasture:

A1—0 to 6 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate very fine angular blocky; very hard, very firm; many fine roots; few snail shell fragments; few fine siliceous pebbles; slightly alkaline; gradual smooth boundary.

A2—6 to 12 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium angular blocky structure parting to moderate very fine angular blocky; very hard, very firm; many fine roots; common distinct pressure faces; few fine siliceous pebbles; slightly alkaline; gradual wavy boundary.

Bss1—12 to 24 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and coarse angular blocky structure; few wedge-shaped peds: very hard, very firm; few fine roots; few cracks 1-inch wide; many large grooved slickensides tilted from horizontal 30 to 60 degrees; few fine siliceous pebbles; few fine iron-manganese concretions and masses; moderately alkaline; gradual wavy boundary.

Bss2—24 to 39 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and coarse angular blocky structure; common wedge-shaped peds: very hard, very firm; few fine roots; many large grooved slickensides tilted 30 to 60 degrees from horizontal; few fine iron-manganese concretions and masses; few fine concretions and masses of calcium carbonate; few fine siliceous pebbles; very slightly effervescent; moderately alkaline; gradual wavy boundary.

Bss3—39 to 51 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine and medium streaks and spots of pink (5YR 7/4); moderate medium and coarse angular blocky structure; many wedge shaped peds; very hard, very firm; few fine roots; many large grooved slickensides tilted 30 to 60 degrees from horizontal; few fine iron-manganese concretions and masses; few fine concretions of calcium carbonate; few fine siliceous pebbles; slightly effervescent; moderately alkaline; clear irregular boundary.

Bss4—51 to 76 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common streaks and spots of reddish brown (5YR 4/3); moderate medium and coarse angular blocky structure; common wedge shaped peds; very hard, very firm; few fine roots; many large grooved slickensides tilted 30 to 60 degrees from horizontal; few very dark gray (10YR 3/1) vertical streaks; few iron-manganese concretions; few concretions and masses of calcium carbonate; slightly effervescent; moderately alkaline; clear irregular boundary.

2CBkss—76 to 80 inches; yellowish red (5YR 4/6) silty clay; few streaks of light gray (10YR 6/1); moderate coarse angular blocky structure; common wedge shaped peds; very hard, very firm; few fine roots; many large grooved slickensides tilted 30 to 60 degrees from horizontal; few dark gray vertical streaks; common concretions and masses of calcium carbonate; strongly effervescent; moderately alkaline.

The A and B horizons are cyclic, ranging from 60 to 80 inches thick. In more than 70 percent of the pedon, they exceed 48 inches in thickness. Clay content of the 10- to 40-inch control section ranges from 45 to 60 percent. When dry, cracks 1 to 3 inches wide extend to a depth of 25 to 60 inches or more. In undisturbed areas, gilgai microrelief consists of knolls 3 to 10 inches higher than depressions; distance between the center of knolls and the center of depressions ranges from 5 to 12 feet. Slickensides begin at a depth of 15 to 30 inches.

Thickness of the A horizons varies with microrelief, ranging from 6 inches on the microknolls to as much as 30 inches in the microdepressions. The A horizon is black or very dark gray. Reaction ranges from moderately acid to slightly alkaline.

The Bss1 horizon is black, very dark gray, or dark gray. Redoximorphic features in shades of brown or gray range from none to few. Slickensides range from common to many. Reaction ranges from moderately acid to moderately alkaline.

The lower Bss horizons are dark gray, gray, dark grayish brown, grayish brown, or light olive gray. Redoximorphic features in shades of the same colors range from none to common in the Bss2 horizon and are commonly more distinct in the Bss3 and Bss4 horizons. Slickensides range from common to many. Reaction is slightly or moderately alkaline and may or may not be effervescent. Calcium carbonate concretions and masses range from none to common.

Some pedons have a Bk horizon that is dark grayish brown, grayish brown, light olive gray, pale olive, or olive yellow. Redoximorphic features in shades of these colors range from few to many. Slickensides range from none to few. Reaction is slightly or moderately alkaline. Calcium carbonate concretions and masses range from few to many.

The 2BCkss horizon has colors in shades of red, yellow, pink, or brown. Texture is clay loam, silty clay loam, or silty clay. Siliceous pebbles range from none to about 5 percent. Reaction is moderately alkaline. The soil is slightly to violently effervescent. Calcium carbonate concretions range from few to many.

Some pedons have a 2C horizon of effervescent, reddish loamy or clayey sediments below a depth of 60 inches.

Burlewash Series

The Burlewash series consists of moderately deep, well drained, very slowly permeable soils that formed from weakly cemented sandstone, mudstone, and tuffaceous clays. These gently sloping to very steep soils are on uplands. Slopes range from 2 to 50 percent. The soils in the Burlewash series are fine, smectitic, thermic Ultic Paleustalfs.

Typical pedon of Burlewash fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1361 and Texas Highway 36 in Somerville, 5.1 miles northeast on Farm Road 1361, 2.15 miles southeast on County Road 433, 0.25 mile south on private road, 200 feet southeast of road, in an area of rangeland:

A—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; hard, friable; common fine and medium roots; very strongly acid; abrupt wavy boundary.

Bt1—8 to 18 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium angular blocky structure; very hard, firm; common clay films on faces of peds; common fine roots; very strongly acid; gradual wavy boundary.

Bt2—18 to 28 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium angular blocky structure; very hard, very firm; common clay films on faces of peds; few fine roots; common medium faint red (2.5YR 5/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

BCt—28 to 34 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; weak medium angular blocky structure; very hard, firm; few clay films on faces of peds; remnants of gray (10YR 5/1) interbedded mudstone; few fine roots; common medium faint yellowish red (5YR 5/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Cr—34 to 45 inches; stratified very pale brown (10YR 7/4) weakly cemented sandstone and gray (10YR 5/1) mudstone.

The thickness of the solum ranges from 20 to 40 inches, corresponding to the depth of a paralithic contact consisting of weakly cemented sandstone or mudstone. Base saturation ranges from 35 to 75 percent throughout the argillic horizon. Clay content of the upper 20 inches of the Bt horizon is 40 to 50 percent. Siliceous pebbles range from none to few throughout the surface layer.

The A horizon is grayish brown or brown. Some pedons have a thin E horizon lighter in color than the A horizon. Reaction ranges from very strongly acid to moderately acid.

The Bt horizons are red, dark reddish brown, reddish brown, dark brown, or brown clay loam or clay. Redoximorphic features in shades of yellow and brown range from none to few. Reaction ranges from extremely acid to strongly acid.

The BCt horizon is yellowish red or strong brown with iron concentrations in shades of red or yellow. It is clay interbedded with remnants of weakly cemented sandstone or mudstone. Reaction is very strongly acid or strongly acid.

The Cr horizon consists of stratified beds of weakly cemented sandstone, mudstone or tuffaceous clays in varied shades of gray, brown and yellow.

Cadelake Series

The Cadelake series consists of very deep, poorly drained, rapidly permeable soils that formed in thick beds of sandy colluvium. These nearly level soils are on poorly defined drainageways and in depressions on uplands. These soils are saturated most of the year. Slopes range from 0 to 2 percent. The soils of the Cadelake series are sandy, siliceous, thermic Typic Humaquepts (fig. 19).

Typical pedon of Cadelake fine sandy loam, 0 to 2 percent slopes; from the intersection of Texas Highway 36 and Texas Highway 21 in Caldwell, 1.8 miles northwest on Texas Highway 36, 1.8 miles west on County Road 316, 500 feet north of road adjacent to drainageway, in an area of rangeland: (All colors are for moist soil.)

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine and medium subangular blocky structure; very friable; many fine roots; common fine pores; few fine faint dark yellowish brown (10YR 4/4) masses of iron accumulation; extremely acid; clear wavy boundary.

A/Eg—4 to 15 inches; black (N 2/) loamy fine sand; about 10 percent masses of light brownish gray (10YR 6/2) loamy fine sand (Eg part); weak fine and medium subangular blocky structure; very friable; many fine and medium roots; common fine pores; extremely acid; clear wavy boundary.

Bg/A—15 to 20 inches; gray (10YR 5/1) fine sand; about 15 percent masses of black (N 2/) loamy fine sand (A part); weak medium subangular blocky structure; very friable; common fine roots; few fine distinct yellow (2.5Y 8/6) masses of iron accumulation; extremely acid; clear wavy boundary.

Bg1—20 to 33 inches; light gray (10YR 7/1) fine sand; single grained; loose; few fine roots; common medium distinct brownish yellow (10YR 6/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Bg2—33 to 80 inches; white (10YR 8/2) fine sand; single grained; loose; few fine roots; common coarse distinct pale yellow (2.5Y 7/4) masses of iron accumulation; strongly acid.

The thickness of the solum is more than 80 inches. Reaction ranges from extremely acid to moderately acid.

The A horizon is black, very dark gray, or very dark grayish brown. The umbric epipedon ranges from 11 to 19 inches in thickness.

The A/Eg horizon is black, very dark gray, or very dark grayish brown. Masses of gray or light gray loamy fine sand (Eg part) range from 10 to 20 percent. It is fine sand, loamy fine sand, or fine sandy loam. The combined thickness of the dark colored A horizons ranges from 10 to 20 inches.

The Bg/A horizon is gray or light gray fine sand or loamy fine sand. Masses of black loamy fine sand (A part) range from 10 to 20 percent. Iron concentrations in shades of brown or yellow range from few to common.

The Bg horizons are light gray or white fine sand or loamy fine sand. Redoximorphic features in shades of brown, yellow, or gray range from few to many. Some pedons have small masses of fine sandy loam or sandy clay loam materials below a depth of 40 inches.

Figure 19.—Profile of Cadelake fine sandy loam. Note the wavy soil horizon boundary.

Chazos Series

The Chazos series consists of very deep, moderately well drained, slowly permeable soils formed in loamy and clayey sediments. These very gently sloping to moderately sloping soils are on stream terraces and relict Pleistocene terraces on uplands. Slopes range from 1 to 8 percent. The soils of the Chazos series are fine, smectitic, thermic Udic Paleustalfs.

Typical pedon of Chazos loamy fine sand, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 7.7 miles southwest on Texas Highway 21, 3.8 miles southeast on Farm Road 60, 0.7 mile southwest on County Road 142, 700 feet southwest on private farm road, 300 feet south, in an area of improved pasture:

Ap—0 to 9 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable; many fine roots; common fine pores; few fine siliceous pebbles; moderately acid; clear wavy boundary.

E—9 to 15 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; many fine roots; common fine pores; few fine siliceous pebbles; moderately acid; abrupt wavy boundary.

Bt1—15 to 28 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, firm; many fine roots mainly along faces of peds; many medium pressure faces; continuous clay films on faces of peds; common medium prominent red (2.5YR 4/8) masses of iron accumulation; common medium distinct grayish brown (10YR 5/2) iron depletions; moderately acid; gradual wavy boundary.

Bt2—28 to 38 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, firm; few fine roots; few medium pressure faces; continuous clay films on faces of peds; many medium prominent red (2.5YR 4/8) and many medium distinct brownish yellow (10YR 6/8) masses of iron accumulation; moderately acid; gradual wavy boundary.

Bt3—38 to 54 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm; few fine roots; continuous clay films on faces of peds; few pressure faces; common medium prominent yellowish red (5YR 5/8) masses of iron accumulation; moderately acid; gradual wavy boundary.

BCt1—54 to 65 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; few fine roots; continuous clay films on faces of peds; common medium distinct reddish yellow (7.5YR 6/6) and common fine prominent yellowish red (5YR 5/8) masses of iron accumulation; slightly acid; gradual wavy boundary.

BCt2—65 to 80 inches; light gray (10YR 7/2) fine sandy loam; weak coarse prismatic structure; slightly hard, very friable; common medium distinct reddish yellow (5YR 6/8) masses of iron accumulation; neutral.

The thickness of the solum is more than 80 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 35 to 50 percent. Rounded siliceous pebbles range from 0 to 5 percent throughout the solum.

The A horizon is grayish brown, brown, or yellowish brown. The E horizon is yellowish brown, light yellowish brown, pale brown, or very pale brown. The combined A and E horizons range from 10 to 20 inches thick. Reaction ranges from moderately acid to neutral.

The Bt horizons are grayish brown, light gray, light brownish gray, brown, pale brown, yellowish brown, light yellowish brown, brownish yellow, or red. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. Some pedons have a mixed matrix of these colors. These horizons are clay or sandy clay. Reaction ranges from moderately acid to neutral.

The BCt horizons have a matrix in shades of red, yellow, brown, or gray. Redoximorphic features in shades of these colors range from few to many. These horizons are fine sandy loam, sandy clay loam, clay loam, or sandy clay. Reaction ranges from slightly acid to moderately alkaline.

Coarsewood Series

The Coarsewood series consists of very deep, well drained, moderately rapidly permeable soils that formed in calcareous, loamy alluvial sediments. These nearly level soils are on flood plains of the Brazos River. Slopes are 0 to 1 percent. The soils of the Coarsewood series are coarse-silty, mixed, (calcareous), thermic Udic Ustifluvents (fig. 20.).

Typical pedon of Coarsewood silt loam, 0 to 1 percent slopes, rarely flooded; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 11.1 miles northeast on Texas Highway 21, 1.8 miles southeast on Farm Road 50, 300 feet east, in an area of cropland:

Ap—0 to 11 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

Bw1—11 to 30 inches; pink (7.5YR 7/4) very fine sandy loam, light brown (7.5YR 6/4) moist; common fine distinct bedding planes of yellowish red (5YR 4/6) silt loam; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; violently effervescent; moderately alkaline; gradual smooth boundary.

Bw2—30 to 43 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; common distinct bedding planes of reddish brown (5YR 5/3) silt loam; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; violently effervescent; moderately alkaline; gradual smooth boundary.

C1—43 to 70 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; many distinct bedding planes of reddish brown (5YR 4/3) silty clay loam; slightly hard, friable; violently effervescent; moderately alkaline; gradual smooth boundary.

C2—70 to 80 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak bedding planes; slightly hard, very friable; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. Clay content of the 10- to 40-inch control section ranges from 8 to 18 percent. Less than 15 percent is sand coarser than very fine sand. The soil is slightly to violently effervescent.

The A horizon is reddish brown or brown.

The Bw horizons are reddish yellow, reddish brown, yellowish red, light reddish brown, or pink. Bedding planes less than 0.5-inch thick, are in shades of brown or red. The matrix is very fine sandy loam or silt loam.

The C horizons are reddish brown, yellowish red, reddish yellow, light reddish brown, or pink. Bedding planes are in these colors and are very fine sandy loam, loam, silt loam, or silty clay loam.

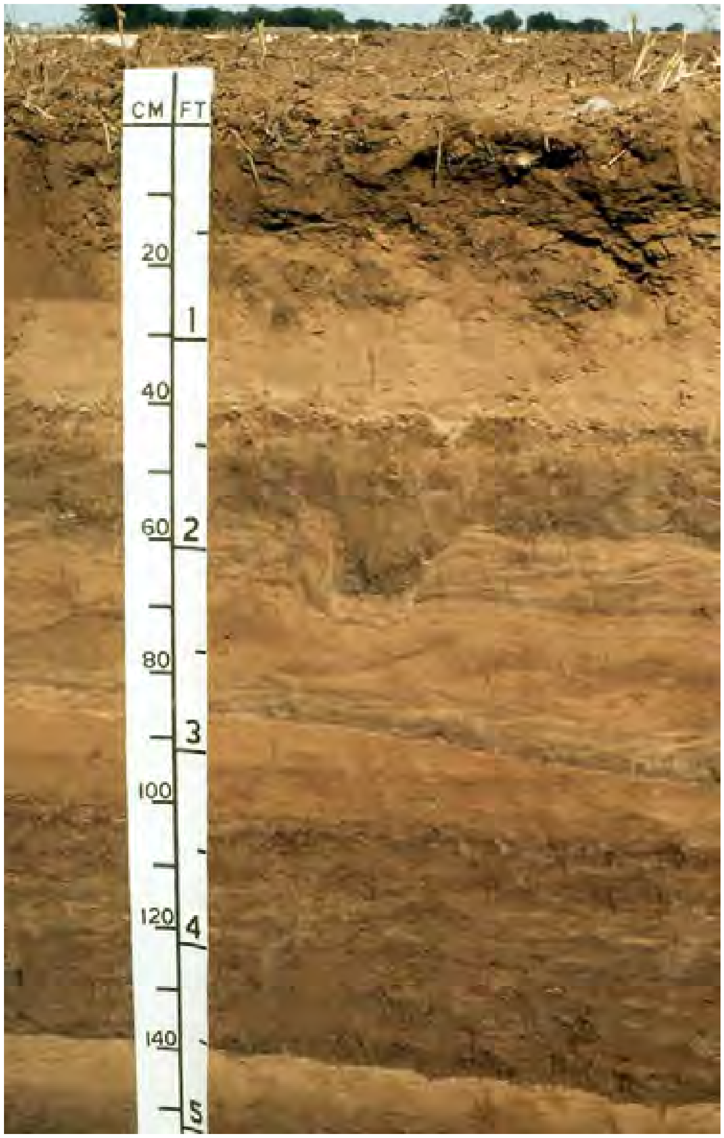

Figure 20.—Profile of Coarsewood silt loam, formed in alluvium on the Brazos River flood plain. Distinct stratification is evidence of deposition by flooding long ago.

Crockett Series

The Crockett series consists of soils that are deep to weathered shale. They are moderately well drained and very slowly permeable. These very gently sloping soils are on uplands. Slopes range from 1 to 3 percent. The soils of the Crockett series are fine, smectitic, thermic Udertic Paleustalfs.

Typical pedon of Crockett loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 2.1 miles southwest on Texas Highway 21, 3.0 miles southeast and southwest on County Road 105, 85 feet southeast of road, in an area of rangeland:

A—0 to 6 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine granular structure; very hard, friable; common fine roots; 1 percent ironstone pebbles; moderately acid; abrupt wavy boundary.

Bt—6 to 13 inches; dark brown (10YR 3/3) clay, dark brown (10YR 3/3) moist; moderate medium angular blocky structure; extremely hard, firm; common fine roots; 2 percent by ironstone pebbles; common distinct clay films on faces of peds; few pressure faces; common fine prominent reddish brown (5YR 4/4), few fine prominent red (2.5YR 4/6) and few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

Btss1—13 to 23 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; extremely hard, firm; few fine roots; few fine iron-manganese concretions; 1 percent ironstone pebbles; common distinct clay films on faces of peds; few cracks 0.5-inch wide; common slickensides; common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; gradual wavy boundary.

Btss2—23 to 37 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate medium angular blocky structure; extremely hard, firm; few fine iron-manganese concretions; common distinct clay films on faces of some peds; common slickensides; few fine faint brown (10YR 5/3) masses of iron accumulation; neutral; gradual wavy boundary.

BCtss—37 to 48 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak medium angular blocky structure; extremely hard, firm; few fine iron-manganese concretions; few concretions of calcium carbonate; common slickensides; common fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately alkaline; gradual wavy boundary.

Cy—48 to 60 inches; light olive gray (5Y 6/2) shale; massive; very hard, firm; 8 percent calcium sulfate crystals; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. Pressure faces and slickensides range from few to common throughout the Btss horizons. Clay content of the upper 20 inches of the Bt horizons is 40 to 50 percent.

The thickness of the A horizon averages less than 10 inches in 50 percent or more of the pedon but ranges up to 15 inches in subsoil troughs. The A horizon is dark brown, brown, pale brown, or dark yellowish brown. Ironstone pebbles range from 0 to 5 percent. Reaction ranges from moderately acid to slightly alkaline.

The Bt horizon is dark brown or reddish brown. Iron concentrations in shades of brown, red, and yellow range from few to many. Ironstone pebbles range from 0 to 5 percent. Reaction ranges from moderately acid to neutral.

The Btss horizons are in shades of brown, olive, or yellow. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. Some pedons have concretions of calcium carbonate and calcium sulfate crystals. Reaction ranges from slightly acid to moderately alkaline.

The BCtss horizon is brown, yellow, olive, or gray. Redoximorphic features in shades of these colors range from few to many. This horizon is clay or clay loam with or without weathered shale fragments. Reaction ranges from slightly acid to moderately alkaline.

The Cy horizon is in shades of yellow, brown, olive, or gray. It is mainly weathered shale. Some pedons are stratified with sandstone and soil material ranging from loam to clay. Calcium sulfate crystals and masses range from few to many. Reaction ranges from slightly acid to moderately alkaline.

Davilla Series

The Davilla series consists of very deep, moderately well drained, very slowly permeable soils formed in loamy and clayey alluvial sediments. These nearly level soils are on relict stream terraces on uplands. Slopes range from 0 to 2 percent. The soils of the Davilla series are fine-loamy, siliceous, thermic Udic Haplustalfs.

Typical pedon of Davilla loam, in an area of Davilla-Wilson complex, 0 to 2 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 5.45 miles northeast on Texas Highway 21, 0.5 mile southeast on County Road 214, 600 feet west on County Road 214, 100 feet north, in an area of native hayland:

A—0 to 8 inches; dark grayish brown (10YR 4/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; 2 percent ironstone pebbles; slightly acid; gradual smooth boundary.

Bt1—8 to 19 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; few thin clay films on faces of peds; 2 percent ironstone pebbles; common medium distinct strong brown (7.5YR 5/8) and few fine faint dark grayish brown (10YR 4/2) masses of iron accumulation; slightly acid; gradual wavy boundary.

Bt2—19 to 28 inches; reddish yellow (7.5YR 6/8) clay, strong brown (7.5YR 5/8) moist; moderate medium prismatic structure; hard, firm; few very fine roots; common distinct clay films on faces of peds; 2 percent ironstone pebbles; few fine iron-manganese nodules; common fine prominent red (2.5YR 4/8) masses of iron accumulation; slightly acid; gradual wavy boundary.

Bt3—28 to 50 inches; reddish yellow (7.5YR 6/8) clay, strong brown (7.5YR 5/8) moist; moderate medium prismatic structure; hard, firm; common distinct clay films on faces of peds; 5 percent ironstone pebbles; common fine iron-manganese nodules; common fine prominent red (2.5YR 4/8) masses of iron accumulation and few fine distinct light brownish gray (10YR 6/2) iron depletions; slightly acid; gradual wavy boundary.

BCt—50 to 80 inches; brownish yellow (10YR 6/8) clay, yellowish brown (10YR 5/8) moist; weak medium subangular blocky structure; very hard, firm; few thin continuous clay films; 5 percent ironstone pebbles and fragments; common fine iron-manganese nodules; common fine prominent yellowish red (5YR 5/8) iron accumulations and few fine distinct light brownish gray (10YR 6/2) iron depletions; slightly acid.

The thickness of the solum is more than 80 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 27 to 35 percent. Ironstone pebbles range from 0 to 5 percent on the surface or in the matrix.

The A horizon is dark grayish brown, dark brown, brown, or dark yellowish brown. Reaction is slightly acid or neutral.

The Bt horizons are brown, dark yellowish brown, strong brown, yellowish brown, brownish yellow, or reddish yellow. Redoximorphic features in shades of red, gray, brown, or yellow range from few to many. These horizons are sandy clay loam or clay loam in the upper part and clay in the lower part. Reaction ranges from slightly acid to slightly alkaline.

The BCt horizon has a matrix in shades of red, gray, brown, olive, or yellow with redoximorphic features of the same colors. Reaction ranges from slightly acid to moderately alkaline. Concretions and soft masses of calcium carbonate range from none to common. Pedons commonly contain few to common ironstone and siliceous pebbles. Some pedons do not have a BCt horizon.

Eufaula Series

The Eufaula series consist of very deep, somewhat excessively drained, rapidly permeable soils that formed in sandy alluvial sediments. These very gently sloping soils are on convex stream terraces. Slopes range from 1 to 3 percent. The soils of the Eufaula series are sandy, siliceous, thermic Psammentic Paleustalfs.

Typical pedon of Eufaula loamy fine sand, 1 to 3 percent slopes; from the intersection of Farm Road 1361 and Texas Highway 36 in Somerville, 4.7 miles northeast on Farm Road 1361, 1.4 miles southeast on County Road 433, 1.55 miles south on private farm road, 300 feet southwest of road, in an area of rangeland:

A—0 to 6 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; common fine roots; slightly acid; clear smooth boundary.

E—6 to 40 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few thin strong brown (7.5YR 4/6) lamellae which are about 0.06-inch thick in lower part of horizon; few fine roots; neutral; gradual smooth boundary.

E & Bt—40 to 80 inches; very pale brown (10YR 7/4) fine sand (E part); strong brown (7.5YR 4/6) fine sandy loam (Bt part), wavy and discontinuous; lamellae as much as 0.5-inch thick, 0.5 to 3.0 inches apart; fine sand (E part) is single grained and lamellae (Bt part) are massive; soft, very friable; coatings of sand grains and some clay bridging in lamellae; slightly acid.

The thickness of the solum is more than 80 inches.

The A horizon is brown, dark yellowish brown, or yellowish brown. Reaction ranges from moderately acid to neutral.

The E horizon is yellowish brown, pale brown, light yellowish brown, or very pale brown. It is fine sand or loamy fine sand. Reaction ranges from strongly acid to neutral.

The E part of the E & Bt horizon is pale brown or very pale brown. It is fine sand or loamy fine sand. The E material makes up about 55 to 75 percent of the horizon.

The Bt part (lamellae) of the E & Bt horizon is brown or strong brown. It is loamy fine sand or fine sandy loam. The lamellae, which are as much as 1 inch thick, are wavy and discontinuous in most pedons. Reaction ranges from strongly acid to slightly acid.

Gaddy Series

The Gaddy series consists of very deep, somewhat excessively drained, moderately rapid permeable soils that formed in sandy alluvium. These nearly level soils are on flood plains of the Brazos River. Slopes range from 0 to 2 percent. The soils of the Gaddy series are sandy, mixed, thermic Udic Ustifluvents.

Typical pedon of Gaddy loamy fine sand, frequently flooded; from the intersection of County Road 444 and Farm Road 50 in Clay, 1.7 miles east on County Road 444, 3.4 miles northeast and then southeast on private farm road, 100 feet south, on a river sandbar:

A—0 to 11 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/2) moist; weak fine granular structure; slightly hard, very friable; common fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—11 to 25 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; few fine roots; thin bedding planes of brown (7.5YR 5/4) loamy fine sand and fine sandy loam; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—25 to 80 inches; Light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; few fine roots; thin bedding planes of brown (7.5YR 5/4) loamy fine sand and fine sandy loam; strongly effervescent; moderately alkaline.

Reaction is mildly or moderately alkaline. The soil is slightly or strongly effervescent throughout.

The A horizon is dark grayish brown, dark brown, brown, or strong brown.

The C horizon is brown, yellowish brown, light brown, reddish yellow or brownish yellow. It is fine sand or loamy fine sand. Thin bedding planes of brown or light brown loamy fine sand or fine sandy loam are throughout.

Gasil Series

The Gasil series consists of very deep, well drained, moderately permeable soils that formed in deeply weathered loamy sediments and sandstones. These gently sloping soils are on convex uplands. Slopes range from 2 to 5 percent. The soils of the Gasil series are fine-loamy, siliceous, thermic Ultic Paleustalfs.

Typical pedon of Gasil fine sandy loam, 2 to 5 percent slopes; from the intersection of Texas Highway 36 and Texas Highway 21 in Caldwell, 6.2 miles northwest on Texas Highway 36, 0.4 mile west on Farm Road 1363, 0.4 mile north on County Road 315, 3.5 miles west on County Road 308, 2.0 miles north on private road; 0.8 mile west on private road; 100 feet north of road, in an area of rangeland:

A—0 to 13 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; moderately acid; clear smooth boundary.

E—13 to 18 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; moderately acid; clear smooth boundary.

Bt1—18 to 31 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; moderate medium prismatic structure; hard, firm; few fine roots; common distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—31 to 51 inches; yellow (10YR 7/8) sandy clay loam, brownish yellow (10YR 6/8) moist; moderate medium prismatic structure; hard, firm; few fine roots; common distinct clay films on faces of peds; few fine iron-manganese concretions; common medium distinct dark yellowish brown (10YR 4/6) masses of iron accumulation; strongly acid; clear smooth boundary.

Bt3—51 to 74 inches; yellow (10YR 7/6), sandy clay loam, brownish yellow (10YR 6/6) moist; weak medium subangular blocky structure; slightly hard, friable; common distinct clay films on faces of peds; common medium distinct red (2.5YR 4/8) masses of iron accumulation and few medium light brownish gray (10YR 6/2) masses of iron depletions; strongly acid; clear smooth boundary.

BCt—74 to 80 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; soft, very friable; few clay films on faces of peds; common medium distinct brown (10YR 5/3) masses of iron accumulation; strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the upper 20 inches of the Bt horizons ranges from 18 to 30 percent. Ironstone pebbles range from 0 to about 5 percent throughout the solum.

The combined thickness of the A and E horizons ranges from 10 to 20 inches. Reaction ranges from moderately acid to neutral. The A horizon is brown, dark brown, yellowish brown, or dark yellowish brown. The E horizon is yellowish brown, brownish yellow, light yellowish brown, pale brown, very pale brown, or strong brown.

The Bt horizons are yellow, yellowish brown, brownish yellow, strong brown, or reddish yellow. Iron accumulations in shades of red, yellow, and brown range from few to common. These horizons are sandy clay loam or loam. Reaction ranges from strongly acid to slightly acid.

The BCt horizon is brown, strong brown, or yellowish brown. Iron accumulations in shades of brown, yellow, red, and gray. Iron depletions range from few to many. This horizon is fine sandy loam or loam. Reaction ranges from strongly acid to slightly acid.

Gladewater Series

The Gladewater series consists of very deep, somewhat poorly drained, very slowly permeable soils that formed in clayey alluvium. These soils are on nearly level flood plains. Slopes are 0 to 1 percent. The soils of the Gladewater series are very fine, smectitic, thermic Chromic Endoaquerts.

Typical pedon of Gladewater clay, frequently flooded; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.1 miles southeast on Farm Road 2155, 1.6 miles southwest on Farm Road 1361, 2.9 miles southeast on County Road 434, 1.4 miles south on private ranch road to its junction with railroad track, 2.4 miles southwest on ranch road, 100 feet east of road, on a flood plain:

A—0 to 9 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine angular blocky structure; extremely hard, very firm; common fine roots; common fine distinct dark yellowish brown (10YR 3/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

Bssg1—9 to 25 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; common large slickensides; few fine iron-manganese concretions; common fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

Bssg2—25 to 61 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse angular blocky structure; extremely hard, very firm; few fine roots; many large slickensides; common fine iron-manganese concretions; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Bssgy—61 to 80 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse angular blocky structure; extremely hard, very firm; common large slickensides; 7 percent calcium sulfate crystals; few fine faint grayish brown (10YR 5/2) iron depletions; moderately acid.

The thickness of the solum is more than 80 inches. Clay content of the 10- to 40-inch control section ranges from 60 to 75 percent. Iron-manganese concretions range from none to common in the A horizon and few to common throughout the B horizons. Cracks as much as 2 inches wide extend to a depth of more than 20 inches when the soil is dry. Slickensides begin at a depth of 10 to 24 inches and extend throughout the solum.

The A horizon is very dark gray or dark gray. Redoximorphic features in shades of gray, brown, or yellow range from none to common. Reaction ranges from moderately acid to neutral.

The Bssg horizon is dark gray, gray, dark grayish brown, or grayish brown. Redoximorphic features in shades of gray, brown, or yellow range from few to many. Reaction ranges from very strongly acid to slightly acid.

The Bssgy horizon is gray, dark grayish brown, or grayish brown. Redoximorphic features in shades of gray, brown, or yellow range from few to many. Crystals of calcium sulfate range from few to many. Reaction ranges from very strongly acid to slightly acid.

Gredge Series

The Gredge series consists of very deep, well drained, very slowly permeable soils that formed in loamy and clayey sediments. These very gently sloping soils are on convex relict stream terraces on uplands. Slopes range from 1 to 3 percent. The soils of the Gredge series are fine, smectitic, thermic Udic Paleustalfs.

Typical pedon of Gredge fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 7.7 miles southwest on Texas Highway 21, 4.2 miles southeast on Farm Road 60, 1.8 miles southeast on County Road 140, 1.1 miles southwest on County Road 136, 0.4 mile southeast on County Road 130, 1,300 feet northeast, in an area of rangeland:

A—0 to 6 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; very hard, firm; common fine roots; slightly acid; abrupt wavy boundary.

Bt1—6 to 16 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; common fine roots; continuous clay films on faces of peds; common medium prominent grayish brown (10YR 5/2) iron depletions; strongly acid; gradual wavy boundary.

Bt2—16 to 31 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; continuous clay films on faces of peds; few fine distinct reddish yellow (5YR 6/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

Bt3—31 to 41 inches; reddish yellow (5YR 5/6) sandy clay loam, reddish yellow (5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few clay films on faces of peds; few fine distinct light brownish gray (10YR 6/2) masses of iron accumulation; moderately acid; gradual wavy boundary.

BCt1—41 to 54 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; slightly hard, firm; few fine roots; few clay films on faces of peds; few medium prominent brownish yellow (10YR 6/8) and dark yellowish brown (10YR 4/6) masses of iron accumulation; slightly alkaline; gradual wavy boundary.

BCt2—54 to 80 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; soft, friable; few fine roots; few clay films; common medium distinct yellow (10YR 7/8) masses of iron accumulation; slightly alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the upper part of the Bt horizon ranges from 40 to 55 percent, decreasing by 20 percent or more within a depth of 20 to 35 inches. Colors with chroma of 2 or less are considered lithochromic or relict. Low chroma colors are not indicative of current wetness conditions.

The A horizon is dark grayish brown, grayish brown, brown, very pale brown, and yellowish brown. Some pedons have a thin E horizon. Siliceous pebbles range from 0 to 5 percent. Reaction ranges from very strongly acid to slightly acid.

The Bt1 horizon is red, reddish brown, or yellowish red. Redoximorphic features in shades of brown, yellow, or gray range from few to many. This horizon is clay or clay loam. Reaction ranges from very strongly acid to moderately acid.

The Bt2 and Bt3 horizons have a matrix in shades of brown, yellow, red, or gray. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. These horizons are clay, clay loam, or sandy clay loam. Reaction ranges from strongly acid to slightly alkaline.

The BCt horizons have a matrix in shades of brown, yellow, red, or gray. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. These horizons are fine sandy loam, sandy clay loam, or clay loam. Reaction ranges from moderately acid to moderately alkaline.

Some pedons have a 2C horizon of shale, mudstone or stratified soil materials below a depth of 60 inches. These materials are mainly loam, clay loam, or clay. Reaction ranges from moderately acid to moderately alkaline.

Highbank Series

The Highbank series consists of very deep, well drained, slowly permeable soils formed in clayey alluvium. These nearly level soils are on flood plains of the Brazos River. Slopes are 0 to 1 percent. The soils of the Highbank series are fine, mixed, thermic Fluventic Udertic Haplustepts (fig. 21).

Typical pedon of Highbank silt loam, 0 to 1 percent slopes, rarely flooded; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 3.4 miles northeast on Farm Road 60, 5.0 miles south on Farm Road 50, 1.5 miles northeast on County Road 443, 0.7 mile southeast on county road, 150 feet west of road, in an area of cropland:

Ap—0 to 6 inches; reddish yellow (7.5YR 6/6) silt loam, strong brown (7.5YR 5/6) moist, weak medium subangular blocky structure; hard; friable; strongly effervescent; moderately alkaline, clear smooth boundary.

A—6 to 17 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw1—17 to 32 inches; light brown (5YR 6/4) clay, brown (7.5YR 4/4) moist; moderate medium angular blocky structure; very hard, very firm; common pressure faces; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bw2—32 to 60 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium angular blocky structure; very hard, very firm; few cracks; few small slickensides; common fine faint dark red (2.5YR 3/6) masses of iron accumulation; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C/B—60 to 80 inches; bedding planes of reddish yellow (7.5YR 7/6) and strong brown (7.5YR 5/6) very fine sandy loam, silt loam and silty clay loam; about 25 percent of strata is thicker than 2 inches and has weak medium subangular blocky structure (B part); strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to about 80 inches. Clay content of the 10- to 40-inch control section ranges from 40 to 55 percent. Reaction is moderately alkaline. The soil is slightly or strongly effervescent throughout.

The A horizons are reddish yellow, reddish brown, light brown, brown, or strong brown.

The Bw horizons are light brown, reddish brown, or yellowish red silty clay or clay.

The C/B horizon has bedding planes of very fine sandy loam, silt loam, or silty clay loam that range from 1 to 6 inches thick.

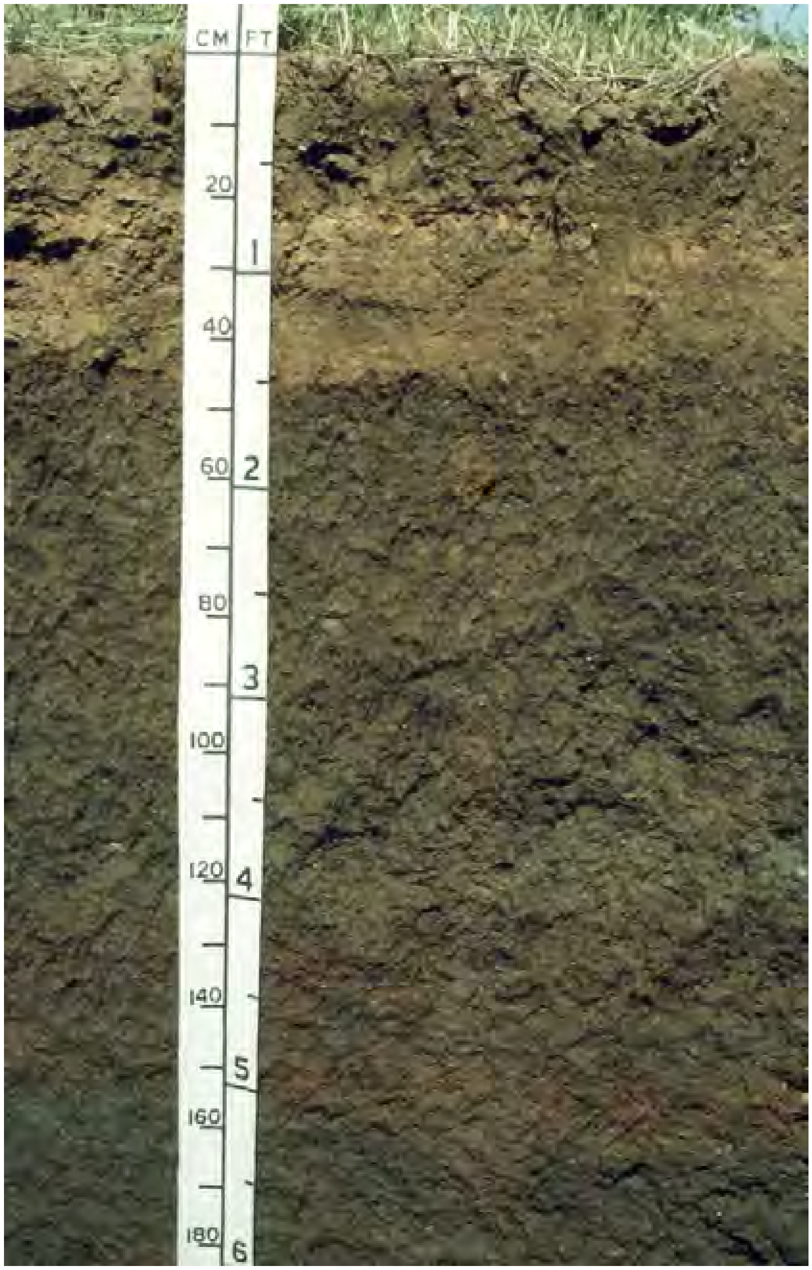

Figure 21.—Profile of Highbank silt loam, formed in alluvium on the Brazos River flood plain. Note the sharp contrast between loamy and clayey textures at depth of about 18 inches.

Jedd Series

The Jedd series consists of moderately deep, well drained, moderately slowly permeable soils that formed in weakly cemented sandstone and shale. These strongly sloping to moderately steep soils are on convex ridges and side slopes on uplands. Slopes range from 5 to 20 percent. The soils of the Jedd series are fine, mixed, thermic Ultic Paleustalfs.

Typical pedon of Jedd fine sandy loam, 5 to 8 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 1.5 miles northeast on Texas Highway 21, 5.2 miles north on Farm Road 2000, 0.4 mile west on private ranch road, 20 feet south of road:

A—0 to 4 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine faint strong brown (7.5YR 5/6) masses of iron accumulation; slightly acid; abrupt smooth boundary.

Bt1—4 to 12 inches; red (2.5YR 5/8) clay; red (2.5YR 4/8) moist; strong medium subangular blocky structure; very hard, firm; few ironstone fragments; common fine roots; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—12 to 20 inches; reddish yellow (5YR 6/8) clay, yellowish red (5YR 5/8) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; continuous clay films on faces of peds; few flakes of mica; common medium distinct red (2.5YR 5/8) masses of iron accumulation; very strongly acid; gradual smooth boundary.

BCt—20 to 29 inches; red (2.5YR 5/8) clay, red (2.5YR 4/8) moist; thin layers of brownish yellow (10YR 6/8) weakly cemented sandstone and gray (5YR 6/1) shale; weak medium subangular blocky structure; very hard, firm; few very fine roots; few clay films on faces of peds; common flakes of mica; strongly acid; gradual smooth boundary.

Cr—29 to 40 inches; stratified brownish yellow (10YR 6/8) weakly cemented sandstone, gray (5YR 6/1) shale and very pale brown (10YR 7/3) fine sandy loam; hard, firm; common flakes of mica;

Depth to stratified sandstone and shale is 20 to 40 inches. Clay content in the upper 20 inches of the Bt horizons ranges from 35 to 50 percent. Base saturation of the Bt horizons ranges from 35 to 75 percent. Fragments of ironstone and sandstone less than 3 inches to about 48 inches across, cover as much as 15 percent of the surface in some areas.

The A horizon is dark brown, brown, dark yellowish brown, and yellowish brown. Ironstone pebbles and fragments range from 0 to 5 percent in this horizon of some pedons. Reaction ranges from moderately acid to neutral.

The Bt horizons are red, reddish yellow, reddish brown, or yellowish red clay or clay loam. Redoximorphic features in shades of red or yellow range from few to many. Ironstone pebbles and fragments range from 0 to 2 percent. Reaction ranges from very strongly acid to moderately acid.

The BCt horizon is red, reddish brown, yellowish red, or reddish yellow. Redoximorphic features in shades of brown or yellow range from few to many. This horizon is clay, clay loam, or sandy clay loam stratified with weakly cemented sandstone and shale. Reaction ranges from very strongly acid to moderately acid.

The Cr horizon is stratified weakly cemented sandstone and shale interbedded with strata of fine sandy loam. The matrix is in shades of red, yellow, or brown.

Kaufman Series

The Kaufman series consists of very deep, moderately well drained, very slowly permeable soils that formed in alkaline clayey alluvium. These nearly level soils are on flood plains. Slopes are 0 to 1 percent. The soils of the Kaufman series are very-fine, smectitic, thermic Typic Hapluderts.

Typical pedon of Kaufman clay, frequently flooded; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.1 miles southeast on Farm Road 2155, 1.6 miles southwest on Farm Road 1361, 2.9 miles southeast on County Road 434, 1.4 miles south on private ranch road to junction with railroad track, 0.5 mile south on private ranch road, 150 feet west of road, on a flood plain:

A—0 to 14 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate coarse angular blocky structure; extremely hard, very firm; common fine roots; common pressure faces on faces of peds; moderately acid; gradual wavy boundary.

Bss1—14 to 42 inches; very dark gray (N 3/) clay, black (N 2/) moist; moderate coarse angular blocky structure; extremely hard, very firm; few fine roots; few cracks; common large slickensides; slightly acid; gradual wavy boundary.

Bss2—42 to 66 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium angular blocky structure; extremely hard, very firm; cracks filled with (N 2/) material from overlying horizon; many large slickensides; 1 percent calcium sulfate crystals; moderately acid; gradual wavy boundary.

Byss—66 to 80 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine angular blocky structure; extremely hard, very firm; common large slickensides; 8 percent calcium sulfate crystals; moderately acid.

The thickness of the solum is more than 80 inches. Reaction ranges from moderately acid to slightly alkaline throughout. Clay content of the 10- to 40-inch control section ranges from 60 to 72 percent. Cracks on the surface are about 1 to 5 inches wide and extend to a depth of 20 inches or more. Common large slickensides are below a depth of 15 inches.

The A horizon is dark gray or very dark gray.

The Bss horizons are dark gray or very dark gray in the upper subhorizons, and gray or dark gray in lower subhorizons. Masses of iron accumulation in shades of brown or yellow are in the lower subhorizons of some pedons.

The Byss horizon is dark gray or gray. Some pedons have few to common masses of iron accumulation in shades of brown or yellow. In most pedons, crystals and masses of calcium sulfate are present. Some pedons contain few masses and concretions of calcium carbonate.

Koether Series

The Koether series consists of shallow, somewhat excessively drained, rapidly permeable soils that formed in strongly cemented tuffaceous sandstone. These strongly sloping to very steep soils are on uplands. Slopes range from 8 to 50 percent. The soils of the Koether series are sandy-skeletal, siliceous, thermic Lithic Ustorthents.

Typical pedon of Koether very stony loamy fine sand, in an area of Burlewash-Koether soils, 8 to 50 percent slopes; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.4 miles southeast on Farm Road 2155, 3.0 miles east on Farm Road 1361, 3.9 miles south on Farm Road 50, 600 feet east, in an area of rangeland:

A—0 to 18 inches; pale brown (10YR 6/3) very stony loamy fine sand, brown (10YR 5/3) moist; single grained, loose; about 30 percent fragments of sandstone more than 3 inches in diameter, 5 percent fragments of sandstone less than 3 inches in diameter; strongly acid; abrupt wavy boundary.

R—18 to 20 inches; coarsely fractured, strongly cemented tuffaceous sandstone.

The thickness of the solum ranges from 10 to 20 inches, which corresponds to the depth to a lithic contact. Angular sandstone fragments range from 35 to 70 percent on the surface and within the solum.

The A horizon is grayish brown, light brownish gray, brown, or pale brown. Fragments of sandstone more than 3 inches in diameter range from 30 to 70 percent. Fragments of sandstone less than 3 inches in diameter range from 5 to 10 percent. Reaction is very strongly acid or strongly acid.

Kurten Series

The Kurten series consists of well drained, very slowly permeable soils that are deep to shale. These gently sloping to moderately sloping soils are on convex uplands. Slopes range from 2 to 8 percent. The soils of the Kurten series are fine, smectitic, thermic Udertic Paleustalfs.

Typical pedon of Kurten fine sandy loam, 2 to 5 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 3.4 miles northeast on Texas Highway 21, 2.1 miles southeast on County Road 210, 0.75 mile east and north on private road, 300 feet east of private road, in an area of improved pasture:

Ap—0 to 7 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable; many fine roots; 1 percent ironstone pebbles; strongly acid; abrupt smooth boundary.

Bt—7 to 20 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium angular blocky structure; very hard, firm; common fine roots; common distinct pressure faces; continuous clay films on faces of peds; very strongly acid; gradual wavy boundary:

Btss1—20 to 37 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; common distinct pressure faces; common medium slickensides; continuous clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) masses of iron depletions; very strongly acid; gradual wavy boundary.

Btss2—37 to 42 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common distinct pressure faces; few cracks; common medium slickensides; continuous clay films on faces of peds; many medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation; very strongly acid; gradual wavy boundary.

BCt—42 to 53 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak medium angular blocky structure; extremely hard, very firm; common medium distinct yellowish red (5YR 5/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

C—53 to 60 inches; grayish brown (10YR 5/2) shale; massive; extremely hard, very firm; few threads and pockets of jarrosite; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulations; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Some pedons have as much as 10 percent ironstone pebbles. Some pedons have ironstone fragments on the surface as much as 20 inches in diameter. Clay content of the upper 20 inches of the Bt horizon ranges from 40 to 60 percent.

The A horizon is dark grayish brown, brown, yellowish brown, or dark yellowish brown. Some pedons have an E horizon that is slightly lighter in color than the A horizon. Some pedons have an eroded surface layer that has ironstone fragments on the surface. It is fine sandy loam or loam. Reaction ranges from strongly acid to neutral.

The Bt horizon is red or reddish brown. Redoximorphic features in shades of red, brown, gray, or yellow range from few to common in some pedons. Reaction ranges from very strongly acid to moderately acid.

The Btss horizons are red, reddish brown, light gray, or light brownish gray. Redoximorphic features in shades of red, brown, yellow, or gray range from few to many in most pedons. Reaction ranges from very strongly acid to moderately acid.

The BCt horizon is grayish brown, light brownish gray, or light gray. Redoximorphic features in shades of red, brown, or yellow range from few to common. This horizon is clay loam or clay. Reaction ranges from very strongly acid to neutral.

The C horizon has a matrix in shades of gray or brown. Redoximorphic features in shades of gray or brown range from few to common. This horizon is weakly consolidated shale. Some pedons are stratified with loam or fine sandy loam. Reaction ranges from very strongly acid to slightly alkaline.

Lexton Series

The Lexton series consists of very deep, well drained, moderately slowly permeable soils that formed in glauconitic marine sediments. These very gently sloping soils are on convex uplands. Slopes range from 1 to 3 percent. The soils of the Lexton series are fine, mixed, thermic Udic Haplustalfs.

Typical pedon of Lexton sandy clay loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.0 miles southwest on Texas Highway 21, 5.8 miles northwest on Farm Road 908, 100 feet north of fence, in a pasture:

Ap—0 to 6 inches; dark reddish brown (2.5 YR 3/4) sandy clay loam; dark reddish brown (2.5YR 3/4) moist; weak medium subangular blocky structure; hard, friable, sticky, plastic; common fine roots; few wormcasts; few fine rounded ironstone pebbles; few fine hard black concretions; moderately acid; abrupt smooth boundary.

Bt1—6 to 23 inches; dark reddish brown (2.5YR 3/4) clay; dark reddish brown (2.5YR 3/4) moist; moderate medium angular blocky structure parting to moderate fine granular; hard, firm, sticky, plastic; common fine and few medium roots; common fine pores; thin continuous clay films on faces of peds; few fine and medium rounded ironstone pebbles, few fine hard black concretions; slightly acid; gradual smooth boundary.

Bt2—23 to 36 inches; dark red (2.5YR 3/6) clay; dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; few fine roots; common fine pores; common thin discontinuous clay films on faces of peds; few fine and medium rounded ironstone pebbles, few hard black concretions; 2 percent fragments of partly weathered glauconitic material; slightly acid; gradual smooth boundary.

BCt—36 to 50 inches; mottled dark reddish brown (5YR 3/3) and yellowish brown (10YR 5/8) clay; weak coarse angular blocky structure; slightly hard, firm, sticky, plastic; few fine roots; few fine pores; few thin discontinuous clay films on faces of peds; few fine platy ironstone fragments; 10 to 20 percent fragments of partly weathered glauconitic material; slightly acid; gradual smooth boundary.

C—50 to 80 inches; stratified yellowish brown (10YR 5/8) and dark reddish brown (5YR 3/3) clay loam and partly weathered glauconitic materials; massive; hard, firm; common calcareous shell fossils; few calcium carbonate concretions; slightly acid matrix, moderately alkaline shell fragments and concretions.

The thickness of the solum ranges from 40 to 60 inches. Ironstone pebbles and fragments make up as much as 10 percent of the solum.

The A horizon is dark reddish brown, reddish brown, red, or yellowish red. The horizon is less than 6 inches thick where chromas are less than 3.5 moist. Reaction ranges from moderately acid to neutral.

The Bt horizons are dark red, red, dark reddish brown, or reddish brown. Masses of iron accumulation in shades of brown and yellow range from none to common in the lower part. These horizons are clay loam or clay. Clay content ranges from 35 to 55 percent. Reaction ranges from strongly acid to slightly acid.

The BCt horizon is clay loam or clay in shades of red, brown, and yellow. Reaction is moderately acid or slightly acid.

The C horizon is in shades of yellow, brown, olive, or black, and ranges from partly weathered glauconitic sandstone and greensand marl to clay loam or sandy loam materials. Marine shell fossils range from none to common. Reaction is moderately acid or slightly alkaline.

Luling Series

The Luling series consists of very deep, well drained, very slowly permeable soils that formed in shale. These gently sloping soils are on uplands. Slopes range from 1 to 5 percent. The soils of the Luling series are fine, smectitic, thermic Udic Haplusterts (fig. 22).

Typical pedon of Luling clay, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 2.7 miles northeast on Texas Highway 21, 400 feet south, in an area of native hayland:

A—0 to 8 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; extremely hard, very firm; common fine roots; few fine ironstone pebbles; neutral; gradual wavy boundary.

Bss1—8 to 24 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm; common fine roots; few fine ironstone pebbles; common large slickensides; few cracks; neutral; gradual wavy boundary.

Bss2—24 to 69 inches; olive gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common large slickensides; few fine calcium carbonate concretions; few fine crystals of gypsum; common fine ironstone pebbles; common medium faint olive (5Y 4/3) masses of iron accumulation; moderately alkaline; gradual wavy boundary.

C—69 to 80 inches; white (2.5Y 8/2) shale, light gray (2.5Y 7/2) moist; extremely hard, very firm; common coarse prominent brownish yellow (10YR 6/8) masses of iron accumulation; moderately alkaline.

The thickness of the solum ranges from 60 to 75 inches. Clay content of the 10- to 40-inch control section ranges from 40 to 55 percent. Iron-manganese concretions range from none to few throughout. Ironstone pebbles and fragments range from 0 to 3 percent on the surface. Undisturbed areas have gilgai microrelief with a distance of 6 to 40 feet between microhighs. The microhigh is 6 to 14 inches higher than the microlow. When dry, the soil has cracks as much as 2 inches wide at the surface. Half-inch-wide cracks commonly extend to a depth of more than 40 inches. Large slickensides are at a depth of 12 to 24 inches and extend throughout the solum. Reaction ranges from neutral to moderately alkaline. The soil is typically noncalcareous in the A horizon and calcareous or noncalcareous in the lower horizons.

The A horizon is very dark grayish brown, or dark grayish brown in more than half of each pedon. The amplitude of waviness between the A and the Bss horizon is 4 to 24 inches.

The Bss horizons have a matrix in shades of olive, brown, yellow, or gray. Redoximorphic features in shades of brown, yellow, gray, or olive range from none to common.

The C horizon has a matrix in shades of white, gray, brown, yellow, or olive. Redoximorphic features in shades of brown, yellow, olive, or gray range from few to common. This horizon is weathered shale or clay stratified with shale and weakly cemented sandstone.

Figure 22.—Profile of a Luling clay. Lighter colored material is a microhigh caused by soil movement.

Mabank Series

The Mabank series consists of very deep, moderately well drained, very slowly permeable soils that formed in alkaline clayey sediments. These nearly level soils are on stream terraces and on relict terraces on uplands. Slopes are 0 to 1 percent. The soils of the Mabank series are fine, smectitic, thermic Oxyaquic Vertic Paleustalfs.

Typical pedon of Mabank fine sandy loam, 0 to 1 percent slopes; from the intersection of Farm Road 1361 and Texas Highway 36 in Somerville, 4.7 miles northeast on Farm Road 1361, 1.4 miles southeast on County Road 433, 1.4 miles south on private ranch road, 180 feet southwest of road, in an area of rangeland:

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; common fine roots; moderately acid; abrupt wavy boundary.

Bt—6 to 25 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium angular blocky structure; extremely hard, firm; few fine roots; common pressure faces; few clay films; moderately acid; gradual wavy boundary.

Btssg1—25 to 45 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, firm; very few fine roots; few cracks; common slickensides; continuous clay films on faces of peds; common fine faint very dark grayish brown (10YR 3/2) masses of iron accumulation; slightly acid; gradual wavy boundary.

Btssg2—45 to 60 inches; light gray (2.5Y 7/2) clay; light brownish gray (2.5Y 6/2) moist; weak medium angular blocky structure; extremely hard, firm; common slickensides; continuous clay films on faces of peds; neutral; gradual wavy boundary.

BCtg—60 to 80 inches; light gray (10YR 7/2) clay loam; light brownish gray (10YR 6/2) moist; weak subangular blocky structure; hard, firm; continuous clay films on faces of peds; few pressure faces; few iron-manganese concretions; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 40 to 50 percent.

The A horizon is grayish brown or dark grayish brown. It is massive and hard when dry, but has weak granular structure when moist. Some undisturbed pedons have a thin E horizon. Reaction ranges from moderately acid to neutral.

The Bt horizon is dark gray or very dark gray. Reaction ranges from moderately acid to slightly alkaline.

The Btssg horizons are dark gray, dark grayish brown, grayish brown, light brownish gray, or gray. Redoximorphic features in shades of yellow or brown range from none to common. These horizons are clay loam or clay. Reaction ranges from moderately acid to moderately alkaline.

The BCtg horizon is dark gray, gray or light gray. Redoximorphic features in shades of yellow or brown range from none to common. This horizon is clay loam or clay. Reaction ranges from neutral to moderately alkaline.

A 2C horizon is below a depth of 60 inches in some pedons.

Normangee Series

The Normangee series consists of moderately well drained, very slowly permeable soils that are deep to shale. These gently sloping soils are on uplands. Slopes range from 3 to 5 percent. The soils of the Normangee series are fine, smectitic, thermic Udertic Haplustalfs.

Typical pedon of Normangee clay loam, 3 to 5 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 2.4 miles northeast on Texas Highway 21, 3,000 feet northwest, in an area of improved pasture:

Ap—0 to 5 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; extremely hard, firm; common fine roots; few fine ironstone pebbles; moderately acid; clear wavy boundary.

Btss1—5 to 22 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium angular blocky structure; extremely hard, very firm; common fine roots; few fine ironstone pebbles; few cracks; common medium slickensides; few fine faint brown (7.5YR 4/4) masses of iron accumulation; moderately acid; gradual wavy boundary.

Btss2—22 to 48 inches; olive yellow (2.5Y 6/6) clay, light olive brown (2.5Y 5/6) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few medium concretions of calcium carbonate; few fine ironstone pebbles; common medium slickensides; common medium faint olive yellow (2.5Y 6/8) masses of iron accumulation; neutral; gradual wavy boundary.

C—48 to 60 inches; light gray (N 7/) shale, interbedded with thin lenses of weakly cemented sandstone; massive; extremely hard, very firm; neutral.

The thickness of the solum ranges from 40 to 60 inches. Depth to secondary carbonates is more than 30 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 40 to 50 percent. Cracks 0.5-inch wide extend to a depth of more than 20 inches when the soil is dry.

The A horizon is dark brown, brown, or grayish brown. Some pedons contain small ironstone pebbles on the surface and throughout the solum. Reaction ranges from moderately acid to neutral.

The Btss horizons are olive yellow, olive brown, light olive brown, yellowish brown, brown, or dark brown. Redoximorphic features in shades of yellow, brown, or red range from few to common. Reaction ranges from moderately acid to moderately alkaline.

The C horizon has a matrix in shades of gray, yellow, olive, or brown. It is shale interbedded with lenses of weakly cemented sandstone. Reaction ranges from neutral to moderately alkaline.

Padina Series

The Padina series consists of very deep, well drained, moderately permeable soils formed in thick sandy materials. These gently sloping to moderately steep soils are on uplands. Slopes range from 1 to 15 percent. The soils of the Padina series are loamy, siliceous, thermic, Grossarenic Paleustalfs.

Typical pedon of Padina fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.3 miles southwest on Texas Highway 21, 10.5 miles northwest on Farm Road 908, 2.7 miles north and east on County Road 304, 500 feet north of road, in an area of wooded rangeland:

A—0 to 8 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; few fine light gray (10YR 7/2) masses of fine sand; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; common medium and few fine roots; moderately acid; abrupt wavy boundary.

E1—8 to 27 inches; yellow (10YR 7/6) fine sand, brownish yellow (10YR 6/6) moist; weak medium subangular blocky parting to weak fine granular structure; soft, very friable; few brown (10YR 5/3) krotovinas; common coarse and few fine roots; common fine distinct very pale brown (10YR 7/3) masses of iron accumulation; neutral; gradual wavy boundary.

E2—27 to 42 inches; very pale brown (10YR 8/4) fine sand, very pale brown (10YR 7/4) moist; weak medium subangular blocky structure; soft, very friable; few fine and medium roots; few fine distinct very pale brown (10YR 7/3) and brownish yellow (10YR 6/6) masses of iron accumulation; slightly acid; gradual wavy boundary.

E3—42 to 67 inches; very pale brown (10YR 8/3) fine sand, very pale brown (10YR 7/3) moist; single grained; loose, very friable; few, very thin, discontinuous brownish yellow (10YR 6/8) lamellae less than 0.6-inch thick; slightly acid; gradual wavy boundary.

Bt1—67 to 72 inches; reddish yellow (7.5YR 7/6) fine sandy loam, reddish yellow (7.5YR 6/6) moist; moderate medium subangular blocky structure; slightly hard, firm; common coarse yellowish red (5YR 5/8) brittle bodies; thin discontinuous strong brown (7.5YR 5/6) clay films along ped faces; few fine pores; common medium distinct pale brown (10YR 6/3) masses of iron accumulation; moderately acid; clear wavy boundary.

Bt2—72 to 80 inches; reddish yellow (7.5YR 6/8) fine sandy loam, strong brown (7.5YR 5/8) moist; moderate medium subangular blocky structure; hard, firm; common thin continuous strong brown (7.5YR 5/6) clay films along vertical ped faces; 2 percent ironstone fragments; common medium distinct red (2.5YR 5/8) masses of iron accumulation and light gray (10YR 7/2) iron depletions; strongly acid.

The thickness of the solum is more than 80 inches. The combined thickness of the A and E horizons is 40 to 80 inches. Reaction ranges from moderately acid to neutral.

The A horizon is dark grayish brown, dark brown, brown, pale brown, dark yellowish brown, yellowish brown, very pale brown, grayish brown, or light brownish gray.

The E horizons are light yellowish brown, yellowish brown, yellow, pale brown, very pale brown, and brown. They are loamy fine sand or fine sand.

The Bt horizons have a matrix in shades of red, yellow, brown or gray. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. These horizons are fine sandy loam or sandy clay loam. Clay content ranges from 10 to 25 percent. Reaction ranges from strongly acid to slightly acid.

Rader Series

The Rader series consists of very deep, moderately well drained, very slowly permeable soils that formed in slightly acid to alkaline, clayey sediments interbedded with loamy materials. These very gently sloping soils are on stream terraces and on relict terraces on uplands. Slopes range from 1 to 3 percent. The soils of the Rader series are fine-loamy, mixed, thermic Aquic Paleustalfs.

Typical pedon of Rader fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 1.5 miles northeast on Texas Highway 21, 10.7 miles north on Farm Road 2000, 1.8 miles west on County Road 335, 150 feet north, in a pasture:

Ap—0 to 5 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable; common fine roots; common fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

E—5 to 13 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine roots; few medium faint dark yellowish brown (10YR 4/4) masses of iron accumulation; very strongly acid; gradual wavy boundary.

E/B—13 to 18 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; common medium masses of yellowish brown (10YR 5/6) (B part); weak medium subangular blocky structure; hard, friable; common fine roots; strongly acid; gradual wavy boundary.

Bt1—18 to 28 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; moderate medium subangular blocky structure; very hard, firm; continuous clay films on faces of peds; few fine roots; common medium distinct strong brown (7.5YR 5/6) and few fine prominent yellowish red (5YR 5/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Bt2—28 to 43 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; moderate medium prismatic structure; very hard, firm; continuous clay films on faces of peds; common fine distinct light brownish gray (10YR 6/2) iron depletions; few fine prominent red (2.5YR 4/8) masses of iron accumulation; strongly acid; gradual wavy boundary.

Bt3—43 to 65 inches; reddish yellow (7.5YR 7/8) sandy clay loam, reddish yellow (7.5YR 6/8) moist; weak medium prismatic structure; very hard, firm; continuous clay films on faces of peds; common fine distinct light gray (10YR 7/2) iron depletions and few fine prominent dark red (2.5YR 3/6) masses of iron accumulation; slightly acid; gradual wavy boundary.

BCt—65 to 80 inches; light gray (10YR 7/2) sandy clay loam, light gray (10YR 7/1) moist; weak medium prismatic structure; hard, firm; few clay films on faces of peds; common coarse distinct reddish yellow (7.5YR 6/8) and few medium prominent red (2.5YR 4/8) masses of iron accumulation; slightly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the upper 20 inches of the Bt horizons ranges from 28 to 35 percent.

The A horizon is brown or pale brown. The E horizon is very pale brown or light yellowish brown. Combined thickness of the A and E horizons is 10 to 20 inches. Reaction of these horizons ranges from very strongly acid to slightly acid.

The E/B horizon is 70 to 85 percent E materials. The E part is pale brown, light yellowish brown, or very pale brown. It is fine sandy loam or loam. The E material occurs as coatings on peds and in pockets. The B part of the E/B horizon is fine bodies of yellowish brown or brownish yellow. It is loam or sandy clay loam. Reaction ranges from very strongly acid to slightly acid.

The Bt1 horizon has a matrix in shades of brown or gray. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. This horizon is sandy clay or clay. Reaction is very strongly acid or strongly acid.

The underlying Bt horizons have a matrix in shades of brown, yellow, or gray. Redoximorphic features in shades of brown, yellow, red, or gray range from few to many. These horizons are sandy clay loam or clay loam. Reaction ranges from strongly acid to slightly acid.

The BCt horizon has a matrix in shades of gray, yellow, or brown. Redoximorphic features in shades of brown, yellow, red, or gray range from few to common. This horizon is sandy clay loam or clay loam. Reaction ranges from strongly acid to moderately alkaline.

Rehburg Series

The Rehburg series consists of deep, moderately well drained, very slowly permeable soils that formed in tuffaceous sandstones, mudstones and clays. These gently sloping soils are on uplands. Slopes range from 1 to 5 percent. The soils of the Rehburg series are loamy, mixed, thermic Aquic Arenic Paleustalfs.

Typical pedon of Rehburg loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 60 and Texas Highway 36 in Lyons, 6.5 miles west on Farm Road 60, 4.5 miles southeast on Park Road 57 to the main entrance to Birch Creek Park, 0.9 mile southeast on park road, 0.1 mile south on park road, 0.6 mile east on park road, 50 feet east of road:

A—0 to 15 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose, very friable; many very fine and fine roots; strongly acid; clear smooth boundary.

E—15 to 25 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose, very friable; many very fine and fine roots; few fine faint brownish yellow (10YR 6/6) iron accumulations in lower part; strongly acid; abrupt wavy boundary.

Bt—25 to 34 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; very hard, firm; common very fine and fine roots; continuous clay films on faces of peds; common medium prominent red (2.5YR 4/8) and common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; few fine faint light gray (10YR 7/2) iron depletions; moderately acid; gradual wavy boundary.

BCt—34 to 46 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; hard, firm; few very fine and fine roots; few fine weakly cemented sandstone fragments; clay films on faces of peds; common medium faint brownish yellow and common medium faint brown (10YR 5/3) masses of iron accumulation; strongly acid; gradual wavy boundary.

Cr—46 to 50 inches; grayish brown (2.5Y 5/2) and light yellowish brown (2.5Y 6/4) weakly cemented sandstone and tuffaceous clay; massive; very hard, very firm.

The thickness of the solum and the depth to the paralithic contact ranges from 40 to 60 inches. The combined thickness of the A and E horizons ranges from 20 to 40 inches.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or light gray. Reaction ranges from strongly acid to neutral.

The E horizon is light brownish gray, pale brown, or very pale brown. Some pedons have brownish yellow masses of iron accumulation that range from few to common in the lower part of the horizon. Reaction ranges from strongly acid to neutral.

The Bt horizon is dark grayish brown, grayish brown, or light brownish gray. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. This horizon is sandy clay loam or clay loam. Clay content of the control section ranges from 25 to 35 percent. Reaction ranges from very strongly acid to slightly acid.

The BCt horizon is yellowish brown or very pale brown sandy clay loam that has fragments of weakly cemented sandstone and tuffaceous clays. Reaction ranges from very strongly acid to slightly acid.

The Cr horizon is weakly to strongly cemented sandstone and tuffaceous clays.

Robco Series

The Robco series consists of very deep, moderately well drained, slowly permeable soils that formed in loamy sediments. These gently sloping soils are on uplands and stream terraces. Slopes range from 1 to 5 percent. The soils of the Robco series are loamy, siliceous, thermic Aquic Arenic Paleustalfs.

Typical pedon of Robco loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.3 miles southwest on Texas Highway 21, 5.85 miles northwest on Farm Road 908, 2.15 miles west on County Road 318, 1,500 feet northwest, in an area of improved pasture:

Ap—0 to 5 inches; light yellowish brown ((10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak medium granular structure; soft, very friable; common fine roots; strongly acid; clear smooth boundary.

E—5 to 24 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; single grained; soft, very friable; common fine roots; few fine distinct yellow (10YR 7/8) masses of iron accumulation; few medium faint light gray (10YR 7/2) iron depletions; strongly acid; gradual wavy boundary.

Bt/E—24 to 34 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist (Bt part); 40 percent tongues of very pale brown (10YR 7/3) loamy fine sand albic material (E part); weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of prisms; strongly acid; gradual wavy boundary.

Bt1—34 to 53 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; moderate medium prismatic structure; hard, firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of prisms; common medium distinct brownish yellow (10YR 6/8) and common medium prominent red (2.5YR 4/8) masses of iron accumulation; strongly acid; gradual smooth boundary.

Bt2—53 to 80 inches; yellow (10YR 7/6) sandy clay, brownish yellow (10YR 6/6) moist; moderate medium subangular blocky structure; very hard, very firm; continuous clay films on faces of peds; common medium prominent red (10R 4/8) masses of iron accumulation; common fine distinct light brownish gray (10YR 6/2) iron depletions; moderately acid.

The thickness of the solum range from 60 to more than 80 inches. Clay content of the upper 20 inches of the Bt horizon is 25 to 35 percent. The combined thickness of the A and E horizons is 20 to 40 inches.

The A horizon is brown, pale brown, yellowish brown, or light yellowish brown. Reaction ranges from strongly acid to slightly acid.

The E horizon is yellowish brown, light yellowish brown, pale brown, or very pale brown. Redoximorphic features in shades of gray or yellow range from none to common. Reaction ranges from very strongly acid to moderately acid.

The Bt/E horizon is 60 to 90 percent B material. The Bt part is yellowish brown or brownish yellow. It is loam or sandy clay loam. The E material consists of tongues, interfingers, and pockets. The E part is light yellowish brown, pale brown, very pale brown, or light gray loamy fine sand or fine sand. Redoximorphic features in shades of gray, yellow, or red range from few to common. Reaction ranges from very strongly acid to moderately acid.

The Bt horizons are grayish brown, light brownish gray, very pale brown, light gray, brownish yellow, or yellow. Redoximorphic features in shades of red, yellow, brown, and gray range from few to many. These horizons are sandy clay loam or clay loam. The lower part of the Bt horizon is sandy clay loam, clay loam, or sandy clay. Reaction ranges from very strongly acid to moderately acid.

Roetex Series

The Roetex series consists of very deep, somewhat poorly drained, very slowly permeable soils that formed in clayey alluvium. These nearly level soils are in depressions or swales within the flood plain of the Brazos River. Slopes are 0 to 1 percent. The soils of the Roetex series are very fine, mixed, thermic Aquic Hapluderts (fig. 23).

Typical pedon of Roetex clay, occasionally flooded; from the intersection of Farm Road 166 and Texas Highway 36 in Caldwell, 12.5 miles east on Farm Road 166, 1,500 feet north, in an area of rangeland:

A1—0 to 8 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; common fine roots; very slightly effervescent; slightly alkaline; abrupt wavy boundary.

A2—8 to 15 inches; dark reddish brown (5YR 3/2) clay, dark reddish brown (5YR 2.5/2) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; common fine roots; slightly effervescent; moderately alkaline; clear wavy boundary.

Bss1—15 to 21 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; few pressure faces and small slickensides; few vertical streaks of very dark gray (5YR 3/1) clay as much as 0.5-inch wide and 3 to 6 inches long; common medium prominent dark gray (10YR 4/1) iron depletions; strongly effervescent; moderately alkaline; clear wavy boundary.

Bss2—21 to 26 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; few cracks; common medium slickensides; common fine prominent gray (5YR 5/1) iron depletions; common fine faint dark reddish brown (5YR 3/4) masses of iron accumulation; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bss3—26 to 36 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few cracks; many large slickensides tilted 40 to 60 degrees; common fine prominent gray (5YR 5/1) iron depletions; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bss4—36 to 53 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; common discontinuous bedding planes 1 to 2 inches thick of reddish brown (5YR 4/3) and gray (5YR 5/1) clay; moderate medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; many large slickensides tilted at 40 to 60 degrees; few fine concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

BCss1—53 to 61 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; common large slickensides; some gray (5YR 5/1) faces of peds; few fine concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

BCss2—61 to 72 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; common large slickensides; some gray (5YR 4/1) faces of peds; few fine concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—72 to 80 inches; bedding planes of yellowish red (5YR 4/6) and reddish gray (2.5YR 5/1) silty clay; massive; extremely hard, very firm; few fine concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to 80 inches. Clay content of the control section ranges from about 60 to 72 percent. Slickensides ranging from few to many, begin at a depth of 12 to 24 inches and extend throughout the solum. The soil cracks when dry. Cracks remain open for less than 90 cumulative days. Reaction is slightly alkaline or moderately alkaline throughout. The soil is very slightly to strongly effervescent.

The A horizons are dark reddish gray, dark grayish brown, dark brown, or reddish brown.

The Bss horizons, or Bw horizon in some pedons, are reddish brown, dark brown or brown. Iron depletions with chroma of 2 or less range from few to common. These horizons are clay or silty clay. Some pedons have thin bedding planes of silty clay loam or silt loam.

The BCss horizons has a matrix in shades of red or brown. Some pedons have redoximorphic features in shades of red, brown, or gray that range from few to many. These horizons are clay or silty clay.

The C horizon has a matrix in shades of red, brown, yellow or gray. It is silty clay or clay with bedding planes of loamy materials.

Figure 23.—Profile of a Roetex clay, formed in clayey alluvium on the Brazos River flood plain.

Sandow Series

The Sandow series consists of very deep, moderately well drained, moderately slowly permeable soils that formed in loamy alluvial sediments. These nearly level soils are on flood plains. Slopes are 0 to 1 percent. The soils of the Sandow series are fine-loamy, siliceous, thermic Udifluventic Haplustepts.

Typical pedon of Sandow loam, frequently flooded; from the intersection of Texas Highway 36 and Texas Highway 21 in Caldwell, 3.5 miles northwest on Texas Highway 36, 1,200 feet east, on a flood plain:

A—0 to 7 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, firm; common fine roots and pores; moderately acid; gradual smooth boundary.

Bw—7 to 24 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots and pores; many fine distinct strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid; clear smooth boundary.

Ab—24 to 36 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure; hard, friable; few fine roots and pores; common fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation; slightly acid; clear smooth boundary.

Bwb1—36 to 50 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; slightly hard, friable; few fine roots and pores; few fine iron-manganese concretions; common fine distinct dark yellowish brown (10YR 3/4) masses of iron accumulation; moderately acid; clear smooth boundary.

Bwb2—50 to 64 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; hard, friable; few fine iron-manganese concretions; common medium prominent brownish yellow (10YR 6/8) masses of iron accumulation; neutral; clear smooth boundary

Bwb3—64 to 80 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; weak medium prismatic structure; hard, friable; common medium prominent light brownish gray (10YR 6/2) iron depletions; slightly alkaline.

The thickness of the solum is more than 80 inches thick. Clay content of the 10- to 40-inch control section ranges from 18 to 25 percent. Reaction ranges from moderately acid to neutral in the recent sediments and moderately acid to slightly alkaline in the buried sediments.

The A horizon is dark grayish brown, dark brown, or brown. Redoximorphic features in shades of brown, yellow, or gray range from few to common in some pedons.

The Bw horizon is pale brown, light yellowish brown, yellowish brown, or brownish yellow. Redoximorphic features in shades of brown, yellow, or gray range from few to many in most pedons. This horizon is fine sandy loam, loam, or sandy clay loam.

The Ab horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, or dark brown. Redoximorphic features in shades of brown or yellow range from few to common in most pedons. This horizon is loam, sandy clay loam, or clay loam. Some pedons do not have an Ab horizon.

The Bwb horizons are dark gray, dark grayish brown, grayish brown, light brownish gray, brown, strong brown, or reddish yellow. Redoximorphic features in shades of gray, brown, or yellow range from few to common in most pedons. These horizons are loam, sandy clay loam, or clay loam.

Ships Series

The Ships series consists of very deep, moderately well drained, very slowly permeable soils that formed in clayey alluvial sediments. These nearly level to very gently sloping soils are on flood plains of the Brazos River. Slopes range from 0 to 3 percent. The soils of the Ships series are very fine, mixed, thermic Chromic Hapluderts.

Typical pedon of Ships clay, 0 to 1 percent slopes, rarely flooded; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 3.4 miles northeast on Farm Road 60, 3.4 miles southeast on Farm Road 50, 2.1 miles northeast on private ranch road, 1,300 feet southeast, in an area of cropland:

Ap—0 to 9 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine angular blocky structure; very hard, firm; common fine and very fine roots; shell fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

A—9 to 20 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; moderate medium angular blocky structure; very hard, very firm; common fine and very fine roots; few medium pressure faces; shell fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

Bss1—20 to 55 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; moderate fine angular blocky structure; very hard, very firm; few fine and very fine roots; few cracks; common large slickensides; shell fragments; few fine concretions of calcium carbonate; common medium distinct brown (7.5YR 4/2) masses of iron accumulation; strongly effervescent; moderately alkaline; clear smooth boundary.

Bss2—55 to 73 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; very hard, very firm; common large slickensides; common medium distinct brown (7.5YR 4/2) masses of iron accumulation; strongly effervescent; moderately alkaline; clear smooth boundary.

2Ab—73 to 80 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; hard, firm; moderately alkaline.

The thickness of the solum is more than 80 inches. Cracks more than 0.5-inch wide extend to a depth of 20 to 50 inches when the soil is dry. Clay content of the 10- to 40-inch control section is 60 to 70 percent. Large slickensides occur throughout the control section. Reaction is moderately alkaline. The soil is strongly effervescent throughout the solum.

The A horizons are dark brown, brown, dark reddish gray, or reddish brown.

The Bss horizons are dark brown, brown, or reddish brown. Redoximorphic features in shades of gray or brown range from none to common. These horizons are clay or silty clay.

The 2Ab horizon is dark gray or very dark gray silty clay loam or clay loam. Some pedons do not have a 2Ab horizon.

Shiro Series

The Shiro series consists of moderately deep, well drained, slowly permeable soils formed in weakly cemented sandstone and tuffaceous shales. These gently sloping soils are on uplands. Slopes range from 1 to 5 percent. The soils of the Shiro series are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Shiro loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.9 miles southeast on Farm Road 2155, 1.5 miles southwest on Farm Road 1361, 2.4 miles southeast on County Road 434, 0.25 mile south on farm trail, 100 feet west, in an area of rangeland:

A—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; few siliceous pebbles; strongly acid; clear smooth boundary.

E—8 to 11 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; slightly hard, very friable; common fine roots; few siliceous pebbles; strongly acid; abrupt smooth boundary.

Bt1—11 to 20 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to moderate medium angular blocky; very hard, firm; common fine roots; continuous clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) iron depletions; very strongly acid; gradual smooth boundary.

Bt2—20 to 30 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm; few fine roots; continuous clay films on faces of peds; common fine prominent red (2.5YR 5/8) and few fine distinct brownish yellow (10YR 6/8) masses of iron accumulation; very strongly acid; gradual smooth boundary.

BCt—30 to 36 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; very hard, very firm; few clay films on faces of peds; common medium faint very pale brown (10YR 7/3) and few fine distinct reddish yellow (7.5YR 6/8) masses of iron accumulation; very strongly acid; clear smooth boundary.

Cr—36 to 40 inches; light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) weakly cemented sandstone stratified with dark grayish brown (10YR 4/2) shale; extremely hard; extremely firm.

The thickness of the solum and the depth to the paralithic contact ranges from 20 to 40 inches. The combined thickness of the A and E horizons ranges from 10 to 18 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 35 to 45 percent. Colors with chroma of 2 or less are considered lithochromic or relict.

The A horizon is grayish brown, brown, or light brownish gray. Reaction ranges from strongly acid to slightly acid.

The E horizon is very pale brown, pale brown, light brownish gray, or grayish brown. Reaction ranges from strongly acid to slightly acid.

The Bt1 horizon is red, reddish brown, or yellowish red. Redoximorphic features in shades of gray, brown, or yellow range from few to many. This horizon is clay loam, sandy clay, or clay. Reaction is very strongly acid or strongly acid.

The underlying Bt and BCt horizons are gray, light gray, or light brownish gray. Iron concentrations in shades of red, brown, or yellow range from few to many. These horizons are clay loam, sandy clay, or clay. Reaction ranges from very strongly acid to neutral.

The Cr horizon is weakly to moderately cemented tuffaceous sandstone or mudstone that is interbedded with shale.

Silawa Series

The Silawa series consists of very deep, well drained, moderately permeable soils that formed in sandy and loamy sediments. These gently sloping soils are on stream terraces. Slopes range from 2 to 5 percent. The soils of the Silawa series are fine-loamy, siliceous, thermic Ultic Haplustalfs.

Typical pedon of Silawa loamy fine sand, 2 to 5 percent slopes; from the intersection of Texas Highway 36 and Texas Highway 21 in Caldwell, 15.5 miles southeast on Texas Highway 36, 3.5 miles northeast on County Road 423, 200 feet north, in an area of hayland:

Ap—0 to 9 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; common fine roots; strongly acid; clear smooth boundary.

Bt1—9 to 21 inches; light red (2.5YR 6/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; common fine roots; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—21 to 35 inches; light red (2.5YR 6/8) sandy clay loam, red (2.5YR 4/8) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; continuous clay films on faces of peds; few fine distinct brownish yellow (10YR 6/8) masses of iron accumulation; strongly acid; gradual smooth boundary.

BCt—35 to 47 inches; reddish yellow (5YR 7/8) fine sandy loam, reddish yellow (5YR 6/8) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; strongly acid; gradual smooth boundary.

C—47 to 80 inches; reddish yellow (7.5YR 7/8) loamy fine sand, reddish yellow (7.5YR 6/8) moist; single grained; slightly hard, friable; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Clay content of the upper 20 inches of the Bt horizons ranges from 18 to 35 percent. Clay decreases by 20 percent or more of maximum at a depth of 30 to 60 inches. Siliceous pebbles range from 0 to 3 percent throughout the solum.

The A horizon is dark yellowish brown or brown. Reaction ranges from strongly acid to slightly acid.

Some pedons have an E horizon that is yellowish brown, very pale brown, or pale brown. Reaction ranges from strongly acid to slightly acid.

The Bt horizons are red, light red, or yellowish red. Some pedons have few masses of iron accumulation in shades of red, brown, or yellow in the lower Bt horizons. The Bt horizons are sandy clay loam or clay loam. Reaction ranges from very strongly acid to moderately acid.

The BCt horizon is red, reddish yellow, or yellowish red. It is sandy clay loam or fine sandy loam. Reaction ranges from very strongly acid to moderately acid.

The C horizon has a matrix in shades of red, yellow, or brown. It is loamy fine sand or fine sandy loam. Reaction ranges from very strongly acid to slightly acid.

Silstid Series

The Silstid series consists of very deep, well drained, moderately permeable soils that formed in beds of sandy or loamy materials and interbedded sandstones. These gently sloping to moderately sloping soils are on uplands. Slopes range from 1 to 8 percent. The soils of the Silstid series are loamy, siliceous, thermic Arenic Paleustalfs.

Typical pedon of Silstid loamy fine sand, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 4.3 miles southwest on Texas Highway 21, 9.0 miles northwest on Farm Road 908, 0.25 mile south on oilfield road, 0.65 mile on private road, 50 feet south, in an area of rangeland:

A—0 to 12 inches; light yellowish brown (10YR 6/4) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; loose, very friable; common very fine and fine roots; moderately acid; clear smooth boundary.

E—12 to 28 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose, very friable; common very fine and fine roots; moderately acid; clear smooth boundary.

Bt1—28 to 38 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; moderate medium subangular blocky structure; hard, friable; few very fine and fine roots; thin clay films on faces of peds; common medium faint yellowish red (5YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

Bt2—38 to 70 inches; yellow (10YR 7/8) sandy clay loam, brownish yellow (10YR 6/8) moist; moderate medium subangular blocky structure; hard, friable; thin clay films on faces of peds; common medium prominent red (2.5YR 4/8) masses of iron accumulation; strongly acid; clear wavy boundary.

BCt—70 to 80 inches; yellow (10YR 7/8) fine sandy loam; brownish yellow (10YR 6/8) moist; weak medium subangular blocky structure; slightly hard, very friable; thin clay films on faces of peds; common medium prominent red (2.5YR 5/8) masses of iron accumulation; strongly acid.

The thickness of the solum ranges from 60 to 80 inches.

The A horizon is brown, light brown, pale brown, or light yellowish brown. The E horizon is light yellowish brown, very pale brown, or pink. The combined thickness of the A and E horizons is 20 to 40 inches. Reaction ranges from moderately acid to neutral.

The Bt horizons are yellow, brownish yellow, yellowish brown, reddish yellow, or strong brown. Masses of iron accumulation, in shades of red, range from few to many throughout the Bt horizons. Clay content of the upper 20 inches of the Bt horizon ranges from 18 to 32 percent. Reaction ranges from strongly acid to slightly acid.

The BCt horizon has a matrix in shades of brown, red, or yellow. Masses of iron accumulation in shades of red and yellow range from none to common. Streaks or pockets of uncoated sand are on faces of peds in some pedons. This horizon is loamy fine sand, fine sandy loam, or loam. Reaction ranges from strongly acid to slightly acid.

Singleton Series

The Singleton series consists of moderately deep, moderately well drained, very slowly permeable soils that formed in weakly cemented sandstone and mudstone. These very gently sloping soils are on uplands. Slopes range from 1 to 3 percent. The soils of the Singleton series are fine, smectitic, thermic Udic Paleustalfs.

Typical pedon of Singleton fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 60 and Texas Highway 36 in Lyons, 3.7 miles southwest on Farm Road 60, 4.55 miles southeast on Park Road 4, 96 feet south of road, in Big Creek Park:

A—0 to 10 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; hard, friable; many fine roots; few fine siliceous pebbles; strongly acid; abrupt wavy boundary.

Bt1—10 to 22 inches; brown (10YR 5/3) clay; brown (10YR 4/3) moist; moderate medium angular blocky; extremely hard, very firm; many fine roots; common grayish brown (10YR 5/2) coatings on faces of peds; continuous clay films on faces of peds; common medium prominent yellowish red (5YR 4/6) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Bt2—22 to 32 inches; brown (10YR 5/3) clay; brown (10YR 4/3) moist; moderate medium angular blocky; very hard, very firm; few fine roots; continuous clay films on faces of peds; few fine distinct strong brown (7.5YR 4/6) masses of iron accumulation; very strongly acid; abrupt wavy boundary.

Cr—32 to 40 inches; very dark gray (10YR 3/1) weakly cemented sandstone; massive and horizontally bedded; very hard, very firm.

The thickness of the solum and the depth to a paralithic contact ranges from 20 to 40 inches.

The A horizon is dark grayish brown, grayish brown, brown, or light gray. Reaction is strongly acid or moderately acid.

The Bt horizons are pale brown or brown. Redoximorphic features in shades of brown, yellow, red, or gray, range from few to common. Clay content of the upper 20 inches of the Bt horizons ranges from 40 to 45 percent. Reaction ranges from very strongly acid to moderately acid.

The Cr horizon is weakly cemented sandstone or mudstone interbedded with clay loam or sandy clay loam.

Spiller Series

The Spiller series consists of very deep, moderately well drained, slowly permeable soils. They formed in weakly consolidated loamy and shaly deposits. These very gently sloping soils are on convex uplands. Slopes range from 1 to 3 percent. The soils of the Spiller series are fine, mixed, thermic Ultic Paleustalfs.

Typical pedon of Spiller fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 166 and Texas Highway 36 in Caldwell, 1.1 miles east on Farm Road 166, 1.7 miles southeast on Farm Road 3058, 100 feet east, in an area of rangeland:

A—0 to 12 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine roots; 1 percent ironstone pebbles; moderately acid; abrupt smooth boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/6) clay, dark yellowish brown (10YR 4/6) moist; moderate medium angular blocky structure; very hard, firm; common fine roots; continuous clay films on faces of peds; common pressure faces; many medium prominent red (2.5YR 4/6) and few fine faint dark yellowish brown (10YR 4/4) masses of iron accumulation; strongly acid; clear smooth boundary.

Bt2—21 to 32 inches; brownish yellow (10YR 6/8) clay, yellowish brown (10YR 5/8) moist; moderate medium angular blocky structure; very hard, firm; few fine roots; continuous clay films on faces of peds; common pressure faces; common fine prominent red (2.5YR 5/8) and few fine distinct brown (10YR 5/3) masses of iron accumulation; strongly acid; clear smooth boundary.

Bt3—32 to 45 inches; brownish yellow (10YR 6/8) clay, yellowish brown (10YR 5/8) moist; moderate medium angular blocky structure; very hard, firm; continuous clay films on faces of peds; few pressure faces; few fine prominent yellowish red (5YR 4/6) masses of iron accumulation; few grayish brown (10YR 5/2) iron depletions; strongly acid; clear smooth boundary.

BCt—45 to 50 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; weak medium subangular blocky structure; hard, firm; few clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) iron depletions; few fine faint yellowish red (5YR 5/8) masses of iron accumulation; slightly acid; clear smooth boundary.

C—50 to 80 inches; weakly consolidated 1 to 3 inch thick strata of strong brown (7.5YR 5/8) loam and light gray (10YR 7/2) shale; massive; neutral.

The thickness of the solum ranges from 50 to 60 inches. Clay content of the upper 20 inches of the Bt horizons ranges from 35 to 45 percent. Ironstone pebbles range from 0 to 5 percent.

The A horizon is dark brown, brown, or dark yellowish brown. Reaction ranges from moderately acid to neutral.

Some pedons have an E horizon that is brown, pale brown, yellowish brown, or light yellowish brown. Reaction ranges from moderately acid to neutral.

The Bt1 and Bt2 horizons are yellowish brown or brownish yellow. Masses of iron accumulation in shades of red, yellow, or brown range from few to many. These horizons are clay, clay loam, or sandy clay. Reaction ranges from strongly acid to slightly acid.

The Bt3 horizon is yellowish brown or brownish yellow. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. This horizon is clay, clay loam, or sandy clay. Reaction is strongly acid or moderately acid.

The BCt horizon is yellowish brown, brownish yellow, strong brown, reddish yellow, or red. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. This horizon is clay loam or sandy clay loam. Reaction ranges from strongly acid to slightly acid.

The C horizon is in shades of gray, yellow, or brown. It is fine sandy loam, loam, or sandy clay loam and has strata of light gray shale. Some pedons have thin lenses of sandstone. Reaction ranges from strongly acid to slightly alkaline.

Sumpf Series

The Sumpf series consists of very deep, very poorly drained, very slowly permeable soils that formed in clayey alluvial sediments in abandoned river channels of the Brazos River. These nearly level soils are on flood plains. Slopes are 0 to 1 percent. The soils of the Sumpf series are very-fine, mixed, thermic Aeric Endoaquerts.

Typical pedon of Sumpf clay, frequently flooded; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 3.4 miles northeast on Farm Road 60, 12.8 miles southeast on Farm Road 50, 1.3 miles east on County Road 444, 3.6 miles northeast on private ranch road, 200 feet north, in oxbow:

A—0 to 25 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; very hard, very firm; common fine and very fine roots; few fine and medium iron-manganese concretions; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bss1—25 to 35 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium angular blocky structure; very hard, very firm; few very fine roots; few cracks; common large slickensides; dark gray (10YR 4/1) coatings on faces of some peds; strongly effervescent; slightly alkaline; clear wavy boundary.

Bss2—35 to 50 inches; dark gray (5YR 4/1) clay, reddish gray (5YR 5/2) moist; moderate coarse angular blocky structure; very hard, very firm; few fine roots along faces of peds; common large slickensides; few fine iron-manganese concretions; slightly effervescent; slightly alkaline; gradual wavy boundary.

C—50 to 80 inches; brown (7.5YR 5/4) clay; brown (7.5YR 4/4) moist with thin bedding planes of dark gray (10YR 4/1) clay; massive; extremely hard, very firm; few fine iron-manganese concretions; violently effervescent; slightly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. This soil remains wet most of the year and seldom cracks to a depth of 20 inches. Reaction is slightly alkaline or moderately alkaline throughout. The soil is slightly to violently effervescent. Clay content in the 10- to 40-inch control section ranges from 60 to 80 percent. Slickensides range from few to many. Buried A horizons are common in the control section.

The A horizon is dark gray or dark grayish brown.

The Bss horizons are dark gray, dark brown, dark reddish gray, reddish gray, or reddish brown. Redoximorphic features in shades of gray, brown, or red range from none to common. These horizons are clay or silty clay.

The C horizon is at a depth of 40 to 60 inches. It is brown or reddish brown clay or silty clay. Some pedons contain thin bedding planes of silt loam or silty clay loam. Some pedons have a 2C horizon.

Tabor Series

The Tabor series consists of very deep, moderately well drained, very slowly permeable soils that formed in clayey and loamy sediments. These nearly level soils are on stream terraces and on relict terraces on uplands. Slopes range from 0 to 2 percent. The soils of the Tabor series are fine, smectitic, thermic Udertic Paleustalfs.

Typical pedon of Tabor fine sandy loam, 0 to 2 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 3.4 miles northeast on Texas Highway 21, 2.2 miles southeast on County Road 210, 0.7 mile east on County Road 225, 100 feet southeast, in an area of native hayland:

A—0 to 13 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; hard, very friable; common fine roots; few siliceous pebbles; strongly acid; clear wavy boundary.

Btss1—13 to 24 inches; yellow (10YR 7/6) clay, brownish yellow (10YR 6/6) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; thin clay films on faces of peds; common medium slickensides; many medium distinct grayish brown (10YR 5/2) iron depletions; common medium prominent red (2.5YR 4/8) masses of iron accumulation; very strongly acid; gradual wavy boundary.

Btss2—24 to 48 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm; thin clay films on faces of peds; few cracks; common medium slickensides; few fine iron-manganese concretions; common fine faint yellow (10YR 7/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

BCt—48 to 80 inches; yellow (10YR 7/6) clay loam, brownish yellow (10YR 6/6) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, firm; thin clay films on faces of peds; few siliceous pebbles; few fine iron-manganese concretions; few medium distinct light gray (10YR 7/2) iron depletions; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the upper 20 inches of the Bt horizons ranges from 45 to 55 percent.

The A horizon is brown, pale brown, very pale brown, light brownish gray, or grayish brown. Siliceous pebbles range from 0 to 5 percent. Reaction ranges from strongly acid to slightly acid.

The Btss horizons are yellow, yellowish brown, brownish yellow, grayish brown, or light brownish gray. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. These horizons are clay; however, some underlying Bt horizons are clay loam. Reaction ranges from strongly acid to neutral.

The BCt horizon is yellow, yellowish brown, brownish yellow, light yellowish brown, or very pale brown. Redoximorphic features in shades of gray or red range from few to common. This horizon is sandy clay loam or clay loam. Reaction ranges from moderately acid to slightly alkaline.

Uhland Series

The Uhland series consists of very deep, moderately well drained, moderately slowly permeable soils that formed in loamy and sandy alluvial sediments. These nearly level soils are on flood plains. Slopes are 0 to 1 percent. The soils of the Uhland series are coarse-loamy, siliceous, thermic Aquic Haplustepts (fig. 24).

Typical pedon of Uhland fine sandy loam, frequently flooded; from the intersection of Farm Road 1361 and Texas Highway 36 in Somerville, 4.7 miles northeast on Farm Road 1361, 2.0 mile southeast on County Road 433, 0.2 mile south on private road, 0.2 mile southeast on oilfield road, 50 feet west of road, on a flood plain:

A—0 to 9 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; few fine faint yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; clear smooth boundary.

Bw1—9 to 28 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular structure; slightly hard, friable; common fine roots; common fine faint dark grayish brown (10YR 4/2) iron depletions; few medium distinct yellow (10YR 7/8) masses of iron accumulation; slightly acid; clear smooth boundary.

Bw2—28 to 50 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; few fine distinct brownish yellow (10YR 6/6) masses of iron accumulation and light brownish gray (10YR 6/2) iron depletions; slightly acid; abrupt smooth boundary.

Bg—50 to 80 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; very hard, firm; few fine iron-manganese concretions; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; slightly acid.

The thickness of the solum of alluvial sediments is more than 80 inches. Clay content of the 10- to 40-inch control section ranges from 10 to 18 percent. Reaction ranges from slightly acid to slightly alkaline.

The A horizon is pale brown, brown, dark brown, grayish brown, or yellowish brown. Some pedons have few or common masses of iron accumulation in shades of brown or yellow.

The B horizons are mainly in shades of brown, yellow, or gray. Redoximorphic features in shades of brown, yellow, or gray range from few to many. These horizons are fine sandy loam or loam.

Some pedons contain buried horizons that are loam or sandy clay loam below a depth of 40 inches.

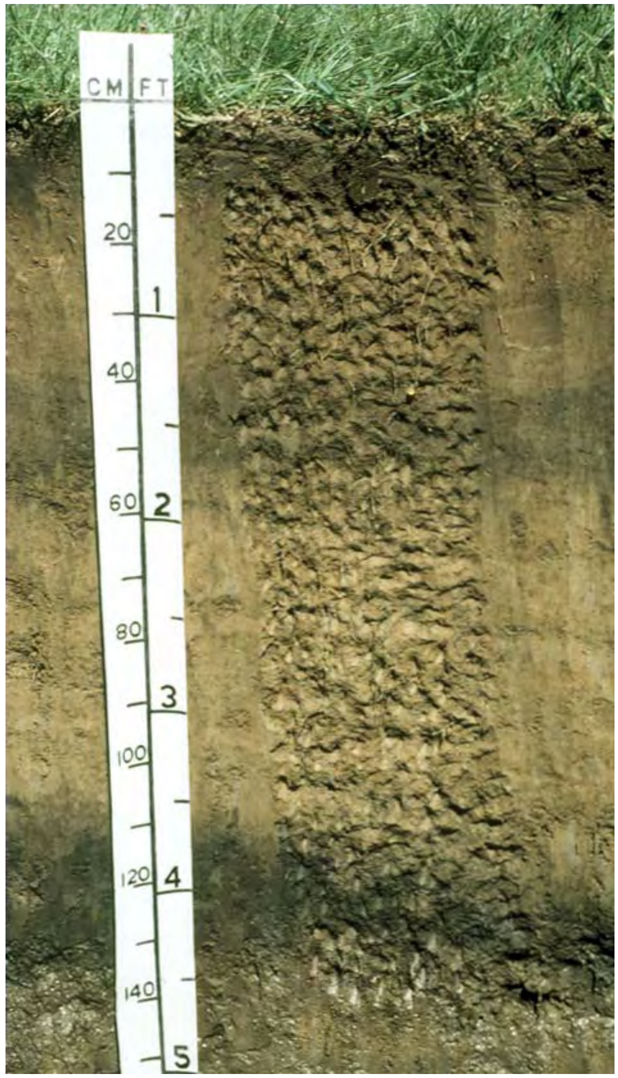

Figure 24.—Profile of a Uhland fine sandy loam, formed in loamy alluvium. Note the dark and light colored stratified layers that are evidence of deposition by flooding.

Weswood Series

The Weswood series consists of very deep, well drained, moderately permeable soils formed in calcareous, loamy alluvial sediments. These nearly level to very gently sloping soils are on flood plains of the Brazos River. Slopes range from 0 to 3 percent. The soils of the Weswood series are coarse-silty, mixed, thermic Udifluventic Haplustepts.

Typical pedon of Weswood silt loam, 0 to 1 percent slopes, rarely flooded; from the intersection of Farm Road 60 and Farm Road 2155 in Snook, 3.4 miles northeast on Farm Road 60, 1.5 miles south on Farm Road 50, 1,000 feet north, 300 feet southeast on field road, in a pecan orchard:

Ap—0 to 9 inches; brown (7.5YR 5/4) silt loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; common wormcasts; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw1—9 to 18 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; moderate fine subangular blocky structure; slightly hard, friable; few very fine roots; common fine pores; common wormcasts; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—18 to 26 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; soft, very friable; few thin discontinuous bedding planes; common fine pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw3—26 to 42 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few discontinuous bedding planes; few fine pores; few fine faint strong brown (7.5YR 5/8) masses of iron accumulation; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw4—42 to 54 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; common discontinuous bedding planes; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw5—54 to 60 inches; pink (7.5YR 7/4) very fine sandy loam, light brown (7.5YR 6/4) moist; weak coarse prismatic structure; soft, very friable; common discontinuous bedding planes; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw6—60 to 73 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common discontinuous bedding planes; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bwb—73 to 80 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; hard, firm; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Clay content of the 10- to 40-inch control section ranges from 18 to 35 percent. The solum is mainly silt loam. In most pedons, however, bedding planes as much as 0.5-inch thick of very fine sandy loam or silty clay loam range from few to many below a depth of 20 inches. Reaction is slightly alkaline or moderately alkaline. The soil is slightly or strongly effervescent

The A horizon is reddish brown, dark brown, or brown. It is silt loam or silty clay loam.

The Bw horizons are light reddish brown, reddish brown, yellowish red, reddish yellow, pink, brown, light brown, or strong brown. They are mainly silt loam in the upper part; however, some Bw subhorizons are very fine sandy loam. The lower part, or 2Bwb horizon, includes silty clay loam or silty clay.

Some pedons have a C horizon that is reddish brown, light reddish brown, reddish yellow, or pink. Bedding planes are very fine sandy loam, silt loam, or silty clay loam.

Wilson Series

The Wilson series consists of very deep, moderately well drained, very slowly permeable soils that formed in alkaline clayey sediments. These nearly level soils are on stream terraces and on relict terraces on uplands. Slopes range from 0 to 2 percent. The soils of the Wilson series are fine, smectitic, thermic Oxyaquic Vertic Haplustalfs.

Typical pedon of Wilson loam, 0 to 1 percent slopes; from the intersection of Farm Road 2155 and Farm Road 60 in Snook, 5.2 miles southeast on Farm Road 2155, 0.25 mile northeast on Farm Road 1361, 0.5 mile north on private road, 2,000 feet northeast, in an area of rangeland:

A—0 to 7 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; massive when dry; very hard; friable; common fine roots; slightly acid; clear wavy boundary.

Bt—7 to 19 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; continuous clay films on faces of peds; neutral; gradual wavy boundary.

Btss1—19 to 33 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm; very few fine roots; few cracks; common medium slickensides; neutral; gradual wavy boundary.

Btss2—33 to 54 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak medium angular blocky structure; extremely hard, firm; common medium slickensides; very dark gray (10YR 3/1) coatings on faces of peds; few concretions of calcium carbonate; neutral; gradual wavy boundary.

BCt—54 to 80 inches; light gray (2.5Y 7/2) clay loam; weak medium subangular blocky structure; hard, firm; few clay films on faces of peds; neutral.

The thickness of the solum ranges from 60 to 80 inches. Clay content of the upper 20 inches of the Bt horizon ranges from 35 to 45 percent.

The A horizon is dark gray, dark grayish brown, or grayish brown. It is massive and hard when dry. Reaction is slightly acid or neutral.

The Bt horizon is very dark gray, dark gray, or gray. Iron concentrations in shades of brown or yellow range from none to common. This horizon is clay loam or clay. Reaction ranges from slightly acid to slightly alkaline.

The Btss horizons are dark gray, gray, grayish brown, or light brownish gray. Iron concentrations in shades of brown or yellow range from none to common. These horizons are clay loam or clay. Reaction ranges from slightly acid to slightly alkaline.

The BCt horizon has a matrix in shades of gray or brown. Iron concentrations in shades of yellow or olive range from none to common. This horizon is silty clay loam or clay loam. Reaction ranges from neutral to moderately alkaline.

Yahola Series

The Yahola series consists of very deep, well drained, moderately rapid permeable soils that formed in calcareous, sandy and loamy alluvial sediments. These nearly level or very gently sloping soils are on flood plains of the Brazos River. Slopes range from 0 to 2 percent. The soils of the Yahola series are coarse-loamy, mixed, (calcareous), thermic Udic Ustifluvents.

Typical pedon of Yahola fine sandy loam, 0 to 2 percent slopes, rarely flooded; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 11.1 miles northeast on Texas Highway 21, 4.3 miles southeast on Farm Road 50, 1.2 miles northeast on County Road 260, 0.8 mile northwest and northeast on field road, 2,500 feet northeast, in an area of rangeland:

A—0 to 7 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; soft, very friable; many fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—7 to 22 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; massive; soft, very friable; common fine roots; distinct bedding planes; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—22 to 50 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; massive; soft, very friable; indistinct bedding planes; slightly effervescent; moderately alkaline; clear smooth boundary.

C3—50 to 62 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grained; loose, very friable; 5 percent siliceous pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

C4—62 to 80 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; 5 percent siliceous pebbles; slightly effervescent; moderately alkaline.

Depth of sandy and loamy alluvial sediments is more than 80 inches. Bedding planes of contrasting textures are evident throughout the underlying horizons. Clay content of the 10- to 40-inch control section ranges from 5 to 18 percent. Reaction is slightly alkaline or moderately alkaline, and the soil ranges from slightly effervescent to strongly effervescent.

The A horizon is dark brown, brown, strong brown, or light brown.

The C horizons are brown, strong brown, light brown, or reddish yellow. They are fine sandy loam or loam above a depth of 40 inches and fine sandy loam or loamy fine sand below a depth of 40 inches. Thin bedding planes of coarser or finer materials occur throughout the C horizon.

Zack Series

The Zack series consists of soils that are moderately deep to thinly bedded mudstone or sandstone. They are moderately well drained and very slowly permeable. These very gently sloping soils are on uplands. Slopes range from 1 to 3 percent. The soils of the Zack series are fine, smectitic, thermic Udic Paleustalfs (fig. 25).

Typical pedon of Zack fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 7.7 miles southwest on Texas Highway 21, 5.0 miles southeast on Farm Road 60, 800 feet north on private road, 1,000 feet northwest, in an area of improved pasture:

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, very friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt—5 to 13 inches; dark brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate medium angular blocky structure; very hard, very firm; common fine roots; common pressure faces; continuous clay films on faces of peds; common fine distinct yellowish red (5YR 5/8) masses of iron accumulation; moderately acid; gradual smooth boundary.

Btss—13 to 30 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; few wedge-shaped aggregates; few cracks; few fine ironstone pebbles; common pressure faces; few small slickensides; continuous clay films on faces of peds; few concretions of calcium carbonate; few fine faint brown (10YR 5/3) masses of iron accumulation; slightly alkaline; gradual smooth boundary.

2BCt—30 to 37 inches; dark brown (10YR 4/3) sandy clay loam; interbedded with very pale brown (10YR 7/3) weakly consolidated sandstone; weak medium subangular blocky structure; hard, firm; few clay films on faces of peds; slightly alkaline; gradual smooth boundary.

2C—37 to 60 inches; stratified very pale brown (10YR 7/3) weakly consolidated mudstone and sandstone with loam texture; massive; hard, firm; slightly alkaline.

The thickness of the solum ranges from 25 to 40 inches, which is the depth to thinly bedded mudstone or sandstone. Clay content of the upper 20 inches of the Bt horizons ranges from 40 to 55 percent. When dry, cracks as much as 2 inches wide extend from a depth of about 5 inches to a depth of 2 feet.

The A horizon is dark grayish brown, dark brown, grayish brown, brown, or dark yellowish brown. Iron concentrations of yellowish brown or brownish yellow are in some pedons. Siliceous pebbles range from 0 to 5 percent. Reaction ranges from strongly acid to slightly acid.

Some pedons have an E horizon that is pale brown, light yellowish brown, or brownish yellow. Some pedons have iron concentrations in shades of brown or yellow that range from few to common. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is red, reddish brown, yellowish red, strong brown, dark brown, or brown. Redoximorphic features in shades of red, brown, yellow, or gray range from few to many. Reaction ranges from moderately acid to neutral.

The Btss horizon is dark grayish brown, grayish brown, or brown. Redoximorphic features in shades of red, brown, yellow, or gray range from few to many. Concretions of calcium carbonate range from none to few. Pressure faces or slickensides range from few to common. Reaction ranges from moderately acid to slightly alkaline.

The 2BCt horizon is dark grayish brown, grayish brown, light brownish gray, dark brown, brown, or pale brown. Iron concentrations in shades of brown, yellow, or gray range from few to common. This horizon is sandy clay loam or clay loam. Concretions of calcium carbonate range from none to common. Reaction ranges from neutral to moderately alkaline.

The 2C horizon is light gray, grayish brown, light brownish gray, or very pale brown. The sediments are weakly consolidated mudstone and sandstone with a texture of loam or clay loam. Reaction ranges from neutral to moderately alkaline.

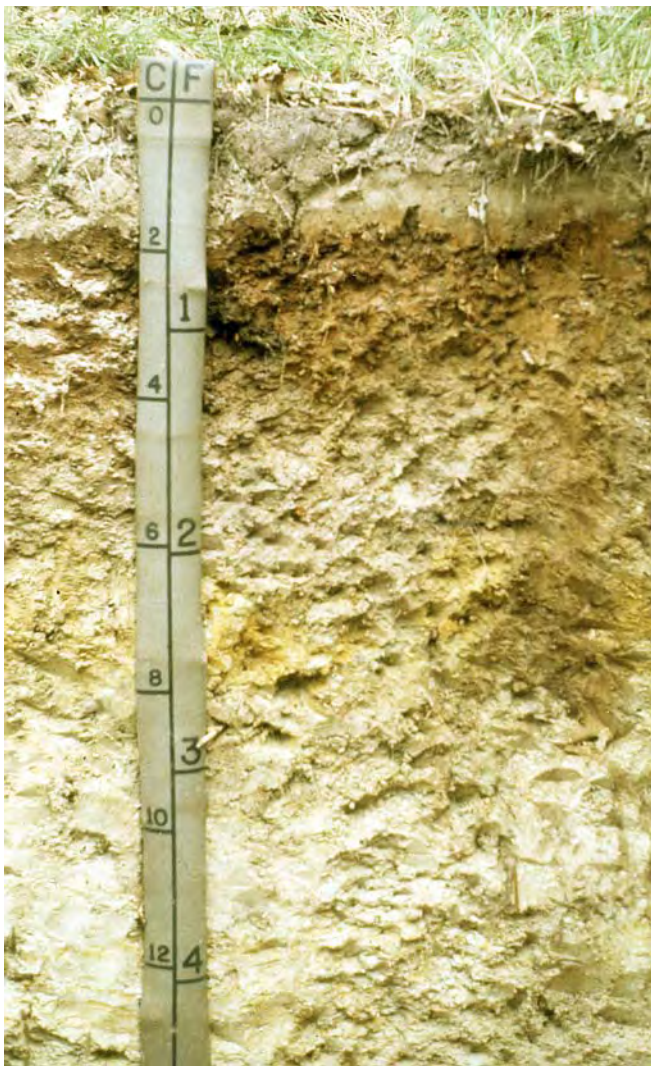

Figure 25.—Profile of a Zack fine sandy loam. Reddish subsoil is underlain by grayish, weakly consolidated shale.

Zilaboy Series

The Zilaboy series consists of very deep, moderately well drained, very slowly permeable soils that formed in clayey alluvium. These nearly level soils are on flood plains. Slopes are 0 to 1 percent. The soils of the Zilaboy series are fine, smectitic, thermic Oxyaquic Hapluderts.

Typical pedon of Zilaboy clay, frequently flooded; from the intersection Texas Highway 21 and Texas Highway 36 in Caldwell, 7.7 miles southwest on Texas Highway 21, 2.5 miles southeast on Farm Road 60, 5.4 miles south on Farm Road 111, 1.0 mile south on County Road 133, 0.6 mile on County Road 134, 150 feet south, in a flood plain:

A—0 to 7 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; common fine roots; moderately acid; gradual wavy boundary.

Bss1—7 to 24 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm; common fine roots; common large slickensides; few very fine iron-manganese concretions; common fine faint brown (7.5YR 4/4) masses of iron accumulation; moderately acid; gradual wavy boundary.

Bss2—24 to 44 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few vertical cracks; common large slickensides; few very fine iron-manganese concretions; few medium prominent brownish yellow (10YR 6/6) masses of iron accumulation; moderately acid; gradual wavy boundary.

A'bss—44 to 62 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common large slickensides; few very fine iron-manganese concretions; 2 percent calcium sulfate crystals; moderately acid; gradual wavy boundary.

BCg—62 to 80 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak medium angular blocky structure; hard, firm; few fine roots; few iron-manganese concretions; common fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; neutral.

The thickness of the solum is more than 80 inches. Clay content of the 10- to 40-inch control section ranges from 40 to 60 percent. Cracks as much as 1 inch wide extend to a depth of more than 20 inches when the soil is dry.

The A horizon is dark gray or very dark gray. Reaction ranges from moderately acid to neutral.

The Bss and A'bss horizons are dark gray, dark grayish brown, or grayish brown. Iron concentrations in shades of brown or yellow range from few to common. Reaction ranges from moderately acid to neutral.

The BCg horizon has a matrix in shades of gray or grayish brown. Iron concentrations in shades of brown or yellow range from few to common. This horizon is sandy clay loam or clay loam. Some pedons contain pockets or streaks of calcium sulfate crystals. Reaction ranges from moderately acid to slightly alkaline.

Zulch Series

The Zulch series consists of soils that are moderately deep to shale and siltstone. They are moderately well drained and very slowly permeable. These very gently sloping soils are on uplands. Slopes range from 1 to 3 percent. The soils of the Zulch series are fine, smectitic, thermic Udertic Paleustalfs.

Typical pedon of Zulch fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 21 and Texas Highway 36 in Caldwell, 7.7 miles southwest on Texas Highway 21, 2.5 miles southeast on Farm Road 60, 1.9 miles northeast on Farm Road 111, 2.4 miles southeast on County Road 116, 1,400 feet west on farm trail, 50 feet north, in an area of rangeland:

A—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable; many fine roots; few fine pores; moderately acid; abrupt wavy boundary.

Btss—4 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse angular blocky structure; extremely hard, very firm; common fine roots; thin clay films on faces of peds; few cracks; common slickensides; common distinct pressure faces; common fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; neutral; gradual smooth boundary.

Btk—32 to 40 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium subangular blocky structure; extremely hard, very firm; few fine roots; common distinct pressure faces; distinct clay films on faces of peds; common calcium carbonate concretions; neutral; clear smooth boundary.

CB—40 to 49 inches; light brownish gray (2.5Y 6/2) moist and dry; weakly consolidated shale; massive; extremely hard, very firm; dark gray (10YR 4/1) vertical streaks; few calcium carbonate concretions; neutral; clear smooth boundary.

2C—49 to 60 inches; light gray (2.5Y 7/2) weakly consolidated siltstone; massive; very hard, firm; neutral.

The thickness of the solum ranges from 30 to 40 inches, which corresponds to the depth to shale or siltstone. Clay content of the upper 20 inches of the Bt horizon ranges from 40 to 45 percent.

The A horizon is dark gray, dark grayish brown, or grayish brown. Reaction ranges from moderately acid to neutral.

The Btss horizon is dark gray or very dark gray. Iron concentrations in shades of brown or yellow range from few to common. Slickensides range from few to common. Reaction ranges from moderately acid to slightly alkaline.

The Btk horizon is very dark gray, dark gray, or gray. Iron concentrations in shades of brown or yellow range from few to common. This horizon is clay loam or clay. Calcium carbonate concretions and masses range from few to many. Reaction ranges from slightly acid to slightly alkaline.

The CB horizon is light brownish gray. Iron concentrations in shades of brown or yellow range from few to common. Reaction ranges from neutral to moderately alkaline.

The 2C horizon is light brownish gray, light gray, or pale yellow. It is weakly consolidated siltstone and shale or stratified layers of siltstone and shale. It is clay loam or clay. Reaction ranges from neutral to moderately alkaline.

Formation of the Soils

This section describes the factors of soil formation and relates them to the formation of the soils in Burleson County. It also describes the surface geology of the survey area.

Factors of Soil Formation

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geological forces. The characteristics of a soil at any given point depend on the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief or lay of the land; and the length of time the forces of soil development have acted on the soil material.

All five factors are important in the genesis of each soil; some have had more influence than others on a given soil.

Parent Material

Parent material is the unconsolidated mass from which a soil forms. It determines the chemical and mineral composition of the soil. In Burleson County, the parent material consists of unconsolidated, sandy, loamy, and clayey sediment deposited by water from the Eocene, Pleistocene, and Holocene epochs.

Geological formations of Eocene age that crop out in Burleson County include Queen City Sand, Weches, Sparta Sand, Cook Mountain, Yegua, and formations of the Jackson Group: Caddell, Wellborn, and Manning *(17)*. Soils on uplands formed from these sediments. Pleistocene deposits are those sediments on the different fluviatile terrace levels of the Brazos River and Yegua Creek. Holocene deposits include the recent alluvial flood plain sediments along the Brazos River, Yegua Creek, and the many smaller streams in the county.

The Arenosa, Gasil, Jedd, Padina, Robco and Silstid soils formed from mostly sandy sediments of the Queen City Sand and Sparta Sand Formations. These soils have a sandy or loamy surface layer and sandy, loamy, or clayey subsoil.

The Benchley and Lexton soils formed from glauconitic clayey sediments of the Weches Formation. These soils have a loamy surface layer and clayey subsoil.

The Benchley, Crockett, Kurten, Luling, Normangee, and Spiller soils formed from clayey shale of the Cook Mountain Formation. These soils have a loamy and clayey surface layer and clayey subsoil.

The Zack, Zulch, and Boonville soils formed from bentonitic clay and shale of the Yegua Formation. These soils have a loamy surface layer and a clayey subsoil.

The Arol, Burlewash, Singleton, Rehburg, and Shiro soils formed from mostly clay and sandstone of the Jackson Group. These soils have a sandy or loamy surface layer and loamy or clayey subsoil.

The Axtell, Burleson, Chazos, Davilla, Eufaula, Mabank, Rader, Robco, Silawa, Tabor, and Wilson soils formed in sandy, loamy, and clayey sediments that are on Pleistocene terraces of the Brazos River, Yegua Creek, and other smaller streams. They vary greatly and have textures that range from sandy to clayey in both surface and subsoil layers.

The soils that formed from alluvial sediments of the Holocene epoch include the Asa, Belk, Coarsewood, Highbank, Ships, and Weswood soils of the Brazos River flood plain. Other soils that formed along other streams in the county include Gladewater, Kaufman, Sandow, Uhland, and Zilaboy. These soils are loamy and clayey.

Climate

The climate in Burleson County was warm and humid during the time the soils in the county formed. It promoted moderately rapid soil development. The current climate is uniform throughout the survey area, but its effect is modified locally by runoff. In some areas the effect also is modified by the direction of exposure. Major differences among soils in this survey area are not believed to have resulted from the climate.

Plant and Animal Life

Plants, insects, earthworms, animals, microorganisms, and other living organisms, including humans, contributed to the development of the soils. The addition of organic matter and nitrogen to the soil, the addition and removal of plant nutrients, and changes in structure and porosity are caused by plants, animals, and humans.

Plants probably have affected soil formation in Burleson County more than other kinds of living organisms. Soils that developed under grasses tend to have a higher content of organic matter in the surface layer than soils that formed under trees.

Relief

Relief or topography, influences soil development through its effect on drainage, erosion, and plant cover.

The soils in Burleson County range from nearly level to steep, although most of the county is gently sloping. The nearly level areas consist of flood plains and the terraces associated with them. The more sloping areas are confined to the upland soils, with the steep areas being the highest points in the county.

The degree of soil profile development often depends on the amount of moisture in the soil. Gladewater soils are in nearly level, somewhat poorly drained areas that receive extra water; therefore, they developed gleyed characteristics and the horizon development is not as well defined. Gredge soils are in more sloping areas that are better drained and exhibit brighter colors and distinct horizons throughout. Soils on footslopes, such as Benchley soils, receive additional organic matter and have a thick, dark surface layer. Soils on adjacent side slopes, such as Normangee soils, have a thin, light-colored surface layer because the surface layer is removed by erosion as quickly as it is developed.

Time

A great length of time is required for the formation of soils with distinct horizons. The differences in the length of time that the parent material has been in place are generally reflected in the degree of development of soil horizons. Young soils have little horizon development, and old soils have well expressed horizons.

Sandow and Uhland soils are young soils. They are on nearly level flood plains. Although they have undergone some horizon development, they closely resemble the loamy and sandy parent material from which they formed. Benchley and Crockett soils are older soils. They have developed distinct horizons that do not resemble their parent material.

Processes of Horizon Differentiation

Several processes are involved in the formation of horizons in soils. These processes include accumulation of organic matter, leaching of carbonates and other bases, and formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of a profile results in the formation of a distinct dark surface layer. The soils in Burleson County range from low to high in content of organic matter. Benchley and Cadelake soils have accumulated organic matter and have a dark surface layer.

Carbonates have been leached downward in most of the soils in this survey area. Much leaching has occurred in very deep soils with thick sandy surface layers, such as Padina and Silstid. Carbonates still remain in the profile of the clayey Luling soils.

The translocation of clay minerals has also contributed to horizon development in many soils. Clay minerals are produced by weathering of primary minerals. The subsoil in many soils has accumulations of clay films in pores and on ped faces. These soils were probably leached of carbonates and bases before the translocation of silicate clay took place. A horizon with accumulations of translocated clay is called an argillic horizon. Chazos soils, for example, have an argillic horizon.

Surface Geology

David L. Amsbury, geologist, National Aeronautic and Space Administration, Clear Lake, Texas, prepared this section.

There is a general correspondence among the major soil types of Burleson County, on the general soil map, and the bedrock geology, shown on the Geological Atlas of Texas, Austin sheet *(25)*. Similar patterns are shown on the smaller scale Geological Map of Texas *(24)* and on the Land Resource Map *(8)*. Geologists, who use field observations and aerial photographs, necessarily rely on soils, vegetation patterns, and drainage patterns for clues to the underlying geology. Within Burleson County, there has been significant downslope movement of sand, silt, and clay that tends to mask the underlying geology; that is, many of the soils were formed in transported material that overlies the bedrock. Most of the material was not transported very far, for example, from the upper slopes of sandy, rolling hills a few hundred yards away into nearby creek valley flats.

Outcrops of geological units form continuous bands that trend southwest-northeast across the county *(10,25)*. Sand, particularly sandstone, units tend to form relatively high ridges in contrast to lower strips formed on clay and shale units. Bedrock, which here includes ancient stream deposits that are not strictly "rocks," provided the parent material for soil development. In Burleson County, weathering of calcareous and noncalcareous shale and sand or sandstone, plus stream deposits derived from these rocks, formed most of the soils. The type of bedrock determines relative resistance to erosion, and thus topographic position; bedrock also affects the chemical composition and physical texture of the soil. Clayey units and old stream deposits tend to have very deep, heavy soils, and sand units provide material for very deep, well drained sandy soils. Bedrock that contains a large amount of weathered volcanic ash, for example, the Yegua Formation, tends to form moderately deep, less productive soils.

Basic Geological Principles

Rocks that underlie the soils of Burleson County are sedimentary; that is, the rock-forming material was deposited originally as particles of sand, clay, and fossil shell fragments. Most sediments that formed the bedrock of the county were deposited in the waters and along the shorelines of the ancient Gulf of Mexico, which extended into central and east Texas periodically through geological history. The periodicity is reflected in alternating units of marine shale, underlain and overlain by deltaic and alluvial sandstone units. Older sediments, Wilcox Group and Carrizo Sand underneath the surface rocks of the county, were deposited in large river systems and their deltas. These river systems drained the Rocky Mountain area, and fed into the East Texas Basin when the shoreline of the ancestral Gulf of Mexico extended only to what are now Washington and Fayette Counties. During and after the last glacial age, streams that eroded the older deposits laid down some much younger deposits.

Sedimentary rocks are deposited in layers. Where the same kind of rock is exposed all around a hill, it is assumed that similar material forms a layer that extends throughout the area under the hill. The assumption can be verified or refuted by examining road cuts or railroad cuts, or by studying drill cuttings. Similarly, when recognizable layers of rock are seen on both sides of a valley, it is assumed that the layers were once continuous across the valley but were eroded away as the valley formed. This assumption obviously is not as easy to test, because no material is left to study. In general, it is assumed to be true by analogy to nearby areas where less erosion has occurred.

Within a body of sedimentary rock that was deposited by water, the lowest layers were deposited first and the highest layers were deposited last. Therefore, the youngest rocks are at the highest elevation. This is the rule of superposition, and it is very helpful in interpreting geological history. In many places older rocks are at a higher elevation than younger rocks. Examples are: If older rocks are uplifted by gentle tilting or by mountain-building forces; if younger rocks are dropped down in a faulted block; or if older rocks are dissected by streams so that younger stream deposits lie in valley bottoms.

No record of mountain-building episodes has been found in the rocks exposed at the surface in Burleson County, but faulting of linear blocks is an important part of the history of the rocks along the northwestern county line and in Milam and Lee Counties. Recognition of the faults played an important part in the discovery of oil, gas, and ground water, and the fault pattern is important for planning the mining of lignite coal. Fractures associated with faults, but without significant displacement of the broken blocks, are important conduits for the movement of ground water and petroleum. Recent horizontal drilling activity within Burleson County is designed to intersect as many fractures as possible within a tight reservoir rock (Austin Chalk), to enhance drainage of the contained petroleum.

Actual dating of rock layers is a complex process that includes the study of fossils, laboratory measurements of radioactive elements in rocks, and reconstructions of geological history worldwide. The approximate ages given here are the best current estimates published by the Geological Society of America.

Eocene Rocks

Bedrock units that occur at the surface in Burleson County, and that are younger than those associated with the modern drainage network, are assigned to the Eocene epoch. The Eocene was defined in the 19th Century for a group of strata in the Paris Basin, in France. These strata then formed the basis for a time-stratigraphic unit that has been correlated worldwide, first by similar fossils, and now by radioactive age dates and worldwide fluctuations in sea level. The Eocene rocks in Burleson County were deposited between about 50 and 36 million years ago and represent several major fluctuations of sea level combined with a varying supply of sand, clay, and volcanic ash.

The basic named geologic map unit is the formation. Named or unnamed members may be recognized within formations. The name that accompanies a map unit is derived from the most typical exposure, or from the rock type at the place where the unit was first named. For example, the Sparta Sand was named by the geologist T.W. Vaughan in 1896 for a town in Bienville Parish, Louisiana, and then traced into Burleson County by later geologists *(15)*.

The rock layers are tilted gently eastward, at a rate greater than the slope of the modern drainage, so that the oldest units occur at the surface in the northwestern part of the county, and the youngest occur along Yegua Creek along the southeastern county line. Carrizo Sand and the Calvert Bluff Formation of the Wilcox Group underlie the surface formations of Burleson County. The Calvert Bluff is a major source of lignite in East Texas, but has relatively low potential within Burleson County *(5,6,7)*. Instead, both the Calvert Bluff *(6)* and Carrizo *(2)* contain thick sand bodies that provide excellent ground water.

Queen City Sand. The Queen City Sand, as the name implies, is dominantly sand or sandstone that crops out in reddish-brown hills up to 500 feet in elevation along the northwestern boundary of the county *(25)*. Total sand thickness is more than 200 feet *(14)*, which is probably half or more of the total thickness of the formation. The Queen City was deposited when stream deltas spread southeastward across the county. The interplay of delta distributaries, tidal currents, and waves left a very complex distribution of sand, silt, and clay beds. Major soils mapped on Queen City substrate are Arenosa, Cadelake, Gasil, Jedd, Padina, Robco, and Silstid.

Weches Formation. The Weches is a distinctive, clayey unit 50 to 60 feet thick. It forms a northeast-trending outcrop belt 1 to 2 miles wide, from the Gus community on East Yegua Creek to the Hix community near the northeastern corner of the county. The Weches represents a tongue of marine mud (clay and silt), marked by abundant fossil shells and the mineral glauconite (greenish, sand-sized grains of a phosphatic iron mineral), between the deltaic Queen City Sand and the overlying alluvial Sparta Sand *(15)*. A geologically-famous outcrop of fossiliferous Weches rocks, the Burleson Bluff Locality, occurs along the Brazos River northeast of the Rita Community *(16)*. Lexton and Benchley are characteristic soils on the Weches. Gullied slopes characteristically display reddish-brown clay ironstone concretions, weathered from the glauconitic and pyritic clay parent material.

Sparta Sand. The Sparta Sand, about 200 feet thick, forms a belt of rolling hills covered by sparse post oak and yaupon vegetation immediately southeast of the Weches outcrop. The formation contains clay and silt, but because sand beds characteristically are uncemented except for layers of clay-ironstone concretions, most slopes are covered by a wash of loose sand. The Sparta and underlying Weches were dropped down into fault blocks along the northwestern County line *(25)*, so that a southeastward traverse along Davidson Creek encounters Queen City, Weches, and Sparta rocks twice. Soils that formed on the Sparta are similar to those formed on the Queen City.

Cook Mountain Formation. The Cook Mountain Formation, termed Crockett Formation *(10,15)* is dominantly shale but contains the ridge-forming Spiller Sand Member. Texas Highway 21 and Southern Pacific Railway follow the outcrop belt of the Cook Mountain from Dime Box through Caldwell to Cooks Point, because travel and construction were relatively easy on the gentle slopes and predominantly prairie landscape during the 18th and 19th centuries.

The Cook Mountain Formation is divided into the Wheelock, Landrum, Spiller, and Mount Tabor Members *(17)*. The basal Wheelock Member is composed of calcareous and noncalcareous, glauconitic gray to greenish-gray shale and siltstone that weather brown because of the contained iron. The Stone City Bluff (Moseley's Crossing) outcrop of the Wheelock is one of the most famous fossil localities in the Gulf Coastal Plain *(15,16)*. Hundreds of species of marine snails, clams, corals, and microscopic animals have been described since Ferdinand Roemer's visit in 1846. Soils of the Benchley-Crockett general soil map unit are on nearly level to gently sloping outcrops of the Wheelock Member. Other soils present include Luling and Normangee. The overlying thin, moderately sloping Landrum Member has patches of Kurten soils. The Spiller Member is a brown weathering sand and silt containing subordinate clay shales. Soils of the Kurten-Spiller general soil map unit are on the Spiller Member. Mount Tabor, the youngest member of the Cook Mountain Formation, is another shale. It occurs along relatively high ground southeast of the railroad. Kurten soil occurs on the Mount Tabor Member.

Yegua Formation. The Yegua outcrop belt is 7 to 10 miles wide in southeastern Burleson County *(25)*. The Yegua Formation is characterized by light-color, ashy shales that contain layers of bentonite, volcanic ash weathered to swelling clays, although the lower part of the formation is composed of the basal Smetana Sand Member and the overlying Bryan Sandstone Member *(10)*. Environmental geologists *(4)* mapped "Rolling Ironstone and Sand" landscapes on the basal Smetana Sand Member, and "Low-relief Sand and Mud-Oak Forest" landscapes on most of the rest of the Yegua outcrop. Silicified wood is locally abundant.

The Yegua represents a major impulse of volcanic sediment, derived from Trans-Pecos Texas and New Mexico, that pushed back the Gulf shoreline during a major period of delta-building *(9)*. Lignite deposits were formed locally in swamps between delta distributaries; southeastern Burleson County is believed to have some potential for lignite mining *(4)*. Soils formed on the Yegua are similar to those in Brazos County *(12)*. Soils of the Kurten-Spiller general soil map unit are on the lower sand units and soils of the Zack-Zulch general soil map unit are on the younger Easterwood Shale Member to the southeast. Remnant terraces of old stream valleys within the general Yegua outcrop area have Gredge soils.

Jackson Group. Three formations of the Jackson Group crop out in extreme southeastern Burleson County *(25)*: the basal Caddell Formation, mostly shale and siltstone; the middle Wellborn Sand; and the upper Manning clay and sandstone. Low-relief Sand and Mud-Oak Forest, is mapped on the Cadell and part of the Manning, whereas Low Rolling Sands is mapped on the Wellborn *(4)*. The Jackson units were deposited on deltas and nearshore bars within the Gulf of Mexico. Like the soils in the Yegua Formation, they contain significant percentages of volcanic sediment that tends to weather to swelling clays. The Manning Formation contains thin lignite beds, probably formed as marsh peats on delta lobes, that were strip-mined in the past *(6)*. Many Jackson sandstones were deposited as barrier islands and nearshore bars, so the sand bodies tend to parallel the ancient shoreline rather than extending at right angles to it. One ridge-forming unit of well-cemented sand near the tip of the Manning is prominent near the community of Clay. This sandstone has been quarried for road material and building stone. Soils of the Singleton-Burlewash general soil map unit dominate the Jackson outcrops.

Quaternary Sediments

The Quaternary Period of geological history began between 3 million and 1 million years ago with the onset of continental glaciation in North America, and continues today. The Quaternary includes the Pleistocene epoch, a time of major climate changes that caused repeated continental glaciations, and the Holocene or Recent epoch, postglacial time, roughly the past 10,000 years. The transition coincides with the extinction of many large mammal species in North America (elephants, camels, horses, many large predators), and the entrance of Paleoindians (Clovis and Folsom cultures). The southernmost glaciation in North America was far north of Texas, so the effects of major climate changes in this area were the alternating downcutting and deposition of sediments by streams. The deposition of gravels and sands led to the formation of a series of terraces along the major streams. Thorough discussions of Quaternary sedimentary deposits, landforms, and soils in the region of the Brazos and Navasota River Valleys are in references *(11,12,13)*.

High gravels. Most counties in east-central Texas display prominent upland surfaces that have mineable deposits or at least scattered pockets of chert and quartz gravel. For example, such gravels are mapped in Brazos County between Bryan and the Navasota River, and in Williamson and Milam Counties along both sides of the San Gabriel River *(25)*. The gravels were derived partly from the Edwards Plateau and partly from the Rocky Mountains, contain no datable fossils, and are not obviously related to modern trunk-stream drainage networks *(12)*. Burleson County is not known to contain sizeable deposits of such gravels, although gravel may underlie a high, very old surface on the interfluve between Berry and Carrington Creeks about 6 miles east of Caldwell. Soils of the Tabor-Rader general soil map unit are on this surface, and Gredge soils are mapped on material that drapes down onto slopes eroded into terrace remnants.

Pleistocene Terraces. Over time, the Brazos River and its tributaries cut downward through older rocks toward present levels. Periods of base-level stability caused valley widening and deposition of alluvial terraces. Few records of Brazos River deposition prior to formation of the Holocene flood plain are preserved within Burleson County but large areas in Brazos County have been studied *(11, 12)*.

Quaternary Terrace. Relatively small areas of Quaternary Terrace deposits are on the west side of the Brazos Valley and north side of Yegua Creek Valley *(25)*. Around Tunis, north and south of Deep Creek, a terrace at an altitude of 260 feet is mapped on the environmental geology map as Sand Terrace. A similar terrace occurs on both sides of Davidson Creek at its junction with Yegua

Creek, at an elevation of about 220 feet. Chazos and Eufaula soils are mapped on this sandy terrace substrate. A broad terrace around Snook, at an elevation of 240 feet, is mapped as Clay-mud Terrace *(4)*. The major soil on this terrace is Burleson. Two terrace levels of different age within the Tunis and Snook deposits occur, and Burleson soil is on the older surface west of Snook and 10 to 13 meters above the flood plain (*13*).

Recent Flood plains. The Brazos River has had a complex history during the past 12,000 years. The river essentially quit cutting downward and has deposited several sequences of alluvial gravel, sand, and mud separated by fossil soils *(11,12,13)*. Nearly all the very broad flood plain occurs within Burleson County, forming a major agricultural resource. Soil type is related directly to geographic position with respect to ancient and present-day channels of the river. Soils of the Weswood-Coarsewood general soil map unit formed in very fine sands and silts of natural levee and crevasse-splay deposits. Soils of the Ships-Belk general soil map unit formed in flood basin clays. Yahola soils formed on ridges and migrating meander scrolls near the modern channel.

Tributaries to the Brazos River also deposited sediment in their beds. This sediment merges upslope with colluvium, material moved downslope largely by soil creep and other mass movement processes. Soils of the Zilaboy-Kaufman general soil map unit are in the flood plains of Yegua Creek and the mouth of Davidson Creek. Soils of the Uhland-Sandow general soil map unit are along the upper reaches of Davidson Creek and Cedar Creek and their tributaries which drain sandy bedrock.

References

(1) American Association of State Highway and Transportation Officials. 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

(2) American Society for Testing and Materials. 1993. Standard classification of soils for engineering purposes. ASTM Standard D 2487.

(3) Burleson County Historical Society. 1980. Astride the Old San Antonio road: A pictorial history of Burleson County.

(4) Jackson, M.L.W., and L.E. Garner. 1982. Environmental geology of the Yegua-Jackson lignite belt, southeast Texas. University of Texas, Bureau of Economic Geology, Report of Investigations, No. 129, page 36.

(5) Jones, C.M., and W.R. Kaiser. 1986. Carrizo Sand aquifer in east-central Texas and future use of upper Wilcox lignites, geology, and ground-water hydrology of deep-basin lignite in the Wilcox Group of east Texas. University of Texas, Bureau of Economic Geology, pages 51-56.

(6) Kaiser, W. R., J.E. Johnston, and W.N. Bach. 1978. Sand-body geometry and the occurrence of lignite in the Eocene of Texas. University of Texas, Bureau of Economic Geology, Geological Circular 78-4, page 19.

(7) Kaiser, W.R. and others. 1986. Geology and ground-water hydrology of deep-basin lignite in the Wilcox Group of east Texas. University of Texas, Bureau of Economic Geology, Special Report 86, page 182.

(8) Kier, R.S., L.E. Garner, and L.F. Brown, Jr. 1977. Land resources of Texas. University of Texas, Bureau of Economic Geology.

(9) Le Blanc, R.J., Jr. 1970. Environments of deposition of the Yegua Formation (Eocene), Brazos County, Texas. Texas A&M University, Texas Engineering Experiment Station, Research Report No. 14, page 13.

(10) Mathews, A.L. 1950. Geology of Brazos County. Texas A&M University, Texas Engineering Experiment Station Research Report No. 14, page 13.

(11) Nordt, L.C. 1986. Regional correlation of terraces and soils of the Brazos, Trinity, and Navasota Rivers of the Tertiary coast plain of Texas. Soil Survey Horizons, volume 27, No. 1, pages 29-35.

(12) Nordt, L.C., and S. Aranow. 2003. Soil Survey of Brazos County, Texas: Surface geology and geomorphology. U.S. Department of Agriculture, Natural Resources Conservation Service.

(13) Nordt, L.C., C.T. Hallmark, L.P. Wilding, and W.G. Chervenka. 1992. Soils and geomorphology tour of Brazos and eastern Burleson Counties, Texas. Soil Science Institute Guidebook. Texas A&M University, Soil and Crop Science Department, unpaged.

(14) Perkins, B.F., and D.K. Hobday. 1980. Middle Eocene coastal plain and near shore deposits of east Texas: Gulf coast section. Society of Economic Paleontologists and Mineralogists Spring Field Trip Guidebook, May 10-11, 1980, page 95.

(15) Plummer, F.B. 1932. Cenozoic systems in Texas. *In* The Geology of Texas. Volume 1: Stratigraphy. University of Texas, Bulletin No. 3232, pages 519-818.

(16) Smith, F.E. 1962. Upper Cretaceous and lower Tertiary rocks in east-central Texas. Baylor University Geological Society, Waco, Texas, page 26.

(17) Stenzel, H.B. 1938. The geology of Leon County, Texas. University of Texas. Bureau of Economic Geology, Publication 3818, page 295, illustrated.

(18) United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook. Soil Survey Staff.

(19) United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture. Handbook. 210.

(20) United States Department of Agriculture, Soil Conservation Service. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. U.S. Department of Agriculture. Handbook. 436.

(21) United States Department of Agriculture, Soil Conservation Service. 1991. Soil survey laboratory methods manual. Soil Survery Investigations Report 42.

(22) United States Department of Agriculture, Soil Conservation Service. 1994. Keys to soil taxonomy. 6th edition, Soil survey staff.

(23) United States Department of Agriculture, Soil Conservation Service. 1993. Soil survey manual. Soil survey staff, U.S. Department of Agriculture. Handbook 18.

(24) University of Texas, Bureau of Economic Geology. 1932. Geologic map of Texas, MM 14.

(25) University of Texas, Bureau of Economic Geology. 1974. Geologic atlas of Texas, Austin, Sheet.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

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.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

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.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

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.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bottomland. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

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 depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

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.

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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

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.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

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.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

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.

Ecological 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.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of 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.

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.

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.

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.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. 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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

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.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. 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.

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, O, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (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.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Controlled flooding.—water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

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.

Knoll. A small, low, rounded hill rising above adjacent landforms.

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.

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.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

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—f*aint, 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).

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

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.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

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:

Very slow	less than .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.

Pleistocene. The epoch of the Quaternary Period of geologic time, following the Pliocene Epoch and preceding the Holocene (from about 2 million to 10 thousand years ago); also the corresponding (time-stratigraphic) “series” of earth materials.

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.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

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.

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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

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.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

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.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by induration of a clay, silty clay, or silty clay loam deposit and having the tendency to split into thin layers.

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.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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

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.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in 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.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

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.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Underlying material. The part of the soil below the solum.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

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