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 Milam County, Texas

How to Use This Soil Survey

General Soil Map

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

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

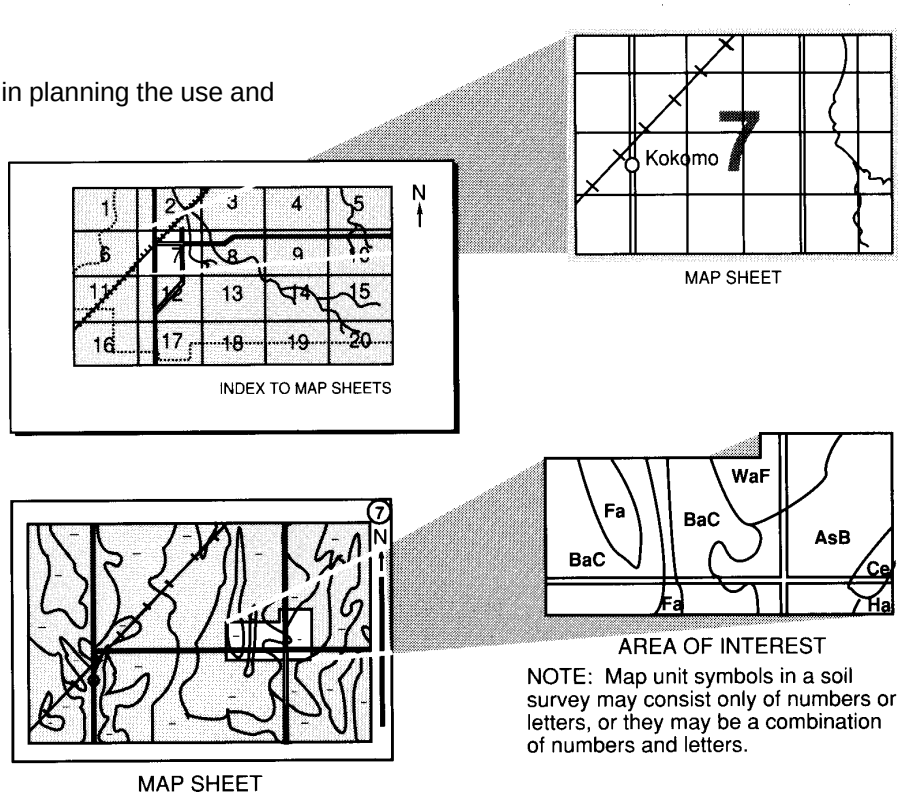
Detailed Soil Maps

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

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

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

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



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

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

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Natural Resources Conservation Service and 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 Central Texas, Little River-San Gabriel, and Taylor Soil and Water Conservation Districts.

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

Cover: Scenic view of cropland fields in the Little River flood plain as seen from Sugarloaf Mountain in Milam County. The soil in the flood plain is Frio silty clay, occasionally flooded. Sandstone is exposed on the edge of Sugarloaf Mountain in an area of Jedd, very gravelly sandy loam, 3 to 15 percent slopes.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov.

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Foreword

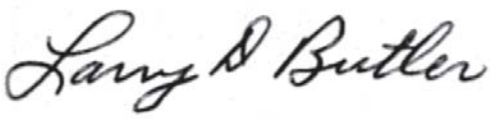
This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

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

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

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

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



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Soil Survey of
Milam County, Texas

By Robert N. Ramsey, Natural Resources Conservation Service

Fieldwork by John L. Coker, Dennis J. Gabor, James M. Germann, Robert N. Ramsey, and Donald Sabo, Natural Resources Conservation Service

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

MILAM COUNTY is located in east-central Texas (fig. 1). It is bordered on the north by Bell and Falls Counties, on the west by Williamson County, on the south by Lee and Burleson Counties, and on the east by Robertson County. Cameron, the county seat, is on U.S. Highways 190 and 77 and Texas Highway 36, about 135 miles northwest of Houston. Rockdale is another principal town in the county.

The county covers about 1,021 square miles or 653,286 acres. Farming is the major enterprise with principle crops of cotton, corn, grain sorghum, oats, wheat, peanuts, watermelons, and pecans. Cattle, hogs, and poultry are also produced. Industries include oil production, lignite mining, smelting of aluminum, and the manufacturing of clothing, furniture, wood products, metal products, and plastic products. Catfish farming adds to the economy.

The topography is nearly level to rolling. Elevation ranges from 306 to 648 feet. The Brazos River, Little River, San Gabriel River, and numerous creeks drain the county, which is in two Major Land Resource Areas. The western part of the county is in the Northern Blackland Prairie. The eastern part is in the Southern Claypan Area. High terraces have formed along most of the large streams. The more productive soils are in the Blackland Prairie and on flood plains and stream terraces. The soils range from deep clays in the western part of the county to deep sandy loams and sands in the eastern part.

Brush encroachment is becoming a major concern in many parts of the county, generally on soils that are low in fertility and eroded. In the southern part of the county, areas that have been mined for lignite are being reclaimed and planted to improved grass. Individuals who live elsewhere own many farms in the southern part of the county.

This soil survey updates the survey published by the U.S. Department of Agriculture, Bureau of Chemistry and Soils, in 1925 (3). It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

This section describes the history and climate of the survey area.

History

The first temporary settlement in Milam County began in about 1744 when Spanish missionaries established a mission at the junction of Brushy Creek and the San Gabriel River. Permanent settlement, however, did not take place until 1836. In 1837, the county was formally organized and named after Ben Milam, a Texas Revolutionary war hero who was killed at San Antonio while commanding the Texas forces that later captured the town.

The first permanent settlement was in the eastern part of the county at Nashville. Most settlers migrated from Tennessee and other southern states. Others, including many German and Czech immigrants, soon moved into the area.

After the first permanent settlers arrived, most of the county was used for cattle ranching. When barbed wire came into common use in the late 1800's, much of

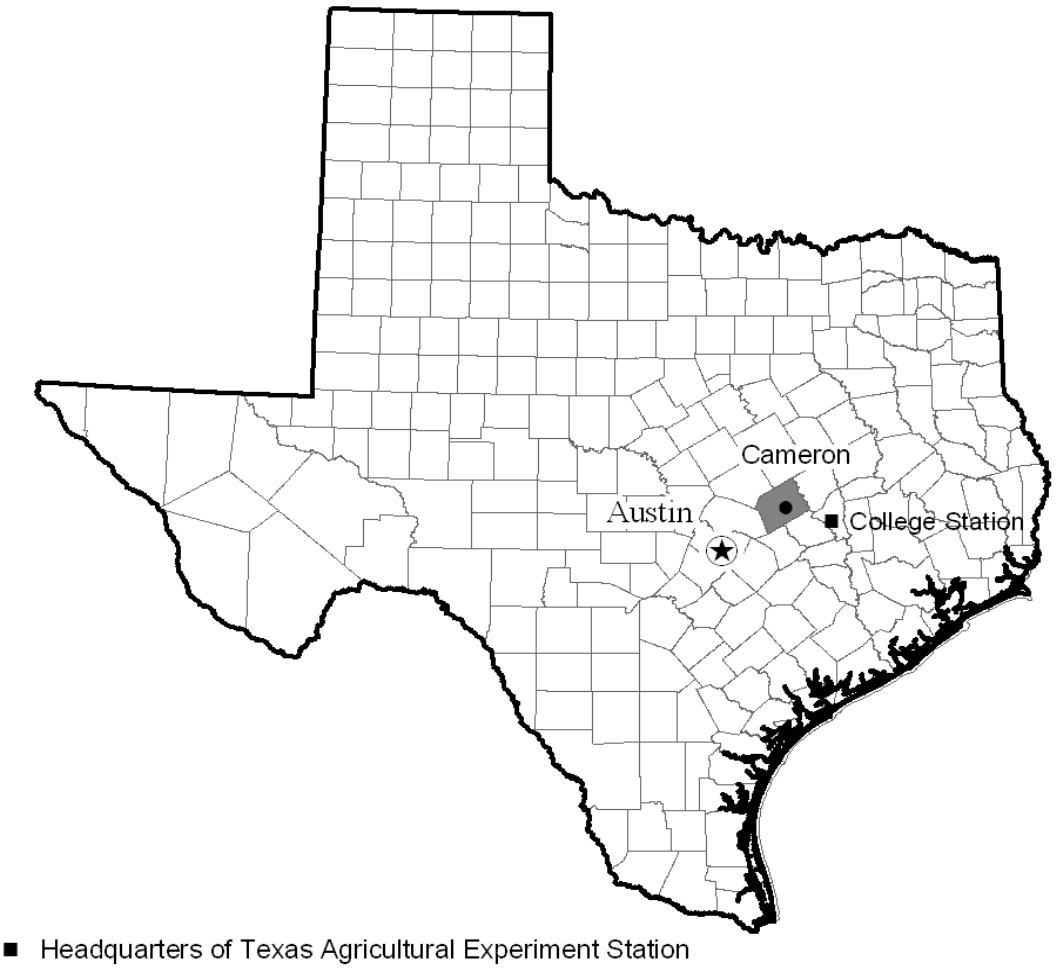

Figure 1.—Location of Milam County in Texas.

the blackland region was put into crop production. During this same period, railroads began crisscrossing the county, allowing farmers to sell their products to distant markets. Cotton, the chief crop for many years, still remains an important part of the county's agricultural output. In later years, however, many other crops also became commonplace.

Agriculture still is a very important part of the economy. In the early 1950's, an aluminum company opened a plant south of Rockdale, which gave the county's economy an added boost. In recent years, many other industries have moved into the area as well, giving the county the economic diversity and prosperity it now enjoys.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Cameron, in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 shows data on length of the growing season.

In winter, the average temperature is 51 degrees F and the average daily minimum temperature is 40 degrees. The lowest temperature on record, which occurred at Cameron on January 17, 1930, is -7 degrees. In summer, the average temperature is 84 degrees. The highest recorded temperature, which occurred at Cameron on July 10, 1917, is 114 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature exceeds a base temperature of 50 degrees F each day. 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 34 inches. Of this, 18 inches, or about 52 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall recorded was 12 inches at Cameron on September 10, 1921. Thunderstorms occur on about 40 days each year, and most occur in May.

Snowfall is rare. The average seasonal snowfall is less than 1 inch. The heaviest recorded 1-day snowfall was 3 inches.

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; however, they cannot predict that a high water table will always be at a specific level on a specific date.

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

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

General Soil Map Units

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

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

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

Sandy and Loamy Soils of Savannahs

The soils in this group make up about 45 percent of the county. The major soils are the Bigbrown, Chazos, Desan, Edge, Gause, Jedd, Minwells, Padina, Rader, Silawa, Silstid, and Travis series. Most of these soils have a sandy or loamy surface layer and a clayey or loamy subsoil.

These soils are mainly in the southern part of the county, and most are used as rangeland or pasture. In some areas the soils are used for growing oats, peanuts, watermelons, and truck crops. Lignite coal is mined in some areas. Improved bermudagrass and kleingrass are the principal pasture grasses. Native vegetation consists of little bluestem, purpletop, indiangrass, and sideoats grama along with scattered post oak, blackjack oak, and hickory trees.

1. Edge-Rader

Very gently sloping to moderately sloping, deep and very deep, loamy and sandy soils formed in marine sands, clays, and shales

This map unit makes up about 20 percent of the county. It is about 52 percent Edge soils, 31 percent Rader soils, and 17 percent other soils.

Edge soils are on ridges and the sides of hills. The Rader soils are in valleys and on footslopes (fig. 2).

The Edge soils have a pale brown, moderately acid fine sandy loam surface layer about 8 inches thick. The subsurface layer, from a depth of about 8 to 11 inches, is very pale brown, slightly acid fine sandy loam. The upper part of the subsoil, from a depth of about 11 to 29 inches, is very strongly acid clay. It is red between depths of about 11 and 19 inches and red with pale brown and yellowish brown mottles between depths of about 19 and 29 inches. From a depth of about 29 to 37 inches, the subsoil is red, very strongly acid clay loam that has light yellowish brown and brown mottles. From a depth of about 37 to 43 inches, it is yellowish red, slightly acid clay loam that has yellowish brown mottles. From a depth of about 43 to 48 inches, the subsoil is reddish yellow, neutral sandy clay loam that has light yellowish brown and light brownish gray mottles. The underlying material, from a depth of about 48 to 80 inches, is slightly alkaline, brownish and grayish weathered siltstone that has a texture of loam or silt loam. It has red mottles in the upper part.

The Rader soils have a brown, slightly acid loamy fine sand surface layer about 5 inches thick. The subsurface layer, from a depth of about 5 to 18 inches, is pale brown, slightly acid fine sandy loam. The upper part of the subsoil, from a depth of about 18 to 26 inches, is brownish yellow, moderately acid sandy clay loam that has pale brown mottles. The lower part, from a depth of about 26 to 80 inches, is mottled light gray, brownish yellow and red sandy clay. Between depths of 26 and 52 inches, the subsoil is strongly acid. Between depths of about 52 and 71 inches, it is moderately acid. It is neutral below a depth of about 71 inches.

Soils of minor extent in this map unit are the Crockett, Minerva, Padina, Sandow, Silstid, and Uhland soils. Crockett and Minerva soils are on side slopes and slope breaks. Padina soils are on hilltops and ridges. Sandow and Uhland soils are on flood plains of local streams. Silstid soils are on footslopes below sandy ridges.

The soils of this map unit are used mainly for native range and pasture. Some areas are mined for lignite. Many abandoned fields and pastures are infested with mesquite and other brush. Some areas are used for

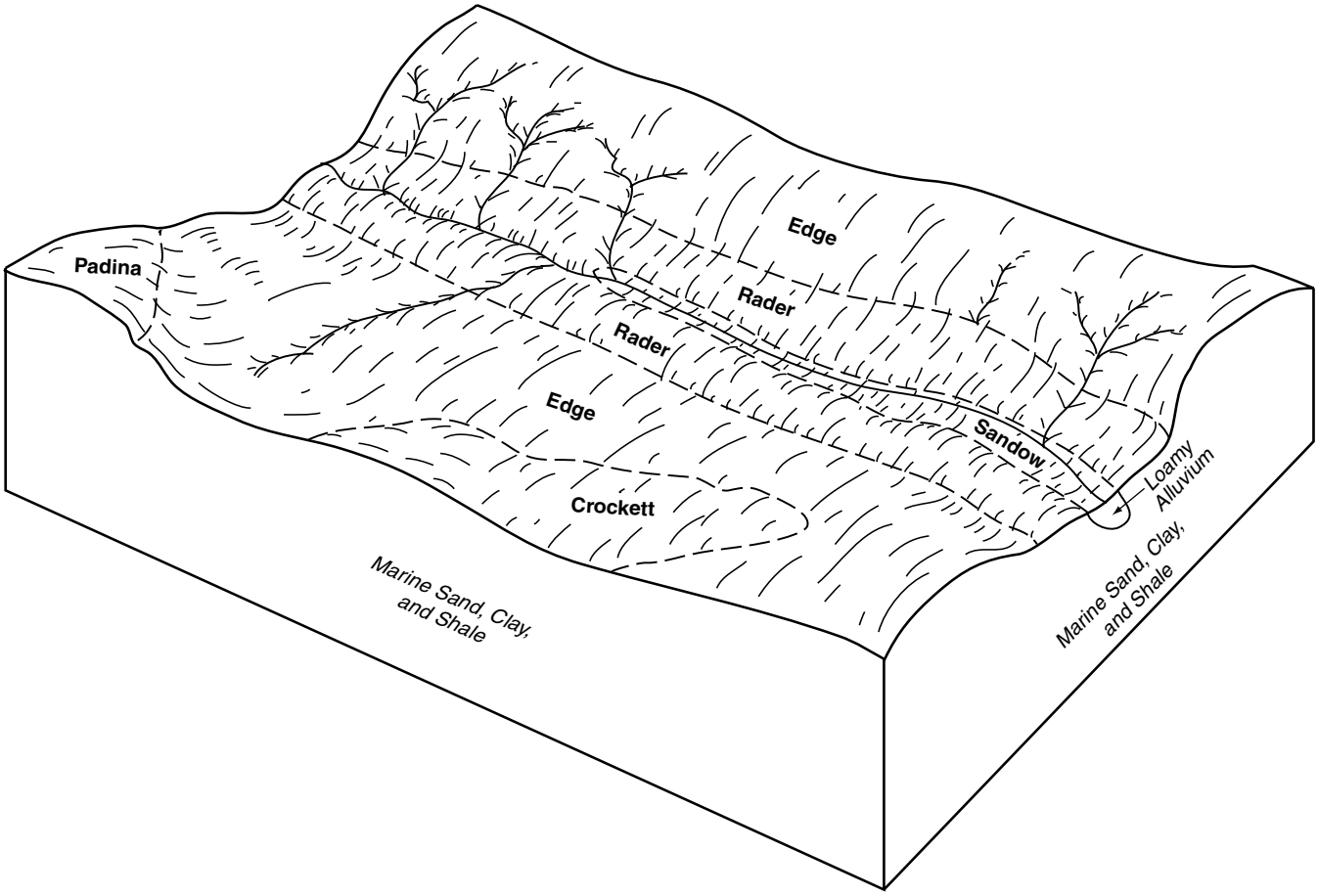

Figure 2.—Typical pattern of soils and underlying material in the Edge-Rader general soil map unit.

improved pasture and for crops. The soils are suited to improved pasture and cool-season crops when brush is controlled. Some areas are suitable for growing peanuts, watermelons, and truck crops. Erosion is a problem in unprotected areas. The soils are capable of producing moderate yields of range forage.

These soils are suited to homesites and urban uses. Limitations include a potential for shrinking and swelling, which affects foundations and streets; the risk of corrosion, which affects underground pipes; and very slow permeability, which affects septic systems. Wetness is a seasonal problem in areas of the Rader soils.

These soils are suited to recreation uses. Very slow permeability is the main limitation, and slope is a limitation in some areas.

2. Padina-Silstid

Very gently sloping to moderately sloping, very deep, sandy soils formed in marine sands and clays

This map unit makes up about 13 percent of the county. It is about 62 percent Padina soils, 16 percent Silstid soils, and 22 percent other soils.

Padina soils are on sides and tops of low, hummocky hills. Silstid soils are on footslopes and in valleys (fig. 3).

The Padina soils have a pale brown, slightly acid fine sand surface layer about 8 inches thick. The subsurface layer, from a depth of about 8 to 66 inches, is very pale brown, slightly acid fine sand. The subsoil, from a depth of about 66 to 80 inches, is strongly acid sandy clay loam that is mottled light gray and reddish yellow in the upper part, and light gray and red in the lower part.

The Silstid soils have a yellowish brown, neutral loamy fine sand surface layer about 8 inches thick. The subsurface layer, from a depth of about 8 to 32 inches, is light yellowish brown, neutral loamy fine sand. The subsoil, from a depth of about 32 to 80 inches, is moderately acid sandy clay loam. It is brownish yellow between depths of about 32 and 40 inches. It is mottled pale yellow, brownish yellow, and red between depths of 40 and 53 inches; mottled red and brownish yellow between depths of 53 and 60 inches; mottled red and reddish yellow between depths of 60 and 72 inches; and red between depths of 72 and 80 inches.

Soils of minor extent in this map unit are Edge, Jedd,

Minerva, Rader, Sandow, and Uhland soils. The Edge soils are on ridges and hillslopes. Jedd soils are on sharp slope breaks. Minerva soils are on narrow ridges and side slopes. Rader soils are on footslopes. Sandow and Uhland soils are on flood plains of local streams.

The soils of this map unit are used mainly for native range and pasture. Post oak, blackjack oak, and hickory trees are in many wooded areas. Some cleared areas are used for improved pasture and for growing peanuts, watermelons, and truck crops. The soils are suited to these uses provided adequate moisture and fertility are available. The soils generally produce low yields of range forage.

These soils are suited to homesites and urban uses. Leachate can contaminate local water wells, but septic systems work well. Corrosion of underground steel pipe is a risk.

These soils are suited to recreation uses. In unprotected areas, the sandy surface provides poor traction during dry periods and is the main limitation. Slope is a limitation in some areas.

3. Minwells

Very gently sloping and gently sloping, very deep, loamy soils formed in sandy and clayey alluvium

This map unit makes up about 4 percent of the county. It is about 65 percent Minwells soils and 35 percent other soils.

The Minwells soils are on low terrace ridges near major stream divides.

The Minwells soils have a slightly acid fine sandy loam surface layer about 10 inches thick. It is dark brown in the upper part and brown in the lower part. The upper part of the subsoil, from a depth of about 10 to 38 inches, is sandy clay. It is reddish brown and slightly acid between depths of 10 and 22 inches, and red and slightly alkaline between depths of 22 and 38 inches. The middle part of the subsoil, from a depth of about 38 to 50 inches, is yellowish red, slightly alkaline sandy clay. The lower part of the subsoil, from a depth of about 50 to 80 inches, is mottled yellowish red and reddish yellow, moderately alkaline sandy clay loam.

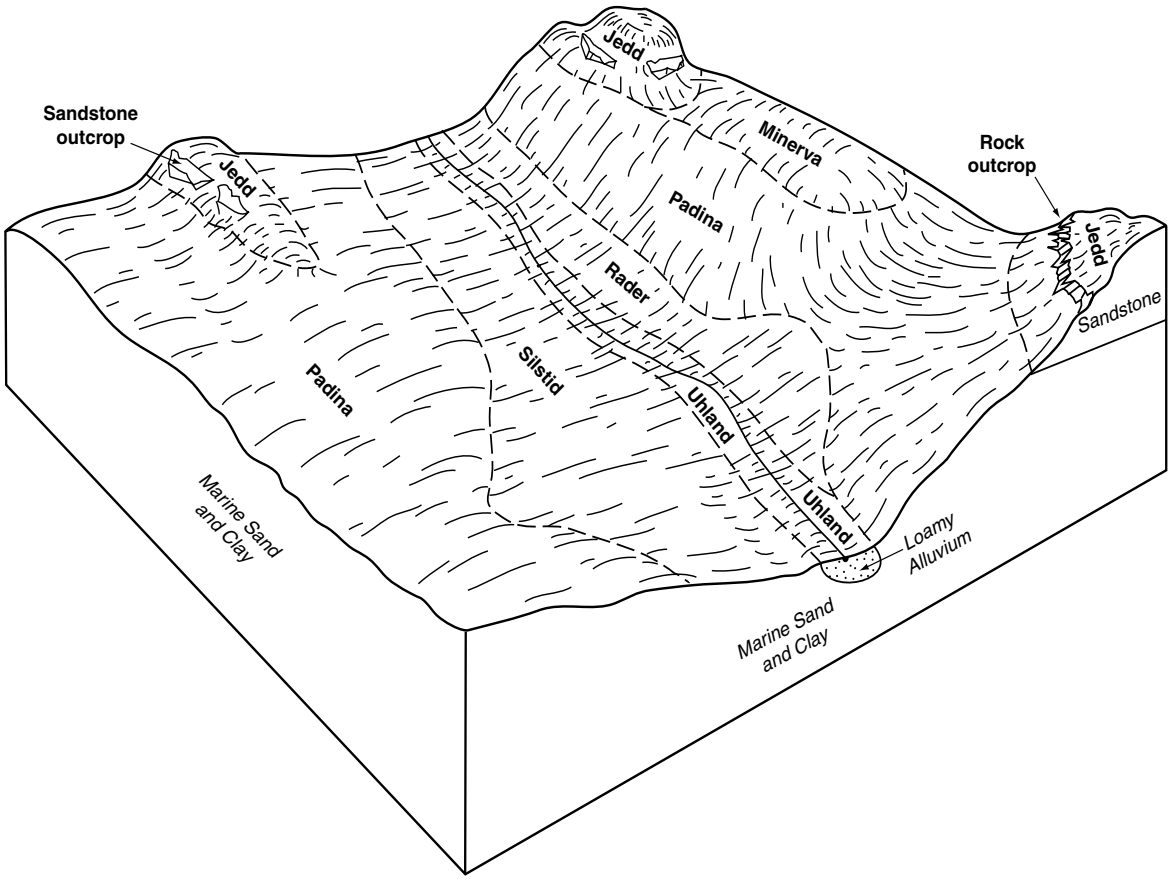

Figure 3.—Typical pattern of soils and underlying material in the Padina-Silstid general soil map unit.

Soils of minor extent in this map unit include the Chazos, Davilla, Frio, Houston Black, Riesel, Satin, Silawa, Travis, Uhland, and Wilson series. Chazos soils are on side slopes. Davilla and Wilson soils are on broad, undulating flats. Frio and Uhland soils are on flood plains. Houston Black and Satin soils are on high divides. Riesel, Silawa, and Travis soils are on side slopes and ridges.

The soils of this map unit are used mainly for pasture and rangeland. Some areas have been mined for gravel. Mesquite and brush have invaded many abandoned fields and pastures. These soils are suited to improved pasture and crops. They are capable of producing moderate yields of range forage. Many areas are suited to truck crops and orchards.

These soils are suitable for homesites and urban uses; however, the potential for shrinking and swelling, which affects foundations and streets, is a limitation, as is very slow permeability, which adversely affects septic systems. Proper installation and planning can overcome most limitations.

These soils are suitable for recreation uses. Limitations are slight except in some sloping areas, where the soils have moderate limitations for playgrounds.

4. Travis-Gause

Very gently sloping to moderately sloping, very deep, sandy soils formed in sandy and clayey alluvium of the Brazos River

This map unit makes up about 4 percent of the county. It is about 48 percent Travis soils, 17 percent Gause soils, and 35 percent other soils.

Travis soils are mainly on ridgetops and side slopes. Gause soils are mostly on footslopes and broad flats.

The Travis soils have a brown, moderately acid loamy fine sand surface layer about 9 inches thick. The subsurface layer, from a depth of about 9 to 17 inches, is light brown, slightly acid loamy fine sand. The subsoil extends from a depth of about 17 inches to a depth of about 80 inches. The upper part, between depths of 17 and 33 inches, is red, strongly acid sandy clay. The middle part, between depths of 33 and 50 inches, is red, very strongly acid sandy clay loam that has reddish yellow mottles. The lower part, between depths of 50 and 80 inches, is red, very strongly acid gravelly sandy clay loam that has reddish yellow mottles.

The Gause soils have a pale brown, slightly acid loamy fine sand surface layer about 14 inches thick. The subsoil extends from a depth of about 14 inches to a depth of about 80 inches. The upper part, from a depth of about 14 to 27 inches, is strongly acid clay. Between depths of 14 and 17 inches, it is brownish yellow with reddish yellow mottles. Between depths of 17 and 27 inches, it is reddish yellow with yellowish red and light yellowish brown mottles. The middle part of the subsoil, from a depth of about 27 to 48 inches, is mottled red, reddish yellow, and light yellowish brown, strongly acid clay. The lower part, from a depth of about 48 to 80 inches, is mottled red, reddish yellow, and very pale brown, moderately acid clay loam.

Soils of minor extent in this map unit are Chazos, Davilla, Gowen, Lufkin, Minwells, Padina, Rader, Uhland, and Wilson series. Chazos and Minwells soils are on gentle side slopes. Davilla, Lufkin, Rader, and Wilson soils are on flats. Gowen and Uhland soils are on flood plains of creeks. Padina soils are on hilltops and ridges.

The soils of this map unit are used mainly for improved pasture. Some areas are used for truck crops, watermelons, and peanuts. These soils are suitable for these uses. Post oak, blackjack oak, hickory, and mesquite trees are in some wooded areas. Travis soils are suitable for orchards. On rangeland, these soils generally produce moderate yields.

These soils are suitable for homesites and urban uses. Limitations include the potential for shrinking and swelling, which affects foundations and streets; the risk of corrosion, which affects underground pipes; and slow permeability, which affects septic systems.

These soils are suited to recreational uses. The limitations are slight except in sloping or gravelly areas.

5. Chazos-Silawa-Desan

Very gently sloping to moderately sloping, very deep, sandy soils formed in sandy and loamy alluvium

This map unit makes up 2 percent of the county. It is about 38 percent Chazos soils, 20 percent Silawa soils, 15 percent Desan soils, and 27 percent other soils.

These soils are on terraces of the Brazos River. Chazos soils are on broad ridgetops or concave footslopes. Silawa and Desan soils are on ridges and slope breaks.

The Chazos soils have a brown, slightly acid loamy fine sand surface layer about 9 inches thick. The subsurface layer, from a depth of about 9 to 17 inches, is pale brown, slightly acid loamy fine sand. The subsoil, from a depth of 17 to 80 inches, is sandy clay. The upper part, from a depth of about 17 to 26 inches, is moderately acid, mottled red, yellowish brown, and light brownish gray. From a depth of about 26 to 36 inches, it is slightly acid, mottled light brownish gray, yellowish brown, and red. From a depth of about 36 to 56 inches, it is slightly alkaline, light brownish gray with brownish yellow and red mottles. The lower part, from a depth of about 56 to 80 inches, is moderately alkaline, light brownish gray with brownish yellow mottles.

The Silawa soils have a brown, slightly acid loamy fine sand surface layer about 14 inches thick. The upper part of the subsoil, from a depth of about 14 to 22 inches, is red, moderately acid fine sandy loam. The middle part, from a depth of about 22 to 50 inches, is red, strongly acid sandy clay loam. The lower part, from a depth of about 50 to 80 inches, is reddish yellow, very strongly acid fine sandy loam.

The Desan soils have a brown, slightly acid loamy fine sand surface layer about 8 inches thick. The subsurface layer, from a depth of about 8 to 50 inches, is light brown, slightly acid loamy fine sand. The subsoil, from a depth of about 50 to 80 inches, is red, slightly acid fine sandy loam.

Soils of minor extent in this map unit are the Crockett, Davilla, Minwells, and Wilson soils. Crockett soils are on slopes and landscape breaks. Davilla and Wilson soils are on flats. Minwells soils are on ridgetops.

The soils of this map unit are used mainly for pasture and cropland. They are suited to pasture. Improved pastures of coastal bermudagrass and bahiagrass have been established in many areas. Some areas are planted in oats, wheat, forage sorghum, and truck crops. These soils can produce moderate yields of range forage. They are well suited to orchards.

These soils are suitable for homesites and urban uses when properly designed to overcome the potential of the Chazos soils to shrink and swell. Because of slow permeability, the Chazos soils are limited for use as septic system absorption fields.

These soils are suited to recreational uses. The sandy surface layers and slope can make foot and vehicle traffic difficult.

6. Bigbrown-Dumps-Pits

Areas of very gently sloping to very steep, very deep, loamy soils formed in lignite coal mine spoil and areas of pits and dumps

This map unit makes up 1 percent of the county. It is about 50 percent Bigbrown soils, 30 percent dumps, 10 percent pits, and 10 percent minor soils and water.

Bigbrown soils consist of reclaimed overburden materials.

The Bigbrown soils have a yellowish brown, moderately acid clay loam surface layer about 2 inches thick. The underlying material, from a depth of 2 to 80 inches, is brownish yellow, moderately acid clay loam that contains many strata and pockets of sandy and clayey materials in shades of red, gray, brown, and yellow.

Dumps consist of mounds of unsmoothed and unreclaimed spoil material from the mining of lignite coal. This soil material, in shades of red, gray, brown, and yellow, ranges from sand to clay. It contains varied amounts of lignite fragments, pyrite, shale, sandstone, and petrified wood fragments. It ranges from extremely acid to slightly alkaline.

Pits consist of depressional areas between the mounds of unclaimed mine spoil. They are usually partly filled with water.

Soils of minor extent in this map unit are the Crockett, Edge, Rader, and Uhland soils. Crockett and Edge soils are on side slopes. The Rader soils are on footslopes and the Uhland soils are on flood plains of streams. Alcoa Lake is also in this map unit, as well as many dumps, small pits, and lakes in areas that have not been reclaimed.

These soils are used mainly as hayland and pastureland. Many areas are suitable for growing improved grasses. Some areas contain slickspots that are extremely acid and cannot support vegetation. Some areas are used only for wildlife.These soils can be suitable for homesites when carefully selected for location. Settling of unstable fill and slow permeability are factors that affect foundations and septic systems.

These soils are suited to most recreational uses. Limitations include slope and extremely acid slickspots.

7. Jedd

Gently sloping to moderately steep, moderately deep, loamy soils formed in weakly cemented sandstone

This map unit makes up about 1 percent of the county. It is about 69 percent Jedd soils and 31 percent other soils.

Jedd soils are on hillsides and ridges.

The Jedd soils have a brown, slightly acid very gravelly sandy loam surface layer about 5 inches thick. The subsurface layer, from a depth of about 5 to 11 inches, is yellowish red, moderately acid very gravelly sandy loam. The upper part of the subsoil, from a depth of about 11 to 21 inches, is red, strongly acid sandy clay. The lower part of the subsoil, from a depth of about 21 to 25 inches, is red, strongly acid sandy clay loam. The underlying material, from a depth of about 25 to 80 inches, is red, very strongly acid weakly cemented sandstone.

Soils of minor extent in this map unit are the Edge, Minerva, Padina, Silstid, and Uhland soils. Edge soils are on side slopes. Minerva soils are on ridges. Padina soils are on high ridgetops. Silstid soils are on lower slopes, and Uhland soils are on flood plains of local streams.

The soils of this map unit are used for rangeland or for wildlife habitat. These soils are best suited to rangeland and not suited to other uses because of the gravelly surface layer and slope. Post oak, blackjack oak, hickory, and other trees, along with an understory of shrubs and grasses, are in most wooded areas.

These soils are suitable for homesites and urban uses. Depth to rock, slope, and a clayey subsoil are limitations, causing difficulty in excavations, septic systems, and road construction. Corrosion of underground pipes is a risk. Areas of these soils are typically higher on the landscape than surrounding soils and provide scenic views for homesites.

These soils are suitable for recreation uses. Small stones and slope affect their use for recreation.

Clayey Soils of Blackland Prairies

The soils of this group make up about 23 percent of the county. The major soils are in the Branyon, Burleson, Ferris, Heiden, and Houston Black series. These soils are clayey throughout.

These soils are in the northern and western parts of the county. They are used mainly for cultivated crops and pasture. The major crops are corn, grain sorghum, wheat, and cotton. Improved bermudagrass and kleingrass are the major pasture grasses. Native vegetation consists of little bluestem, indiangrass, switchgrass, big bluestem, sideoats grama, along with a few scattered live oak, elm, and hackberry trees.

8. Houston Black-Heiden-Ferris

Very gently sloping to moderately steep, deep and very deep, clayey soils formed in marine clays, shales, and marls

This map unit makes up about 12 percent of the county. It is about 43 percent Houston Black soils, 23 percent Heiden soils, 17 percent Ferris soils, and 17 percent other soils.

Houston Black soils are mainly on broad ridges and in valleys. The Ferris and Heiden soils are mainly on sides of hills (fig. 4).

The Houston Black soils have a dark gray clay surface layer about 46 inches thick. The subsoil, from a depth of about 46 to 67 inches, is clay that is dark grayish brown in the upper part and pale yellow in the lower part. The underlying material, from a depth of about 67 to 80 inches, is yellow weathered shale that has clay texture. The soil is calcareous and moderately alkaline throughout.

The Heiden soil is calcareous clay throughout. The surface layer, about 21 inches thick, is dark grayish brown. The subsoil, from a depth of about 21 to 44 inches, is pale olive in the upper part and pale yellow in the lower part. The underlying material, from a depth of about 44 to 80 inches, is pale olive.

The Ferris soil is calcareous clay throughout. The surface layer is grayish brown and is about 10 inches thick. The subsoil is olive in color from a depth of about 10 to 40 inches. The underlying material, from a depth of 40 to 80 inches, is mottled light yellowish brown and pale olive weathered shale that has clay texture.

Soils of minor extent in this map unit are the Altoga, Branyon, Burleson, Crockett, Frio, Lewisville, Satin, Seawillow, and Tinn soils. Altoga, Crockett, Lewisville, and Seawillow soils are on side slopes and slope breaks. The Branyon and Burleson soils are on broad flats. Satin soils are on high ridges. Frio and Tinn soils are on flood plains of streams.

These soils are suited to homesites and urban uses when properly designed to overcome limitations. These include a high potential for shrinking and swelling and the risk of corrosion, which affects underground steel pipe. Buildings and streets buckle and crack if not properly constructed. The very slow permeability limits use of septic systems.

The use of these soils for recreation areas is limited because the soils are very sticky and muddy when wet, which impedes foot and vehicle traffic.

9. Branyon-Burleson

Nearly level and very gently sloping, very deep, clayey soils formed in clayey alluvium

This map unit makes up 11 percent of the county. It is about 39 percent Branyon soils, 22 percent Burleson soils, and 39 percent other soils.

The Branyon and Burleson soils are on broad, smooth areas of terraces (fig. 5).

The Branyon soils have a dark gray clay surface layer about 58 inches thick. The subsoil, from a depth of about 58 to 80 inches, is gray clay. The soil is calcareous and moderately alkaline throughout.

The surface layer of the Burleson soils is about 38 inches thick. It is dark gray, slightly alkaline clay to a depth of 6 inches and dark gray and gray, calcareous clay between depths of about 6 and 38 inches. The subsoil, from a depth of 38 to 80 inches, is calcareous clay that is grayish brown in the upper part and light brownish gray in the lower part.

Soils of minor extent in this map unit are the Altoga, Bosque, Crockett, Ferris, Frio, Heiden, Houston Black, Lewisville, Seawillow, Sunev, Tinn, and Wilson soils. Altoga, Lewisville, Seawillow, and Sunev soils are along hillside breaks to local streams. Bosque, Frio, and Tinn soils are on flood plains of streams. Crockett, Ferris, and Heiden soils are on side slopes. Wilson soils are on broad flats. Houston Black soils are on upland flats.

Soils of this map unit are used mainly for crops. Some areas are used as improved pasture. The soils are productive and yields are usually high. The soils are capable of producing high yields of range forage.

These soils are suited to homesites and urban uses. Proper design overcomes limitations. A high potential

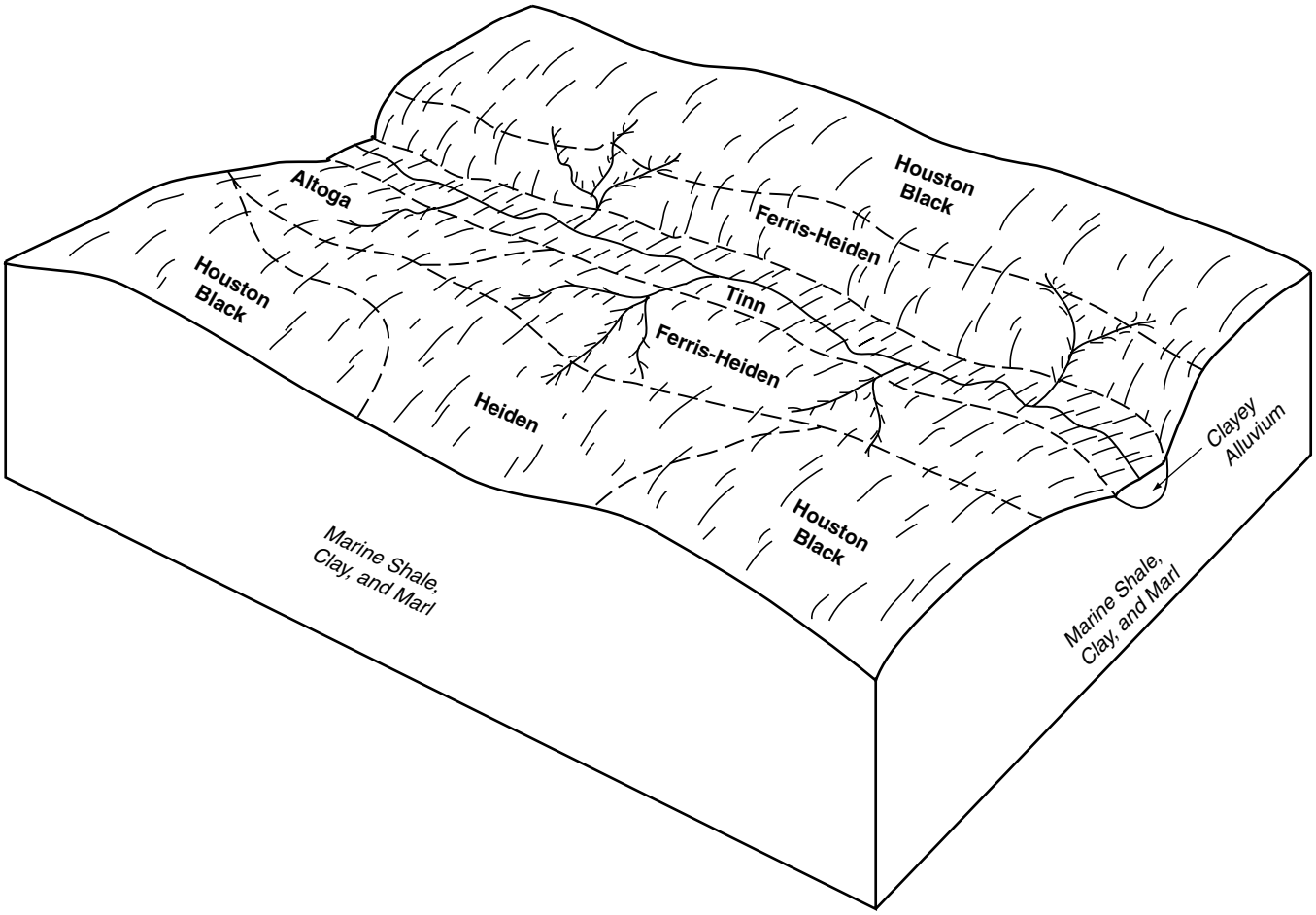

Figure 4.—Typical pattern of soils and underlying material in the Houston Black-Heiden-Ferris general soil map unit.

for shrinking and swelling causes buildings and streets to buckle and crack when not properly constructed. Corrosion of underground steel pipes is a risk. The very slow permeability limits use of septic systems.

These soils are limited for recreational areas because they are sticky and muddy when wet, which impedes foot and vehicle traffic.

Loamy and Clayey Soils of Bottom Lands

The soils in this group make up about 18 percent of the county. The major soils are the Frio, Gaddy, Sandow, Ships, Tinn, Uhland, and Yahola series. These soils are formed in loamy and clayey alluvial sediments.

These soils are on flood plains of major streams throughout the county. They are used mainly for cropland or pastureland. The major crops are cotton, corn, grain sorghum, or wheat. Improved bermudagrass and common bermudagrass are the principal pasture grasses. Native vegetation consists of little bluestem, indiangrass, switchgrass, big bluestem, sideoats grama, and eastern gamagrass, along with an overstory of pecan, oak, hackberry, elm, and cottonwood trees near stream channels.

10. Frio-Tinn

Nearly level, very deep, clayey soils formed in clayey and silty alluvium

This map unit makes up about 15 percent of the county. It is about 46 percent Frio soils, 35 percent Tinn soils, and 19 percent other soils.

The Frio and Tinn soils are on flood plains of the Little River, San Gabriel River, and creeks in the north and west parts of the county (fig. 6).

The Frio soils have a very dark grayish brown, calcareous silty clay surface layer about 50 inches thick. The underlying material, from a depth of about 50 to 80 inches, is dark grayish brown, calcareous silty clay.

The Tinn soils have a dark gray, calcareous clay surface layer about 24 inches thick. The subsoil, from a depth of about 24 to 52 inches, is dark grayish brown, calcareous clay. The underlying material from a depth of about 52 to 80 inches, is dark grayish brown,

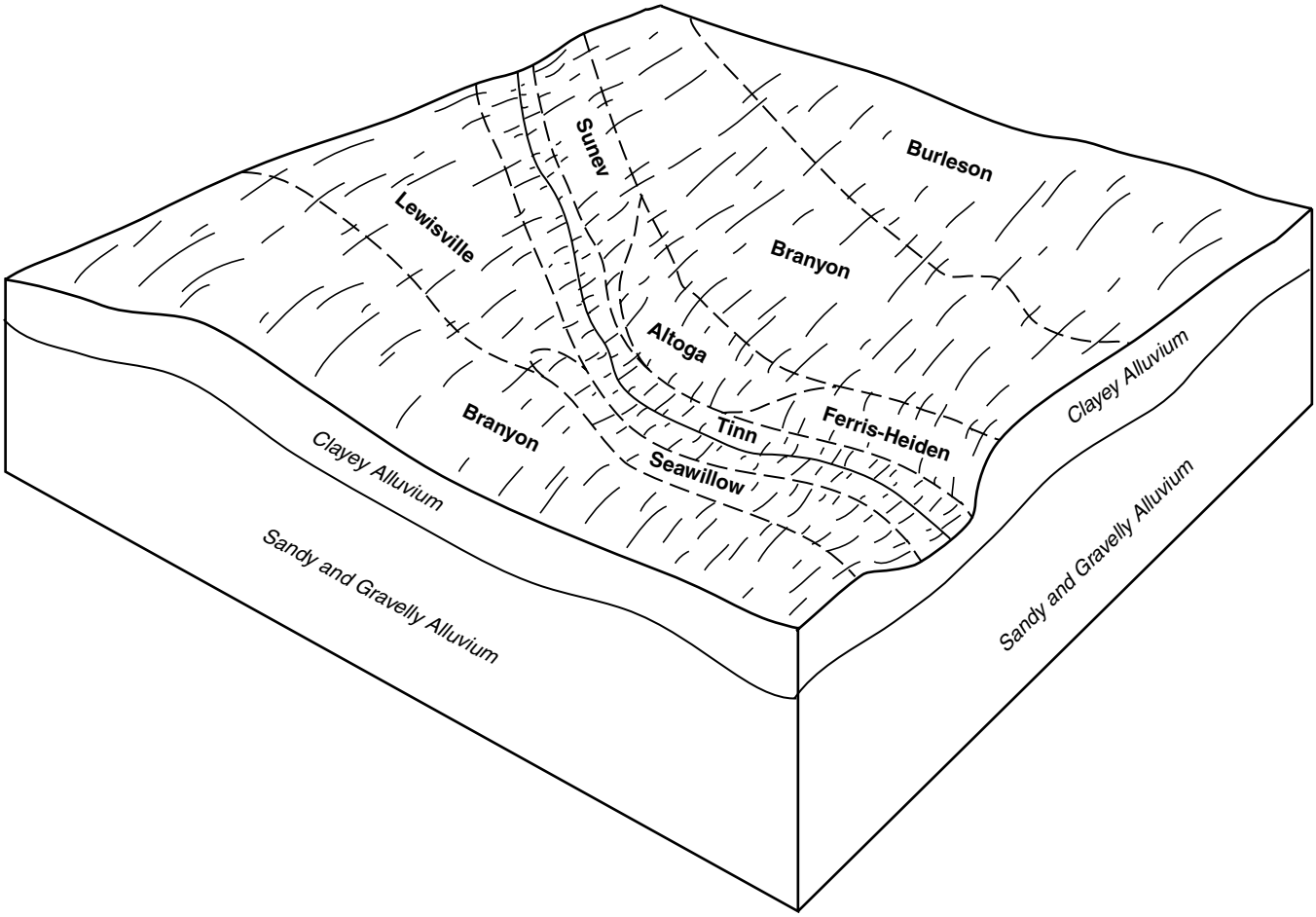

Figure 5.—Typical pattern of soils and underlying material in the Branyon-Burleson general soil map unit.

calcareous clay that has thin strata of clayey sediments that are lighter and darker in color.

Soils of minor extent in this map unit are the Bosque, Branyon, Edge, Ferris, Heiden, Houston Black, Minwells, Oakalla, and Uhland soils. Bosque, Oakalla, and Uhland soils are on the flood plains of the Little River and San Gabriel River. Edge, Ferris, Heiden, and Minwells soils are on upland scarps. Houston Black soils are on broad upland flats near major streams and Branyon soils are on broad stream terraces.

The soils of this map unit are used mainly for growing crops and improved pasture. Yields generally are high when good management practices are used. The soils are capable of producing high yields of range forage. Pecan trees do well in some areas.

These soils are unsuited to homesites and urban uses because of the hazard of flooding.

These soils are suitable for some recreational uses. Flooding is a hazard for camp areas. The surface is sticky when wet, which impedes foot and vehicle traffic.

11. Ships-Gaddy-Yahola

Nearly level, very deep, clayey and loamy soils formed in clayey, silty, and sandy alluvium

This map unit makes up about 2 percent of the county. It is about 50 percent Ships soils, 14 percent Gaddy soils, 12 percent Yahola soils, and 24 percent other soils.

The Ships, Gaddy, and Yahola soils are on flood plains of the Brazos River. Ships soils typically are in backswamp areas and on broad flats; Gaddy soils are in areas inside bends of the river; and Yahola soils are near the river bank.

The Ships soils are moderately alkaline and calcareous throughout. The surface layer is about 66 inches thick. The upper part, to a depth of about 6 inches, is reddish brown clay. The middle part, from a depth of about 6 to 28 inches, is alternating thin strata of reddish brown and dark grayish brown clay. The lower part, from a depth of about 28 to 64 inches, is

dark reddish gray clay. The subsoil, from a depth of about 64 to 80 inches, is reddish brown clay.

The Gaddy soils have a brown fine sandy loam surface layer about 7 inches thick. The underlying material, from a depth of about 7 to 80 inches, is stratified light brown loamy fine sand and dark brown silt loam between depths of 7 and 29 inches and light brown loamy fine sand that contains thin silty strata between depths of 29 and 80 inches. The soil is calcareous and moderately alkaline throughout.

The Yahola soils have a brown loam surface layer about 12 inches thick. The underlying material, from a depth of 12 to 80 inches, is stratified brown loam and yellowish red very fine sandy loam between depths of 12 and 28 inches and pink and light brown very fine sandy loam that has thin silty strata between depths of 28 to 80 inches. The soil is moderately alkaline and calcareous throughout.

Soils of minor extent in this map unit are the Frio, Travis, Uhland, and Weswood soils. Travis soils are on slopes bordering the Brazos River flood plain. Frio and Uhland soils are on flood plains of smaller streams near their intersection with the Brazos River. Weswood soils are on Brazos River flood plains.

The soils of this map unit are used mainly for growing crops and improved pasture. Good yields can be expected when good management practices are used. The soils are capable of producing high yields of range forage. Pecan trees do well in some areas.

These soils are unsuited to homesites and urban uses because of the hazard of flooding.

These soils are suitable for some recreational uses. Flooding is a hazard for camp areas. In some areas the surface is sticky when wet, which impedes foot and vehicle traffic.

12. Uhland-Sandow

Nearly level, very deep, loamy soils formed in loamy and sandy alluvium

This map unit makes up about 1 percent of the county. It is about 77 percent Uhland soils, 15 percent

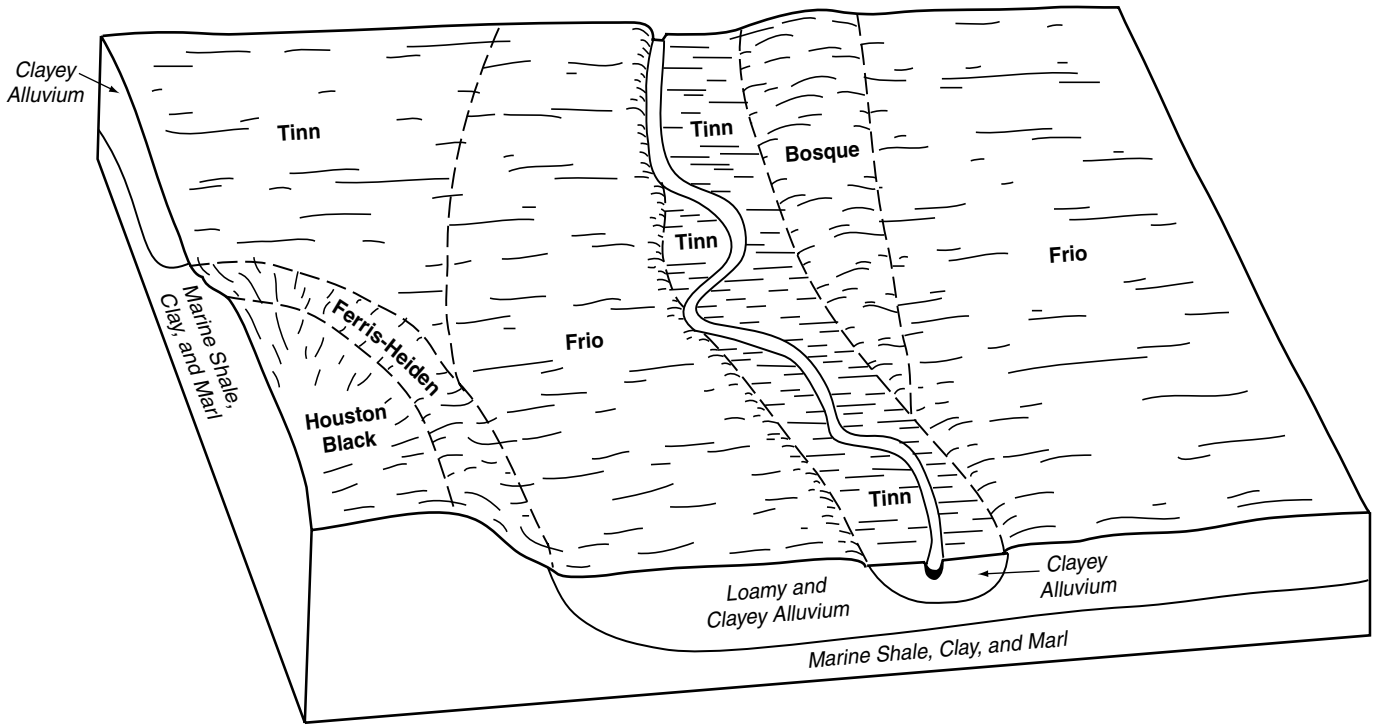

Figure 6.—Typical pattern of soils and underlying material in the Frio-Tinn general soil map unit.

Sandow soils, and 8 percent other soils.The Uhland and Sandow soils are on nearly level flood plains of local streams in the southern and eastern parts of the county.

The Uhland soils have a brown loam surface layer about 6 inches thick. The underlying material, from a depth of 6 to 80 inches, is yellowish brown loam in the upper part; light yellowish brown loamy fine sand in the middle part; and in the lower part, is gray loam that has thin strata of clayey sediments that are dark in color. The soil is slightly alkaline throughout. The surface layer is variable because of continuous deposition and scouring. Textures in the profile range from loam to clay loam, sandy clay loam to fine sandy loam.

The Sandow soils have a dark brown, slightly acid clay loam surface layer about 8 inches thick. The subsoil, from a depth of about 8 to 16 inches, is brown, moderately acid loam that has yellowish red mottles. From a depth of 16 to 28 inches it is grayish brown and brown, slightly acid clay loam that has brownish yellow and dark brown mottles. The underlying material, from a depth of about 28 to 80 inches, is light yellowish brown and slightly acid. It is very fine sandy loam in the upper part with brownish yellow and pale brown mottles, and it is loam in the lower part with yellowish brown, brownish gray, and gray mottles.

Soils of minor extent in this map unit are the Edge, Padina, and Rader soils. Edge and Padina soils are on hillsides bordering local creeks. Rader soils are on low stream terraces.

The soils of this map unit are used mainly for improved pasture and as rangeland. The production potential is high when proper management is used. The soils are capable of producing high yields of native grasses. Native vegetation includes big bluestem, little bluestem, and switchgrass, along with oak, pecan, and cottonwood trees.

These soils are not suitable for homesites and urban uses because of the hazard of flooding.

These soils are suitable for recreational uses. Flooding is a hazard for camp areas. The soils may be saturated with water part of the year, which impedes vehicle and foot traffic.

Loamy Soils of Blackland Prairies

The soils in this group make up about 14 percent of the county. The major soils include the Crockett, Davilla, Satin, and Wilson soils. Mostly, these soils have a loamy surface layer and a clayey subsoil.

These soils are used mainly for pasture and rangeland. Improved bermudagrass, common bermudagrass, and kleingrass are major pasture grasses. Some areas are cropped to wheat, oats, forage sorghum, cotton, corn, and grain sorghum. Native vegetation consists of little bluestem, big bluestem, switchgrass, purpletop, indiangrass, and sideoats grama, along with scattered post oak, elm, and hackberry trees.

13. Wilson-Davilla

Nearly level and very gently sloping, very deep, loamy soils formed in clayey and silty alluvium

This map unit makes up about 10 percent of the county. It is about 53 percent Wilson soils, 15 percent Davilla soils, and 32 percent other soils.

The Wilson and Davilla soils are on broad, smooth areas of stream terraces (fig. 7). Small creeks and drainageways flow through the areas in places.

The Wilson soils have a gray, neutral loam surface layer about 9 inches thick. The subsoil extends to a depth of about 80 inches. From a depth of about 9 to 32 inches, it is dark gray, slightly alkaline clay loam. From a depth of about 32 to 47 inches it is dark gray, slightly alkaline clay. From a depth of 47 to 58 inches it is light brownish gray, moderately alkaline clay. The lower part of the subsoil, from a depth of about 58 to 80 inches, is pale brown, moderately alkaline clay.

The surface layer of the Davilla soil is dark brown, slightly acid loam about 10 inches thick. The subsoil is clay loam and extends to a depth of about 80 inches. From a depth of about 10 to about 24 inches, it is brown with light gray and brownish yellow mottles, and neutral. From a depth of about 24 to 34 inches, it is brown with light gray and reddish yellow mottles, and neutral. From a depth of about 34 to 44 inches, it is light brownish gray with light gray and reddish yellow mottles, and slightly alkaline. From a depth of about 44 to 50 inches, it is light gray with brownish yellow mottles, and slightly alkaline. From a depth of about 50 to 80 inches, the subsoil is light gray, with brownish yellow mottles, and moderately alkaline.

Soils of minor extent in this map unit are the Branyon, Burleson, Crockett, Gowen, Lewisville, Minwells, Payne, Riesel, Sunev, and Tinn soils. Branyon and Burleson soils are in broad, smooth areas. Crockett soils are on low ridges. Gowen and Tinn soils are on the flood plains of creeks. Lewisville, Payne, Riesel, and Sunev soils are on side slopes and scarps. Minwells soils are on higher ridges and slopes.

The soils of this map unit are used mainly for growing crops and improved pasture. Yields are generally high when good management practices are used. The soils are capable of producing high yields of range forage. After prolonged rainfall, the Wilson soils are saturated in the surface layer for short periods in most years.

These soils are suited to homesites and urban uses if properly designed to overcome severe limitations.

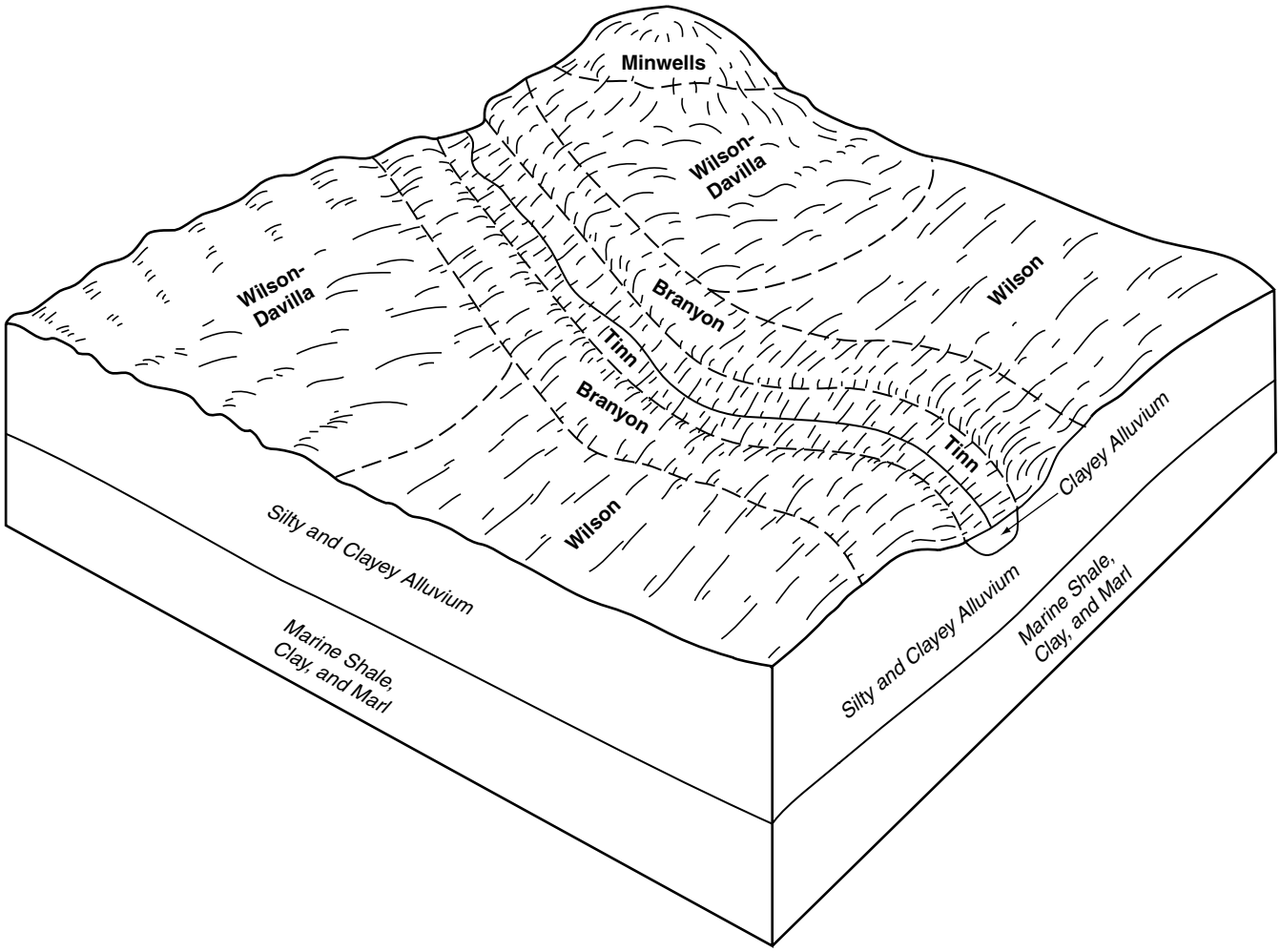

Figure 7.—Typical pattern of soils and underlying material in the Wilson-Davilla general soil map unit.

They include a high potential for shrinking and swelling, which affects foundations and streets; the high risk of corrosion, which affects underground steel pipe; and very slow permeability, which adversely affects septic systems.

These soils are limited for use for recreational areas. The very slow permeability and poor surface drainage are the major limitations.

14. Crockett

Very gently sloping and gently sloping, deep, loamy soils formed in clayey marine sediments

This map unit makes up about 2 percent of the county. It is about 80 percent Crockett soils and 20 percent other soils.

Crockett soils are on broad ridges and on side slopes of uplands.

The Crockett soils have a dark brown, neutral fine sandy loam surface layer about 7 inches thick. The subsoil extends to a depth of about 42 inches. From a depth of about 7 to 13 inches, it is dark brown, neutral clay that has yellowish brown mottles. From a depth of about 13 to 22 inches, it is dark brown, neutral clay that has reddish brown and light brownish gray mottles. From a depth of about 22 to 33 inches, it is light brownish gray, slightly alkaline clay that has red and light brown mottles. From a depth of about 33 to 42 inches, it is light yellowish brown, slightly alkaline clay that has light brownish gray and yellow mottles. The underlying material, from a depth of about 42 to 80 inches, is very pale brown, moderately alkaline clay loam that has interbedded weathered shale materials.

Soils of minor extent in this map unit are the Burleson, Davilla, Frio, Gowen, Normangee, and Wilson soils. Burleson, Davilla, and Wilson soils are on broad flats. Frio and Gowen soils are on flood plains of local streams. Normangee soils are on hillsides.

The soils of this map unit are used mainly for pasture and rangeland. A few areas are planted in forage sorghums, small grains, or other crops.

Moderate yields of improved grasses and rangeland plants can be expected.

These soils are suited to homesites and urban uses when properly designed to overcome limitations that include a high potential for shrinking and swelling, which affects foundations and streets, and very slow permeability, which affects septic systems.

These soils are suitable for recreational uses. Limitations include very slow permeability and, in some areas, slope.

15. Satin

Very gently sloping, very deep, gravelly, loamy soils formed in gravelly alluvium

This map unit makes up about 2 percent of the county. It is about 77 percent Satin soils and 23 percent other soils.

The Satin soils are on terrace ridges and gentle side slopes above small creeks and drainageways.

The Satin soils have a very dark grayish brown, neutral gravelly clay loam surface layer about 9 inches thick. The subsoil extends to a depth of about 60 inches. The upper part, from a depth of about 9 to 42 inches, is neutral very gravelly clay. It is dark gray between depths of 9 and 20 inches, and gray with dark red mottles between depths of 20 and 42 inches. The lower part, from a depth of about 42 to 60 inches, is light gray, slightly alkaline very gravelly clay that has yellow mottles. The underlying material, from a depth of about 60 to 80 inches, is mottled olive yellow, brownish yellow, and light olive gray, moderately alkaline weathered shale that has clay texture.

Soils of minor extent in this map unit are the Burleson, Houston Black, Tinn, and Wilson soils. The Houston Black soils are on the breaks of terraces. The Tinn soils are on flood plains of local creeks. The Burleson and Wilson soils are on nearly level terraces.

The soils of this map unit are used mainly for native range and pasture. A few areas are used as cropland. Cool-season crops, such as oats and wheat, are adapted. Yields are usually low. The soils are best suited to improved pasture or native range.

These soils are suited to homesites and urban uses when properly designed to overcome limitations that include a high potential for shrinking and swelling, which affects foundations and streets; the high risk of corrosion, which affects underground steel pipes; and slow permeability, which adversely affects septic systems.

These soils are suitable for most recreational uses. Gravel on the surface affects use for playgrounds.

Detailed Soil Map Units

The map units delineated on the detailed maps in the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

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. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils 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 other than those of the major soils.

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 the use of 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.

Soil 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 the use or management. For example, Travis loamy fine sand, 1 to 3 percent slopes, is a phase of the Travis series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. The Wilson-Davilla complex, 0 to 2 percent slopes, is an example of a complex.

This survey includes *miscellaneous areas*. Such

areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other 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.

AgD2—Altoga silty clay, 5 to 8 percent slopes, eroded

This very deep, moderately sloping, well drained soil is on side slopes along drainageways on stream terraces. Areas are mainly long and narrow and range from about 10 to 50 acres in size. Most areas have undergone sheet and gully erosion, which have thinned the surface layer or eroded it away in some places, exposing the subsoil. Gullies are mainly 600 to 800 feet apart and 3 to 6 feet deep. Some of the gullies are not actively eroding because native vegetation has been reestablished.

Typically, the surface layer is grayish brown, calcareous silty clay about 7 inches thick. The subsoil extends to a depth of 80 inches. The upper part of the subsoil, from a depth of about 7 to 36 inches, is brownish yellow, calcareous silty clay that contains concretions and masses of calcium carbonate. The lower part, from a depth of about 36 to 62 inches, is yellow, calcareous silty clay loam that has concretions and masses of calcium carbonate. The yellow, calcareous loam is at a depth of about 62 to 80 inches.

This soil is well drained, has moderate permeability, and has medium runoff. Available water capacity is high. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Ferris, Lewisville, Seawillow, and Sunev soils. Ferris and Seawillow soils are in positions on the landscape similar to those of the Altoga soils. Lewisville soils are on ridgetops and Sunev soils are on footslopes. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as pasture and rangeland.

This soil is well suited to use as rangeland. Management practices include weed and brush control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately well suited to urban and recreational uses. The soil is at a higher elevation on the landscape, which affords many areas esthetic views of the valley. Moderate permeability affects septic systems. The moderate potential for shrinking and swelling affects foundations, and the soil is highly corrosive to unprotected underground steel. Because of the high content of calcium, ornamentals and fruit trees are subject to chlorosis.

This soil is moderately suited to use as pasture. Common bermudagrass, improved bermudagrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as vetch, sweetclover, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is not suitable for use as cropland because of slope and the hazard of erosion.

This soil has fair potential as habitat for openland and rangeland wildlife. Songbirds and small animals are fairly plentiful because most areas support grass, weeds, and brush that provide food and cover.

This soil is in capability subclass 6e and in the Clay Loam ecological site.

Ba—Bastsil fine sandy loam, 0 to 2 percent slopes

This very deep, nearly level and very gently sloping, well drained soil is on stream terraces. Areas are irregular in shape and range from about 10 to 150 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 16 inches thick. The subsoil extends to a depth of 80 inches. The upper part of the subsoil, from a depth of about 16 to 41 inches, is yellowish red, neutral sandy clay loam. The lower part, from a depth of about 41 to 80 inches, is reddish yellow, slightly alkaline sandy clay loam.

This soil is well drained, has moderate permeability, and negligible surface runoff on slopes of less than 1 percent and low surface runoff on 1 to 2 percent slopes. Available water capacity is moderate. The hazard of water erosion is moderate.

Included with this soil in mapping are areas of Branyon, Burleson, Minwells, Seawillow, Silawa, and Travis soils. The Branyon and Burleson soils are in slight depressions. The Minwells and Travis soils are in positions on the landscape similar to those of the Bastsil soil. The Seawillow and Silawa soils are on slope breaks. Also included are areas of a Bastsil soil that has a loamy fine sand surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and cropland. Some areas are mined for sand and gravel, which typically underlie the soil.

This soil is well suited to use as cropland. The main crops are small grains, grain sorghum, forage sorghum, and truck crops. Some areas are used as orchards. Leaving crop residue on the surface helps to maintain tilth and organic matter content, conserve moisture,

and reduce erosion. Additional practices for erosion reduction include terraces, grassed waterways, and minimum tillage systems.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, weeping lovegrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grasses and oak savannah.

This soil is well suited to urban and recreational uses. Adapted fruit trees, shade trees, and ornamentals do well with proper applications of fertilizer and water.

This soil has good potential as habitat for openland and rangeland wildlife. Grasses and seed-producing forbs provide food and cover for wild birds and small animals.

This soil is in capability subclass 2e and in the Sandy Loam ecological site.

BbC—Bigbrown clay loam, 2 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on ridges, on hillsides, and in drainageways of reclaimed lignite mine spoil areas. Areas are large, ranging up to several hundred acres in size.

Typically, the surface layer is yellowish brown, moderately acid clay loam about 2 inches thick. The underlying material, from a depth of about 2 to 80 inches, is brownish yellow, moderately acid clay loam that contains many strata and pockets of sandy and clayey materials in shades of red, gray, brown, and yellow.

This soil is well drained, has slow permeability, and has surface runoff is high. Available water capacity is moderate. The hazard of water erosion is moderate to severe.

Included with this soil in mapping are small areas of Crockett, Edge, Minerva, Padina, Rader, Sandow, and Uhland soils. These soils are in areas that have not been disturbed by mining activities. Also included are slickspots and areas of a Bigbrown soil that has slopes of more than 5 percent and small areas of a soil similar to the Bigbrown soil that is extremely acid in the surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as pasture and rangeland.

This soil is well suited to pasture and hayland and to improved pasture grasses, such as coastal bermudagrass. Carefully planned management practices are needed to establish and maintain grass production. This soil, which is low in content of organic matter, has low natural fertility. Areas where slopes are short and steep have very high surface runoff rate and a severe hazard of water erosion. Vegetation is difficult to establish in these areas. Some more sloping areas of this soil require diversion terraces and contouring to control runoff. Applications of lime and fertilizer, as recommended by soil tests, are needed before grasses can be established. To maintain established pasture grasses, lime and fertilizer should be applied at high rates. Most areas need supplemental irrigation. Grazing must be controlled after grasses have been established to prevent future erosion. Good pasture management requires rotational grazing, weed and brush control, maintaining the proper height of forage plants during grazing periods, applications of fertilizer, and an adequate supply of water for livestock.

This soil is well suited to use as rangeland. Management practices include brush and weed control, applications of fertilizer and lime to maintain pH balance, planned grazing, and proper stocking.

This soil is poorly suited to urban and recreational uses. The mixed mine spoil materials are unstable for building foundations, have moderate potential for shrinking and swelling, and are moderately corrosive to underground steel pipes. The slow permeability is a severe limitation for septic systems. Fruit trees, ornamentals, and vegetables grow poorly in some places because the mixed mine spoil materials are extremely acid and do not hold water well. Pine trees and adapted shade trees will grow with proper applications of fertilizer and water during dry periods. Pine trees have been planted in a few areas. Slope is a moderate limitation for playgrounds.

This soil has good potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Grasses and seed-producing forbs provide food and cover for wild birds and a few small animals.

This soil is in capability subclass 4e. It is not assigned to an ecological site.

BcC—Bigbrown-Slickspots complex, 2 to 8 percent slopes

These very deep, very gently sloping to moderately sloping, well drained soils and Slickspots are on ridges,on hillsides, and in drainageways of reclaimed lignite mine spoil areas. Areas are large, ranging up to several hundred acres in size.

The areas of Bigbrown soils and Slickspots are so intricately mixed that separating them is not practical at the scale of mapping. Mapped areas are about 70 percent Bigbrown clay loam and 20 percent Slickspots. The remaining areas contain Crockett, Edge, Minerva, Padina, Rader, Sandow, and Uhland soils that have not been disturbed by mining activities.

Typically, the surface layer of the Bigbrown soil is yellowish brown, moderately acid clay loam that is about 2 inches thick. The underlying material, from a depth of about 2 to 80 inches, is brownish yellow, moderately acid clay loam that contains many strata and pockets of sandy and clayey materials in shades of red, gray, brown, and yellow. A few small fragments of lignite, pyrite, shale, and sandstone are scattered throughout this soil.

Slickspots are small areas that contain a mixture of mine spoil materials that include many lignite and pyrite fragments. They are extremely acid and do not support vegetation. Color and texture are variable.

The Bigbrown soils are well drained, have slow permeability, and have high or very high surface runoff. Available water capacity ranges from low to high. The hazard of water erosion is moderate or severe.

These soils are used mainly as idle land or for wildlife habitat.

These soils are suited to recreational uses. Vegetation is difficult to maintain in areas of Slickspots. Slope is a moderate limitation for playgrounds.

These soils are poorly suited to improved pasture grasses, such as coastal bermudagrass. They require carefully planned management practices to establish and maintain grasses. They have a low content of organic matter and are low in natural fertility. The Slickspots are extremely acid. Many areas have a low available water capacity. Areas where slopes are short and steep have very high surface runoff and a severe hazard of water erosion. Vegetation is difficult to establish in these areas.

Some more sloping areas require diversion terraces and contouring to control runoff before grasses can be established. As recommended by soil tests, these soils need numerous applications of lime and fertilizer to establish pasture grasses. The also require high rates of lime and fertilizer application once the grasses are established. Supplemental irrigation is needed in most areas. Grazing must be controlled after grasses have been established to prevent future erosion. Good pasture management requires rotational grazing, weed and brush control, maintaining the proper height of forage plants during grazing periods, applications of fertilizer, and an adequate supply of water for livestock.

These soils are poorly suited to use as rangeland. Management includes applications of lime to maintain pH balance, brush and weed control, planned grazing, and proper stocking.

These soils are poorly suited to urban uses. The mixed mine spoil materials are unstable for building foundations, have moderate potential for shrinking and swelling, and are moderately corrosive to underground steel pipes. The slow permeability is a severe limitation for septic systems. Fruit trees, ornamentals, and vegetables grow poorly in many areas because the mixed mine spoil materials are extremely acid and do not hold water well. Pine trees which have been planted in a few areas, and adapted shade trees will grow with proper applications of fertilizer and water during dry periods.

In areas of Bigbrown soils, the potential as habitat for openland and rangeland wildlife is fair. Grasses and seed-producing forbs provide food and cover for wild birds and a few small animals.

This map unit is in capability subclass 6e. These Bigbrown soils and Slickspots are not assigned to an ecological site.

Be—Bosque clay loam, occasionally flooded

This very deep, nearly level, well drained soil is on flood plains of streams. Some areas are subject to flooding once every 2 to 8 years for a period of about 2 days, usually in the fall, winter, and spring. Areas are long and narrow and range from about 10 to 200 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is clay loam about 52 inches thick. It is grayish brown in the upper part, dark grayish brown in the middle part, and grayish brown in the lower part. The subsoil, from a depth of about 52 to 80 inches, is pale brown clay loam. The soil is calcareous and moderately alkaline throughout.

This soil is well drained, has moderate permeability, and has negligible surface runoff. Available water capacity is high. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Frio, Oakalla, and Tinn soils. The Frio and Tinn soils are in slightly lower positions on the landscape than those of the Bosque soil. The Oakalla soil is in positions on the landscape similar to those of the Bosque soil. Also included are small areas of a Bosque soil that is frequently flooded. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland.

This soil is well suited to use as cropland. Cotton, wheat, grain sorghum, and corn are the main crops.

Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grasses and scattered elm, pecan, and cottonwood trees.

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

This soil has good potential as habitat for openland and rangeland wildlife. Birds and small animals find food and cover in pastures and in brushy areas along the stream channels. Birds frequent this habitat mainly during planting and harvest seasons.

This soil is in capability subclass 2w and in the Loamy Bottomland ecological site.

BrA—Branyon clay, 0 to 1 percent slopes

This very deep, nearly level, moderately well drained soil is on stream terraces. Areas are irregular in shape and range from 20 to 1,000 acres in size.

Typically, the surface layer is dark gray clay about 58 inches thick. The subsoil extends from a depth of about 58 to 80 inches and is gray clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained, has very slow permeability, and has high surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is slight.

Included with this soil in mapping are areas of Burleson and Tinn soils. The Burleson soil is in positions on the landscape similar to those of the Branyon soil. The Tinn soil is along small drainageways. Also included are small areas of a Branyon soil that has slopes of 1 to 3 percent. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland (fig. 8).

This soil is well suited to use as cropland. Grain sorghum, cotton, wheat, and corn are the major crops (fig. 9). This soil is saturated for short periods following heavy rain because of the very slow permeability. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. Grain sorghum, corn, or other crops that produce large amounts of residue are needed in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Surface runoff from surrounding areas can be controlled by diversion terraces and grassed waterways. Applications of fertilizer, as recommended by soil test, are needed for crops and pasture grasses.

This soil is well suited to use as pasture. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is poorly suited to urban and recreational uses. The very high potential for shrinking and swelling causes foundations and roads to crack unless special reinforcements are installed. The very slow permeability causes septic systems to malfunction. The soil is corrosive to underground pipes and will destroy them in a short time if the pipes are unprotected. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well on this soil. Landscaping and gardening are difficult with hand tools.

This soil has fair potential as habitat for openland and rangeland wildlife. Wildlife includes mostly songbirds, game birds, and rabbits. Some migratory birds feed on the grain lost during harvesting. Rabbits are common mainly along turnrows and in adjoining pastures where cover is available.

This soil is in capability subclass 2w and in the Blackland ecological site.

BrB—Branyon clay, 1 to 3 percent slopes

This very deep, very gently sloping, moderately well drained soil is on stream terraces. Areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is dark gray clay about 31 inches thick. The upper part of the subsoil, from a depth of about 31 to 50 inches, is gray clay that has streaks of dark gray. The lower part of the subsoil, from a depth of about 50 to 80 inches, is light brownish gray clay that has streaks of dark gray. The soil is calcareous and moderately alkaline throughout.

Figure 8.—Grain sorghum is a major crop grown on Branyon clay, 0 to 1 percent slopes.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is moderate.

Included with this soil in mapping are areas of Burleson and Tinn soils. The Burleson soil is in positions on the landscape similar to those of the Branyon soil. The Tinn soil is along drainageways. Also included are small areas of a Branyon soil where slopes are less than 1 percent. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and cropland.

This soil is well suited to use as cropland. Grain sorghum, cotton, wheat, corn, and forage sorghums are the main crops. This soil does have some management concerns. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. Plant roots, water, and air move through the soil very slowly. The cropping system should include crops that produce large amounts of residue, such as grain sorghum or corn. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Terraces and contour tillage help to protect the soil from erosion if row crops are planted. In some areas, diversion terraces and grassed waterways are needed to help reduce erosion caused by runoff from surrounding soils and to provide outlets for terraces.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are major forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil. This soil is well suited to use as

rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is poorly suited to urban and recreational uses. Because of the very high potential for shrinking and swelling, structures shift and foundations break unless they are strongly reinforced. Underground steel pipe corrodes rapidly unless the pipes are protected. Septic systems frequently malfunction, particularly during extended periods of rain. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well on this soil. Landscaping and gardening are difficult with hand tools. A few elm, hackberry, pecan, and live oak trees are native in some areas.

This soil has fair potential as habitat for openland and rangeland wildlife. The wildlife feed on grain lost during harvesting. Rabbits generally are common along fence rows or in adjoining pastures where grass and cover are available.

This soil is in capability subclass 2e and in the Blackland ecological site.

Bu—Burleson clay, 0 to 2 percent slopes

This very deep, nearly level and very gently sloping, moderately well drained soil is on stream terraces. Areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the upper part of the surface layer is dark gray, slightly alkaline clay to a depth of about 6 inches. The lower part of the surface layer, from a depth of about 6 to 38 inches, is gray, calcareous clay. The subsoil extends from a depth of about 38 to 80 inches. It is calcareous clay that is grayish brown in the upper part and light brownish gray in the lower part.

This soil is moderately well drained, has very slow permeability, and has high or very high surface runoff. Available water capacity is high. Water enters the soil

Figure 9.—Wheat and grain sorghum are high-residue crops that grow well on Branyon clay, 0 to 1 percent slopes.

rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Branyon and Wilson soils that are in positions on the landscape similar to those of the Burleson soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and cropland.

This soil is well suited to use as cropland. Grain sorghum, cotton, wheat, corn, and forage sorghums are the main crops. This soil does have some management concerns. Because of very slow permeability in the lower layers, it is saturated for short periods following heavy rains. Plant roots, water, and air move through the soil very slowly. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. Surface crusting delays emergence of seedlings. Grain sorghum, corn, or other crops that produce large amounts of residue are needed in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Surface runoff from surrounding areas can be controlled by diversion terraces and grassed waterways.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie with scattered elm, hackberry, pecan, and live oak trees.

This soil is poorly suited to urban and recreational uses. Structures shift and crack because of the very high potential for shrinking and swelling. Underground steel pipe corrodes rapidly if the pipe is not protected. Septic systems do not function well and can malfunction during extended periods of rain. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well on this soil. Landscaping and gardening are difficult with hand tools.

This soil has fair potential as habitat for openland wildlife and poor potential as habitat for rangeland wildlife. The bird population is highest during grain harvest. Small animals generally travel along turnrows or in adjoining pastures in their search for food and cover.

This soil is in capability subclass 2e and in the Blackland ecological site.

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

This very deep, very gently sloping, moderately well drained soil is on terraces of the Brazos River. Areas are irregular in shape and range up to 150 acres in size.

Typically, the surface layer is brown, slightly acid loamy fine sand about 9 inches thick. The subsurface layer, from a depth of about 9 to 17 inches, is pale brown, slightly acid loamy fine sand. The subsoil is sandy clay that extends to a depth of 80 inches or more. From a depth of about 17 to 26 inches, it is moderately acid and is mottled red, yellowish brown, and light brownish gray. From a depth of about 26 to 36 inches, it is slightly acid and is mottled light brownish gray, yellowish brown, and red. From a depth of about 36 to 56 inches, it is slightly alkaline and is light brownish gray that has brownish yellow and red mottles. From a depth of about 56 to 80 inches, it is moderately alkaline and is light brownish gray that has brownish yellow mottles.

This soil is moderately well drained, has slow permeability, and has high surface runoff. Available water capacity is moderate. The hazard of water and wind erosion is moderate.

Included with this soil in mapping are small areas of Desan, Gause, Minwells, Silawa, Silstid, and Travis soils. Desan, Minwells, Silawa, Silstid, and Travis soils are on ridges and hilltops. Gause soils are in positions on the landscape similar to those of the Chazos soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and rangeland.

This soil is well suited to use as cropland. The main crops are small grains, grain sorghum, forage sorghums, peanuts, and truck crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, weeping lovegrass, and johnsongrass are the main forages. A complete fertilizer is needed to sustain forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass and oak savannah.

This soil is moderately suited to urban and recreational uses. The moderate potential for shrinking and swelling is a limitation for building sites. The risk of corrosion, which affects underground steel pipe, is high. Use of septic systems is severely limited by the slowly permeable subsoil. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas.

This soil has good potential as habitat for openland and rangeland wildlife, which consists mainly of songbirds and small animals. Weed seeds and grasses are plentiful, and some wooded and brushy areas are used for shelter and cover.

This soil is in capability subclass 2e and in the Sandy Loam ecological site.

CrB—Crockett fine sandy loam, 1 to 3 percent slopes

This deep, very gently sloping, moderately well drained soil is on upland ridges. Areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 7 inches thick. The subsoil extends to a depth of about 42 inches. From a depth of about 7 to 13 inches, it is brown, neutral clay that has yellowish brown mottles. From a depth of about 13 to 22 inches, it is brown, neutral clay that has reddish brown and light brownish gray mottles. From a depth of about 22 to 33 inches, it is light brownish gray, slightly alkaline clay that has red and light brown mottles. From a depth of about 33 to 42 inches, the subsoil is light yellowish brown, slightly alkaline clay that has light brownish gray and yellow mottles. The underlying material, from a depth of about 42 to 80 inches, is very pale brown, moderately alkaline clay loam interbedded with weakly consolidated shale materials.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is moderate.

Included with this soil in mapping are areas of Edge, Gowen, Normangee, Travis, and Wilson soils. The Edge, Normangee, and Travis soils are on hillsides and slopes. The Gowen soils are in narrow drainageways. The Wilson soils are in slight depressions and on flats. The included soils make up less than 15 percent of the map unit.

Much of the soil is abandoned cropland and is currently used as rangeland or pasture. Brush encroachment is a problem. A few areas are used for cropland and improved pasture.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is suited to use as cropland. Small grains and forage sorghums are the main crops. Leaving crop residue on the surface helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces, grassed waterways, and minimum tillage systems.

This soil is suited to use as pasture. Common bermudagrass, improved bermudagrass, and johnsongrass are the main forages. A complete fertilizer is needed to sustain forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

This soil is poorly suited to urban and recreational uses. It has a high potential for shrinking and swelling and is highly corrosive to underground steel pipes. Septic systems are inefficient, and effluent can surface during wet periods. Fruit trees and most ornamentals grow poorly on this soil because of the dense, clayey subsoil and continued wetness after heavy rainfall. Adapted shade trees and vegetables do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and post oak trees are native in some areas.

This soil has good potential as habitat for openland and rangeland wildlife. An abundance of wild birds and small animals inhabit brush areas. The habitat is capable of supporting a larger population of wildlife. Generally, wildlife moves into smaller areas as the pastures in the habitat are cleared and the area is planted with improved pasture grasses.

This soil is in capability subclass 3e and in the Claypan Prairie ecological site.

CrC2—Crockett fine sandy loam, 2 to 5 percent slopes, eroded

This deep, very gently sloping and gently sloping, moderately well drained soil is on uplands. Areas are irregular in shape and range from about 10 to 200 acres in size. Most areas have had sheet and gully erosion. The surface layer has been thinned or completely eroded away in some places, exposing the subsoil. Gullies are mainly 500 to 800 feet apart and 2 to 6 feet deep. Many of the gullies have been revegetated with native plants and are not actively eroding.

Typically, the surface layer is brown, slightly acid fine sandy loam about 4 inches thick. The clay subsoil

extends to a depth of about 46 inches. The upper part is brown with yellowish red and yellowish brown mottles. The middle part is light olive brown, and the lower part is yellowish brown. The subsoil is neutral in the upper and middle parts and moderately alkaline in the lower part. The underlying material, from a depth of about 46 to 80 inches, is mottled brownish yellow, light gray, and light yellowish brown, moderately alkaline clay loam.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is severe.

Included with this soil in mapping are areas of Edge, Gowen, Normangee, Travis, and Wilson soils. The Edge, Normangee, and Travis soils are on hillsides and ridgetops. The Gowen soil is in narrow drainageways. The Wilson soil is in depressions. The included soils make up less than 15 percent of the map unit.

Most areas of this soil are abandoned, eroded cropland currently used as pasture or rangeland. Brush encroachment is a concern. A few areas are used for growing oats for grazing.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is suited to use as pasture and hayland. Some areas may require land shaping before grasses are established. Coastal bermudagrass, common bermudagrass, and johnsongrass are the main forages. A complete fertilizer is needed for sustained forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

This soil is poorly suited to use as cropland, although a few areas are planted in small grains and forage sorghums. Leaving crop residue on the surface helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces, grassed waterways, and minimum tillage systems.

This soil is poorly suited to urban and recreational uses. The high potential for shrinking and swelling will affect foundations and other structures. The clayey subsoil will corrode underground steel pipe unless the pipe is protected. Septic systems work poorly and generally malfunction during rainy periods. Fruit trees and most ornamentals grow poorly on this soil because of the dense, clayey subsoil and wetness after heavy rainfall. Adapted shade trees do well with proper applications of fertilizer and water during dry periods. Gardens have fair potential with proper applications of fertilizer and water in areas that are not eroded. A few elm, hackberry, and post oak trees are native to this soil in some areas.

This soil has good potential as habitat for openland and rangeland wildlife. Brush areas provide food and cover for a variety of songbirds, game birds, and small animals. These areas are gradually shrinking in size as they are converted to improved pastures.

This soil is in capability subclass 4e and in the Claypan Prairie ecological site.

DeC—Desan loamy fine sand, 1 to 5 percent slopes

This very deep, very gently sloping and gently sloping, somewhat excessively drained soil is on terraces of the Brazos River. Areas are irregular in shape and range up to several hundred acres in size.

Typically, the surface layer is brown, slightly acid loamy fine sand about 8 inches thick. The subsurface layer, from a depth of about 8 to 50 inches, is light brown, slightly acid loamy fine sand. The subsoil, from a depth of about 50 to 80 inches, is red, slightly acid fine sandy loam.

This soil is somewhat excessively drained, has rapid permeability in the surface and subsurface layers and moderate permeability in the subsoil, and has negligible surface runoff. Available water capacity is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Included with this soil in mapping are small areas of Chazos, Silawa, and Silstid soils. The Chazos and Silstid soils are on footslopes below the Desan soil. The Silawa soil is on ridges. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and rangeland.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, and weeping lovegrass are the main forages. Improved pastures require several light applications of a complete fertilizer for high production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is suited to use as cropland. The main crops are small grains, forage sorghums, peanuts, and truck crops. Leaving crop residue on the soil helps to

maintain tilth and organic matter content, conserve moisture, and reduce erosion. Cover crops and stripcropping help to reduce wind erosion. Minimum tillage systems help reduce the hazard of water and wind erosion.

This soil is suited to urban and recreational uses with some limitations. Septic systems work well; however, leachate can contaminate local water wells. Underground steel pipe is at moderate risk of corrosion. Adapted fruit trees, shade trees, ornamentals, and vegetables can be grown and lawns can be maintained with applications of fertilizer and water. Post oak, blackjack oak, and hickory trees are native in some areas. This soil generally is too droughty to support the kind of grass cover needed for recreation areas. Grass needs irrigation to grow on this soil. The sandy surface, which is dry and loose most of the year, makes foot traffic somewhat difficult.

This soil has fair potential as habitat for openland and rangeland wildlife. Little food is available for small, wild animals and birds that frequent the areas. Wooded areas provide cover and protection in winter.

This soil is in capability subclass 3e and is in the Deep Sand ecological site.

Dp—Dumps-Pits complex

This map unit consists of moderately steep to very steep mounds of lignite mine spoil materials intermingled with pits containing water. The areas are several hundred acres in size. Slopes typically are short with gradients of 12 to 60 percent. Pits containing water make up about 20 percent of the areas. Erosion is active with shallow rills and gullies 3 to 15 feet deep and 4 to 50 feet wide.

The dumps are variable in color, texture, reaction, and content of lignite, pyrite, shale, sandstone, and petrified wood fragments. The materials to depths of several feet change frequently within short distances. The extremely acid to slightly alkaline, sandy to clayey materials are in shades of red, gray, brown, and yellow. Few to many lignite, pyrite, shale, sandstone, and petrified wood fragments are in the material and scattered on the surface. Woody vegetation consists mainly of a scattered cover of blackberry vines, cedar, cottonwood, sumac, and desert willow. Herbaceous plants are mainly limited to threeawns and broomsedge bluestem.

The pits are mainly less than 10 acres in size and the water depth is less than 50 feet.

These areas do not have agricultural value in their present state and provide only limited cover for wildlife. Because of slope, erosion, and acid soil conditions, they are not suited to urban or recreation uses.

Dumps and pits are not assigned to a capability subclass or to an ecological site.

EdC2—Edge fine sandy loam, 2 to 5 percent slopes, eroded

This deep, very gently sloping and gently sloping, well drained soil is on upland ridges and side slopes. Areas are irregular in shape and range from about 10 to more than 100 acres in size. Most areas have undergone sheet and gully erosion. The surface layer has been thinned or completely eroded away in some places, and the subsoil is exposed. Gullies are mainly 500 to 800 feet apart and 2 to 6 feet deep. Many of the gullies have been revegetated with native plants and are not actively eroding.

Typically, the surface layer is pale brown, moderately acid fine sandy loam about 8 inches thick. The subsurface layer, from a depth of about 8 to 11 inches, is very pale brown, slightly acid fine sandy loam. The subsoil extends to a depth of about 48 inches. From a depth of about 11 to 29 inches, it is very strongly acid clay that is red with pale brown and yellowish brown mottles. From a depth of about 29 to 37 inches, the subsoil is red, very strongly acid clay loam that has light yellowish brown and brown mottles. From a depth of about 37 to 43 inches, it is yellowish red, slightly acid clay loam that has yellowish brown mottles. From a depth of about 43 to 48 inches, it is reddish yellow, neutral sandy clay loam that has light yellowish brown and light brownish gray mottles. The underlying material, from a depth of about 48 to 80 inches, is slightly alkaline, brownish and grayish weathered siltstone that has red mottles in the upper part.

This soil is well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Crockett, Minerva, Normangee, and Rader soils. The Crockett, Normangee, and Rader soils are on footslopes or in depressions. The Minerva soil is in positions on the landscape similar to those of the Edge soil. The included soils make up less than 15 percent of the map unit.

Most areas of this soil are abandoned cropland now used as pasture or rangeland. Brush encroachment is a problem. Some areas are used for cropland and improved pasture.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to urban uses. The high potential for shrinking and swelling severely limits most urban uses. Underground steel pipes are at moderate risk for corrosion. Septic systems function

poorly in the dense, clayey subsoil. In areas that are not eroded, adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in many areas.

This soil is suited to use as pasture and hayland. Some areas require shaping, smoothing, and filling of gullies before grasses are established. A complete fertilizer is needed for sustained forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

This soil is poorly suited to use as cropland. Erosion has removed much of the soil surface. If this soil is cultivated, the cropping system should include grain sorghum or some other crop that produces large amounts of residue. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding soils and provide outlets for terraces. In eroded areas, gullies should be shaped, smoothed, and filled before grasses are established.

This soil has severe limitations for most recreational uses because of the very slow permeability.

This soil has fair potential as habitat for openland wildlife and good potential as habitat for woodland and rangeland wildlife. Some areas are wooded and provide food and cover for wild birds and animals. Brush and native grasses provide food and cover in other areas.

This soil is in capability subclass 4e and in the Claypan Savannah ecological site.

EdC3—Edge-Gullied land complex, 2 to 8 percent slopes

The soils of this map unit are very deep, very gently sloping to moderately sloping, and well drained. They are on side slopes and at the heads of small drainageways on uplands. Areas have undergone severe sheet and gully erosion. The surface layer has been partly removed in more than 80 percent of the map unit and has been completely removed, along with the upper part of the subsoil, in about 20 to 25 percent of the map unit. The Edge soil makes up about 55 to 75 percent of the map unit. Gullies are 3 to 20 feet deep and 5 to 100 feet wide; they are about 30 to 200 feet apart (fig. 10). Gullied land makes up about 15 to 35 percent of the map unit, and included soils make up about 10 percent. Areas are long and narrow, oval, or irregular in shape and range from about 10 to 80 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 3 inches thick. The subsoil extends to a depth of 40 inches. The upper part of the subsoil, from a depth of about 3 to 14 inches, is red, moderately acid clay. The middle part, from a depth of about 14 to 23 inches, is yellowish red, moderately acid clay that has pale brown mottles. The lower part of the subsoil, from a depth of about 23 to 40 inches, is yellowish red, moderately acid clay loam that has pale brown and brownish yellow mottles. The underlying material, from a depth of about 40 to 80 inches, is light brownish gray, slightly alkaline sandy clay loam that has thin interbedded layers of shale with sandy clay texture.

The Edge soil is well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Crockett, Minerva, Rader, and Uhland soils. The Crockett and Rader soils are on footslopes. The Minerva soil is in positions on the landscape similar to those of the Edge soil. The Uhland soil is along small drainageways. The included soils make up less than 15 percent of the map unit.

Most areas of this map unit are abandoned cropland, currently used as rangeland or pasture. Brush encroachment is a problem. The soils are not used for cultivation because of past erosion. Some areas are used for improved pasture.

The soils of this map unit are suited to use as pasture and hayland. Common bermudagrass and improved bermudagrass are the main forages. A complete fertilizer is needed for sustained forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil. Diversion terraces are needed in some areas to control runoff from surrounding soils.

These soils are well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

These soils are poorly suited to urban and recreational uses. Severe erosion has caused deep gullies to form. The soils have high potential for shrinking and swelling, and underground steel pipes are at high risk of corrosion. Septic systems function poorly in the dense, clayey subsoil. Between gullies, in areas that are not eroded, adapted fruit trees, shade

Figure 10.—Edge soils are highly erodible, as illustrated by this large gully in an area of Edge-Gullied land complex, 2 to 8 percent slopes.

trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas.

These soils are not suited to use as cropland because of past erosion.

The soils of this map unit have fair potential as habitat for openland wildlife and good potential as habitat for woodland and rangeland wildlife. Brush and native grasses provide food and cover for wild birds and animals.

The Edge soil is in capability subclass 6e, and Gullied land is in capability subclass 7e. The Edge soil is in the Claypan Savannah ecological site. Gullied land is not assigned to an ecological site.

FeE2—Ferris-Heiden complex, 5 to 15 percent slopes, eroded

These deep, moderately sloping to moderately steep, well drained soils are on side slopes along creeks and drainageways. Areas are long and narrow and range from about 10 to 800 acres in size. Most areas have had both sheet and gully erosion. The surface layer has been thinned by sheet erosion and is thinnest near gullies, which are about 400 to 800 feet apart and 2 to 8 feet deep. Many of the gullies have been revegetated with native plants and are not actively eroding.

The areas of Ferris and Heiden soils are so intricately mixed that mapping them separately at the scale used is not practical. Mapped areas are about 50 percent Ferris clay, 35 percent Heiden clay, and 15 percent other soils. The Ferris soil is mainly on steeper slopes and along the rims of gullies. The Heiden soil is mainly on footslopes and in moderately sloping areas between gullies.

Included with these soils in mapping are small areas of Altoga and Houston Black soils. The Altoga soil is in positions on the landscape similar to the Ferris soil and the Houston Black soil is in positions similar to the Heiden soil.

Typically, the Ferris soil is calcareous clay throughout. The surface layer is grayish brown and is about 10 inches thick. The subsoil, from a depth of about 10 to 40 inches, is olive. The underlying material, from a depth of about 40 to 72 inches, is mottled light yellowish brown and pale olive weathered shale that has clay texture.

Typically, the Heiden soil is calcareous throughout. The surface layer is dark grayish brown clay about 18 inches thick. The subsoil, from a depth of about 18 to 42 inches, is grayish brown clay that has yellowish brown mottles. The underlying material, from a depth of about 42 to 80 inches, is light yellowish brown interbedded weathered shale and silty clay.

These soils are well drained, have very slow permeability, and have very high surface runoff. Available water capacity is moderate. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is severe.

Most areas of this map unit are in abandoned, eroded cropland now used as rangeland or pasture. Some areas are in native range. These soils are not suited to cultivation because of slope and the hazard of erosion.

These soils are well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

These soils are suited to use as pasture and hayland. Some shaping and smoothing may be required before pasture grasses are established. Improved bermudagrass, kleingrass, and King Ranch bluestem are the main grasses. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

These soils are poorly suited to urban and recreational uses. Foundations and streets are affected by the very high potential for shrinking and swelling. Corrosion of underground steel pipelines is severe, and the very slow permeability is a severe limitation for septic systems. Many ornamentals, as well as fruit trees, do not grow well. Adapted shade trees do well with proper applications of fertilizer and water during dry periods. In areas that are not eroded, gardens have fair potential with proper applications of fertilizer and water. Landscaping and gardening are difficult with hand tools. Elm and hackberry trees are native in some areas. These soils are not suited to cultivation because of slope and hazard of erosion. The slope, the clayey texture, and gullies affect recreational uses.

These soils have fair potential as habitat for openland and rangeland wildlife. Wildlife consists mostly of wild birds and rabbits.

The Ferris soil is in capability subclass 6e and the Heiden soil is in capability subclass 4e. The Ferris and Heiden soils are in the Eroded Blackland ecological site.

Fr—Frio silty clay, occasionally flooded

This very deep, nearly level, well drained soil is on bottom lands. Areas are long and irregular in shape and range from about 20 to several hundred acres in size. Slopes are less than 1 percent. These areas are subject to brief flooding every 2 to 8 years for a period of about 2 days during fall, winter, and spring.

Typically, the surface layer is very dark grayish brown, calcareous silty clay that is about 50 inches thick. The underlying material, from a depth of about 50 to 80 inches, is dark grayish brown, calcareous silty clay.

This soil is well drained, has moderately slow permeability, and has negligible surface runoff.. Available water capacity is high. The hazard of water erosion is slight.

Included with this soil in mapping are areas of Bosque, Oakalla, and Tinn soils. The Bosque and Oakalla soils are in slightly higher positions on the landscape than those of the Frio soil. The Tinn soil is in low areas of old channels. The included soils make up less than 15 percent of the map unit.

This soil is well suited to use as cropland. Small grains, cotton, corn, grain sorghum, and forage sorghums are the major crops (fig. 11). Leaving crop residue on the surface helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Overseeding with legumes, such as vetch, sweetclover, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include proper stocking, planned grazing, and brush and weed control. The climax vegetation is tall native grass with scattered pecan, elm, and hackberry trees.

This soil can be used for picnic areas, playgrounds, paths, and trails. Flooding is a hazard for camp areas; when the soil is wet the sticky surface impedes foot and vehicle traffic.

This soil is not suited to urban uses because of the risk of flooding. Brush and trees being swept downstream during periods of flooding sometimes

Figure 11.—Harvesting cotton in an area of Frio silty clay, occasionally flooded.

damage roads and bridges near the stream channels. Pecan trees are well adapted to this soil.

This soil has good potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Birds and small animals find food and cover in pastures and in weed and wood areas along the stream channels. Birds frequent this habitat mainly during the planting and harvest seasons.

This soil is in capability subclass 2w and in the Loamy Bottomland ecological site.

Ga—Gaddy fine sandy loam, frequently flooded

This very deep, nearly level, somewhat excessively drained soil is on low flood plains of the Brazos River. It is subject to flooding for periods of less than 2 days at least once in the spring or summer each year. Areas are long, narrow, and parallel to the channel of the river or are partly encircled by bends of the river and range from about 10 to 200 acres in size. Slopes are less than 1 percent.

The soil is variable, ranging from silt loam to loamy fine sand because of continuous deposition and scouring. In a typical area, the surface layer is brown fine sandy loam about 7 inches thick. The underlying material ranges from a depth of about 7 to 80 inches. From a depth of 7 to 29 inches, it is stratified light brown loamy fine sand and dark brown silt loam. From a depth of about 29 to 80 inches, it is light brown loamy fine sand containing thin silty strata. The soil is calcareous and moderately alkaline throughout.

This soil is somewhat excessively drained, has rapid permeability, and has negligible surface runoff. Available water capacity is low. The hazard of water erosion is slight.

Included with this soil in mapping are areas of Ships, Weswood, and Yahola soils. These soils are in areas lower on the landscape. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and rangeland.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately suited to use as pasture and hayland. Common bermudagrass and improved bermudagrass are the main grasses. Applications of nitrogen and phosphorus are needed for sustained production. Management concerns include the frequent flooding and controlling of weeds and brush.

This soil is poorly suited to urban and recreational uses other than for picnic areas, paths, and hiking

trails because of the hazard of flooding. The hazard of flooding severely limits other uses.

This soil is not suited to cultivation because of frequent flooding.

This soil has fair potential as habitat for openland and rangeland wildlife. Except during periods of flooding, small wild animals and birds inhabit the areas and find food and cover in pastures and in weedy and wooded areas along the stream channels.

This soil is in capability subclass 5w and in the Sandy Bottomland ecological site.

GuB—Gause loamy fine sand, 1 to 3 percent slopes

This very deep, very gently sloping, moderately well drained soil is on high terraces of the Brazos River. Areas are irregular in shape and range from about 20 to 800 acres in size.

Typically, the surface layer is pale brown, slightly acid loamy fine sand about 14 inches thick. The subsoil extends to a depth of about 80 inches. From a depth of about 14 to 17 inches, it is brownish yellow, strongly acid clay that has reddish yellow mottles. From a depth of 17 to 27 inches, it is reddish yellow, strongly acid clay with yellowish red and light yellowish brown mottles. From a depth of about 27 to 48 inches, the subsoil is strongly acid clay that is mottled red, reddish yellow, and light yellowish brown. From a depth of about 48 to 80 inches, it is moderately acid clay loam that is mottled red, reddish yellow, and very pale brown.

This soil is moderately well drained, has slow permeability, and has high surface runoff. Available water capacity is moderate. The hazard of water and wind erosion is moderate.

Included with this soil in mapping are small areas of Crockett, Rader, Silawa, and Travis soils. Crockett, Silawa, and Travis soils are on hillsides and ridges. The Rader soil is in positions on the landscape similar to those of the Gause soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture, rangeland, and cropland.

This soil is well suited to use as cropland. The main crops are small grains, forage sorghums, peanuts, watermelons, and truck crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the major forages. Applications of a complete fertilizer are needed for sustained forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to homesites, urban uses, and recreational uses. Most areas of the soil are high on the landscape and are moderately well drained. Limitations include the moderate potential for shrinking and swelling and the high risk of corrosion to underground pipes. The slow permeability is a severe limitation to use for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas.

This soil has good potential as habitat for openland wildlife and rangeland wildlife. A few areas are wooded. Grasses and seed-producing forbs provide food and cover for wild birds and animals.

This soil is in capability subclass 2e and in the Loamy Sand ecological site.

Gw—Gowen clay loam, frequently flooded

This very deep, nearly level, well drained soil is on flood plains of small creeks in the northeast part of the county. Areas are long and narrow and range up to several hundred acres in size. Slopes are less than 1 percent. Areas of this soil are subject to flooding at least once each year for a brief period of about 2 days, mainly during spring and summer.

Typically, the surface layer is clay loam about 37 inches thick. It is dark grayish brown and neutral in the upper part, dark gray and slightly alkaline in the middle part, and dark grayish brown and slightly alkaline in the lower part. The subsoil, from a depth of about 37 to 80 inches, is grayish brown, slightly alkaline clay loam that has light yellowish brown mottles in the lower part.

This soil is well drained, has moderate permeability, and has negligible surface runoff. Available water capacity is high. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Frio, Tinn, and Uhland soils. The Frio and Tinn soils are mainly in old channels and sloughs. The Uhland soil is in slightly higher positions on the landscape than those of the Gowen soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for rangeland and improved pasture. It is well suited to cultivation.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved

bermudagrass, and johnsongrass are the main forage grasses. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is not suited to use as cropland because of frequent flooding.

This soil is not suited to urban and recreational uses because of the hazard of flooding. Local roads are often covered by floodwater during heavy rainfall, and damage to bridges is common; however, some areas can be used for hiking trails and picnic areas.

This soil has poor potential as habitat for openland wildlife and has fair potential as habitat for rangeland wildlife. Except during periods of flooding, small wild animals and birds inhabit the areas. The vegetation provides sufficient food for large populations of wildlife.

This soil is in capability subclass 5w and in the Loamy Bottomland ecological site.

HeC—Heiden clay, 2 to 5 percent slopes

This deep, very gently sloping and gently sloping, well drained soil is on narrow ridges and on side slopes along small creeks and drainageways. Areas usually are long and narrow and range from about 10 to 200 acres in size.

Typically, the soil is calcareous clay throughout. The surface layer, about 21 inches thick, is dark grayish brown. The subsoil, from a depth of about 21 to 44 inches, is pale olive with light gray mottles in the upper part and pale yellow with brownish yellow mottles in the lower part. The underlying material, from a depth of about 44 to 80 inches, is pale olive weathered shale that has clay texture.

This soil is well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Ferris and Houston Black soils. The Ferris soil is in more sloping areas and the Houston Black soil is on ridges. Also included are small areas of an eroded Heiden soil that has a few gullies that range up to 8 feet deep. In addition, along narrow drainageways are small areas of Frio and Tinn soils. Included soils make up less than 15 percent of the map unit.

This soil is used mainly for growing crops and for pasture.

This soil is well suited to use as cropland. Grain sorghum, cotton, wheat, corn, and forage sorghums are the main crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces, grassed waterways, and contour tillage. The clay surface is difficult to work if plowed when wet because it becomes cloddy and compacted. Plant roots, water, and air move through the soil slowly.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is poorly suited to urban and recreational uses. Because of the very high potential for shrinking and swelling, foundations and streets crack, shift, and buckle unless properly designed. Because of the very slow permeability, septic systems can fail. The risk of corrosion is high for underground steel pipelines unless they are well protected. Many ornamentals and fruit trees do not grow well. Adapted shade trees and vegetables do well with proper applications of fertilizer and water during dry periods. Landscaping and gardening are difficult with hand tools. Elm and hackberry trees are native in some areas. The clayey texture and very slow permeability are limitations to most recreational uses of this soil. When wet, the soil is sticky and muddy, making foot and vehicle traffic difficult. In dry periods, the surface cracks and can limit playground activities.

This soil has fair potential as habitat for openland and rangeland wildlife. Wild birds and small animals frequent the grass and brush areas.

This soil is in capability subclass 3e and in the Blackland ecological site.

HoB—Houston Black clay, 1 to 3 percent slopes

This very deep, very gently sloping, moderately well drained soil is on smooth uplands. Areas are irregular in shape and range from about 20 to 300 acres in size.

Typically, the surface layer is dark gray clay about 46 inches thick. The subsoil, from a depth of about 46 to 67 inches, is clay that is dark grayish brown in the upper part and pale yellow in the lower part. The underlying material, from a depth of about 67 to 80 inches, is yellow shale that has clay texture. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Branyon, Burleson, and Heiden soils. The Branyon and Burleson soils are in lower positions on the landscape than the Houston Black soil; the Heiden soil occurs on low ridges. Also included along narrow drainageways are small areas of Frio and Tinn soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for growing crops.

This soil is well suited to use as cropland. Grain sorghum, cotton, wheat, and corn are the major crops along with some oats and forage sorghums. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and compacted. Plant roots, water, and air move through the soil very slowly. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction are terraces, grassed waterways, and contour tillage.

This soil is well suited to use as pasture and hayland. The main forages are common bermudagrass, improved bermudagrass, and kleingrass. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

The soil is poorly suited to urban and recreational uses. Structures shift and foundations break unless they are strongly reinforced because of the very high potential for shrinking and swelling (fig. 12).

Underground steel pipes corrode rapidly unless the pipes are protected. Septic systems frequently malfunction, particularly during extended periods of rain. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well on this soil. Landscaping and gardening are difficult with hand tools. A few elm and hackberry trees are native in some areas.

The clayey texture and very slow permeability are limitations to most recreational uses of this soil. When the soil is wet, the surface is sticky, making foot and vehicle traffic difficult. Surface cracks form during dry periods and may limit playground activities.

This soil has fair potential as habitat for openland and rangeland wildlife. Birds and small animals find food and cover in pastures and weed areas along fence rows. Birds frequent this habitat mainly during the planting and harvest seasons.

This soil is in capability subclass 2e and in the Blackland ecological site.

JeE—Jedd very gravelly sandy loam, 3 to 15 percent slopes

This moderately deep, gently sloping to moderately steep, well drained soil is on knolls and ridges on uplands. Areas are oval or long and narrow and range from about 6 to 100 acres in size. In some areas, as much as 60 to 75 percent of the surface is covered with gravel, cobble, stone, and boulder-sized fragments of sandstone and ironstone.

Typically, the surface layer is brown, slightly acid very gravelly sandy loam about 5 inches thick. The subsurface layer, from a depth of about 5 to 11 inches, is yellowish red, moderately acid very gravelly sandy loam. The upper part of the subsoil, from a depth of about 11 to 21 inches, is red, strongly acid sandy clay. The lower part of the subsoil, from a depth of about 21 to 25 inches, is red, strongly acid sandy clay loam. The underlying material, from a depth of about 25 to 80 inches, is red, very strongly acid, weakly cemented sandstone.

This soil is well drained, has moderately slow permeability, and has medium to high surface runoff. Available water capacity is very low. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Edge, Minerva, and Padina soils. The Edge soil is on hillsides and the Minerva and Padina soils are on ridgetops. Also included are areas of rock outcrop (fig. 13) and areas of a soil similar to the Jedd soil that is underlain by sandstone at a depth of less than 20 inches. Included soils make up less than 15 percent of the map unit.

This soil is used mainly for rangeland and wildlife habitat.

This soil is moderately suited to use as rangeland. Management practices include planned grazing, brush control, and proper stocking. The climax vegetation is tall and mid grasses and oak savannah.

Figure 12.—Dry weather cracks, as much as 2 inches wide, are common in Houston Black clay, 1 to 3 percent slopes. They are indicative of very high potential for shrinking and swelling, which damages roads and foundations.

This soil is poorly suited to use as pasture because of slope and stoniness.

This soil is poorly suited to recreational uses because of slope, gravel, cobbles, stones, and boulders scattered on the surface.

This soil is poorly suited to urban uses. Site preparation is difficult for foundations, buried utility lines, septic systems, and streets because of the underlying sandstone and steep slopes in many areas. Landscaping and gardening are difficult because of the fragments of sandstone and ironstone scattered on the surface. Post oak and blackjack oak trees are native in many areas.

This soil is not suited to use as cropland because of slope, stoniness, and the potential for erosion.

This soil has fair potential as habitat for openland and rangeland wildlife. Many areas are wooded and provide food and cover for wild birds and animals.

This soil is in capability subclass 6e and in the Sandstone Hills ecological site.

LeB—Lewisville silty clay, 1 to 3 percent slopes

This very deep, very gently sloping, well drained soil is on side slopes along drainageways on terraces. Areas are long and narrow and range from about 10 to 50 acres in size.

Typically, the soil is calcareous silty clay throughout. The surface layer is dark grayish brown and is about 14 inches thick. The subsoil extends to a depth of 80 inches. From a depth of about 14 to 26 inches it is light brown, and from a depth of 26 to 80 inches it is reddish yellow.

This soil is well drained, has moderate permeability, and has low surface runoff. Available water capacity is high. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Branyon, Frio, Seawillow, and Sunev soils. The Branyon soil is in low areas. The Frio soil is along drainageways. The Seawillow soil is along hillsides. The

Figure 13.—An outcrop of sandstone bedrock underlying Jedd very gravelly sandy loam, 3 to 15 percent slopes.

Sunev soil is in positions on the landscape similar to those of the Lewisville soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland.

This soil is well suited to use as cropland. The major crops are cotton, corn, wheat, oats, grain sorghum, and forage sorghums. The soil is easily tilled and readily penetrated by plant roots, water, and air. Compacted plow layers form if the soil is plowed when wet or plowed to the same depth each year. The high content of lime makes some nutrients unavailable for plant use, causing some crops to develop chlorosis. The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to maintain tilth and organic matter content, conserve moisture, increase water intake, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Diversion terraces and grassed waterways help to reduce erosion caused by runoff from surrounding soils and provide outlets.

This soil is well suited to use as pasture and hayland. Common bermudagrass, kleingrass, johnsongrass, and improved bluestem are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately suited to urban and most recreational uses. Limitations include the high potential for shrinking and swelling and the high risk of corrosion to underground steel pipes. The moderate permeability is a limitation for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables usually do well with proper applications of fertilizer and water during dry periods. Landscaping and gardening are difficult with hand tools. A few elm, hackberry, pecan,

and live oak trees are native in some areas. When this soil is wet, the surface is sticky and muddy, which impedes foot and vehicle traffic. Slope is a limitation for playgrounds.

The soil has good potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Birds congregate in these areas during the harvest season. At other times, very few birds and small animals are in these areas.

This soil is in capability subclass 2e and in the Clay Loam ecological site.

Lu—Lufkin-Gause complex, 0 to 1 percent slopes

These very deep, nearly level, moderately well drained soils are on stream terraces. Areas are irregular in shape and range up to several hundred acres in size.

The areas of Lufkin and Gause soils are so intricately mixed and so small in size that it is impractical to separate them at the scale of mapping. Mapped areas are made up of about 55 percent Lufkin and closely similar soils and 30 percent Gause soils.

Included with these soils in mapping are areas of Davilla and Rader soils that occupy slightly higher positions on the landscape and make up less than 15 percent of the map unit.

Typically, the surface layer of the Lufkin soil is grayish brown, slightly acid loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. From a depth of about 6 to 16 inches, it is grayish brown, neutral clay. From a depth of about 16 to 29 inches, it is grayish brown, slightly alkaline clay. From a depth of about 29 to 41 inches, it is grayish brown, slightly alkaline clay that has brownish yellow mottles. From a depth of about 41 to 55 inches, it is light brownish gray, moderately alkaline clay that has brownish yellow mottles. From a depth of about 55 to 80 inches, the subsoil is light gray, moderately alkaline clay loam that has brownish yellow mottles.

Typically, the surface layer of the Gause soil is slightly acid fine sandy loam about 16 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of 80 inches or more. The upper part of the subsoil is strongly acid sandy clay. It is yellowish brown with reddish yellow mottles from a depth of about 16 to 25 inches and brownish yellow with red mottles from a depth of about 25 to 50 inches. The middle part of the subsoil from a depth of about 50 to 70 inches, is mottled light yellowish brown, red, and reddish yellow, strongly acid sandy clay. The lower part from a depth of about 70 to 80 inches, is reddish yellow strongly acid sandy clay loam that has red mottles.

The soils in this map unit are moderately well drained, have very slow permeability, and have high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is slight. After prolonged rainfall, the surface layer of the Lufkin soil is saturated for short periods.

These soils are used mainly for cropland and improved pasture.

These soils are well suited to use as cropland and major crops are grain sorghum, wheat, oats, and forage sorghums. A cropping system that includes grain sorghum or some other kind of crop that produces large amounts of residue is desirable. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion.

These soils are well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. A complete fertilizer is needed for sustained forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

These soils are well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

These soils are moderately suited to urban and recreational uses. Limitations for homesites and urban uses are the very high potential for shrinking and swelling that affects foundations and streets, the high risk for corrosion of underground steel pipes, and the very slow permeability that adversely affects septic systems. Fruit trees and most ornamentals grow poorly on these soils because of the dense, clayey subsoil. Adapted shade trees and vegetables do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and post oak trees are native in some areas. These soils are limited for use as recreation areas because of the very slow permeability of the Lufkin soil. The potential of these soils as habitat for openland and rangeland wildlife is fair to good. Brush and grass areas provide food and cover for quail, doves, songbirds, and small animals.

The Lufkin soil is in capability subclass 3w and in the Claypan Savannah ecological site. The Gause soil is in capability class 2e and in the Sandy Loam ecological site.

MnC—Minerva loamy fine sand, 1 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on upland ridges. Areas are

irregular in shape and range from about 10 to 50 acres in size.

Typically, the surface layer is light yellowish brown, slightly acid loamy fine sand about 4 inches thick. The subsurface layer, from a depth of about 4 to 14 inches, is very pale brown, slightly acid loamy fine sand. The subsoil, from a depth of about 14 to 78 inches, is red sandy clay loam that is moderately acid from a depth of 14 to 48 inches and strongly acid from a depth of 48 to 78 inches. From a depth of about 78 to 80 inches, the subsoil is yellowish red, moderately acid sandy clay loam that has very pale brown mottles.

This soil is well drained, has moderate permeability, and low surface runoff. Available water capacity is moderate. The hazard of water or wind erosion is moderate.

Included with this soil in mapping are small areas of Edge, Jedd, Padina, and Rader soils. Also, there are areas of a soil similar to the Minerva soil that has a sandy surface layer 20 to 40 inches thick. The Edge soil is in positions on the landscape similar to those of the Minerva soil. The Jedd soil is along steep, rocky breaks. The Padina soil is on broad upland ridges and the Rader soil is along footslopes. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and for cropland.

This soil is well suited to use as cropland. The major crops are peanuts, small grains, watermelons, and truck crops. Management practices are needed that conserve moisture and protect the soil from erosion. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Oats or other cover crops can keep the soil from blowing in fall, winter, and spring.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and weeping lovegrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Applications of lime are needed in some areas. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is suited to urban and most recreational uses. Most areas are high on the landscape. The potential for shrinking and swelling is a limitation for buildings and roads and the moderate permeability is a limitation for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in many areas. During dry periods, traction on bare ground can be a problem because of the sandy surface.

This soil has good potential as habitat for openland and rangeland wildlife. Many areas are wooded. Grasses and seed-producing forbs in small clearings provide food and cover for the few wild birds and animals in these areas.

This soil is in capability subclass 3e and in the Loamy Sand ecological site.

MwC—Minwells fine sandy loam, 1 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on high terraces. Areas are irregular in shape and range from about 20 to 200 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 10 inches thick. The subsoil, from a depth of about 10 to 50 inches, is sandy clay. It is reddish brown and slightly acid from a depth of about 10 to 22 inches, slightly alkaline from a depth of about 22 to 38 inches, and yellowish red and slightly alkaline from a depth of about 38 to 50 inches. From a depth of about 50 to 80 inches, the subsoil is mottled yellowish red and reddish yellow, moderately alkaline sandy clay loam.

This soil is well drained, has slow permeability, and has high surface runoff. Available water capacity and hazard of water erosion are moderate.

Included with this soil in mapping are small areas of Bastrop, Davilla, Riesel, Sunev, and Wilson soils that are in positions on the landscape similar to those of the Minwells soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as pasture and rangeland. A few areas are used for crops. Some areas are mined for sand and gravel (fig. 14).

This soil is well suited to use as pasture and hayland. Common bermudagrass, kleingrass, improved bermudagrass, and johnsongrass, as well as native grasses, are the main forages. Applications of a complete fertilizer are needed for sustained forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is well suited to urban and recreational uses. Limitations include a moderate potential for shrinking and swelling and the high risk for corrosion of underground pipes. Slow permeability is a severe limitation for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in many areas. Slope is a limitation for use as playgrounds in a few areas.

This soil is moderately suited to use as cropland. Small grains and forage sorghums are the major crops. This soil is well suited to use as orchards. A cropping system that helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion should be used. Terraces, grassed waterways, and contour tillage are needed in areas where row crops are planted.

This soil has good potential as habitat for openland and rangeland wildlife. Some areas are wooded. Grasses and seed-producing forbs in open areas and in abandoned sand and gravel pits provide food and cover for wild birds and small animals.

This soil in capability subclass 3e and in the Sandy Loam ecological site.

NoB—Normangee clay loam, 1 to 3 percent slopes

This deep, very gently sloping, moderately well drained soil is on uplands. Areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is brown, slightly acid clay loam about 6 inches thick. The subsoil extends to a depth of 40 inches. From a depth of about 6 to 14 inches the subsoil is brown, neutral clay. From a depth of about 14 to 27 inches, it is brown, neutral clay that has yellowish red and light olive brown mottles. From a depth of about 27 to 40 inches, it is light olive brown, moderately alkaline clay. The underlying material, from a depth of about 40 to 80 inches, is light yellowish brown weakly consolidated shale that has clay texture. It is moderately alkaline and has yellow mottles.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is high, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Crockett, Heiden, and Wilson soils. These soils are in positions on the landscape similar to those of the Normangee soil. The included soils make up less than 15 percent of the map unit.

Most areas of this soil are abandoned cropland. Some areas are used as improved pasture.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately suited to use as cropland. Grain sorghum, oats, wheat, and forage sorghums are the major crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Diversion terraces and grassed waterways help control the surface runoff and provide outlets for terraces.

This soil is moderately suited to use as pasture and hayland. Common bermudagrass, improved bermuda-grass, improved bluestem, kleingrass, and johnson-grass are the major forages. Applications of a complete fertilizer are needed for sustained forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

This soil is poorly suited to urban and recreational uses. Limitations are the high potential for shrinking and swelling, which affects foundations and streets; the high risk for corrosion of underground steel pipes; and the very slow permeability, which adversely affects septic systems. Fruit trees and most ornamentals grow poorly because of the dense, clayey subsoil. Adapted shade trees and vegetables do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and post oak trees are native in some areas. This soil is limited for recreational uses because of the very slow permeability.

The potential of this soil as habitat for openland and rangeland wildlife is fair. Wildlife consists mainly of quail, doves, and songbirds. Small animals sometimes frequent grass and brush areas.

This soil is in capability subclass 3e and in the Claypan Prairie ecological site.

Oa—Oakalla silty clay loam, occasionally flooded

This very deep, nearly level, well drained soil is on flood plains of streams. Areas are long and narrow and range from 20 to 200 acres in size. Once every 2 to 8 years, areas are subject to flooding for periods of less than 2 days during spring and summer. Some areas are protected from flooding by dams.

Typically, the soil is calcareous silty clay loam throughout. The surface layer is about 38 inches thick and is dark grayish brown in the upper part and brown

Figure 14.—Beds of gravel, that are mined for use as road base material, underlie Minwells fine sandy loam, 1 to 5 percent slopes, in many areas.

in the lower part. The subsoil, from a depth of about 38 to 80 inches, is yellowish brown.

This soil is well drained, has moderate permeability, and has negligible surface runoff. Available water capacity is moderate. The hazard of water erosion is slight.

Included with this soil in mapping are areas of Frio and Tinn soils in low areas of old channels. Also included are small areas of Bosque soil in positions on the landscape similar to those of the Okalla soil. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for cropland and pasture.

This soil is well suited to use as cropland. The main crops are cotton, grain sorghum, wheat, and corn. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. The high content of lime makes some nutrients unavailable, causing some crops to develop chlorosis.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is not suited to urban and most recreational uses because of the hazard of flooding. Near the stream channels, brush and trees being swept downstream sometimes damage roads and bridges.

Pecan trees are well adapted to this soil. This soil can be used for picnic areas, playgrounds, paths, and trails. Flooding is a hazard for camp areas. The surface is sticky when wet, impeding foot and vehicle traffic.

This soil has good potential as habitat for openland and rangeland wildlife. Birds and small animals find food and cover in pastures and weedy and wooded areas along the stream channels. Birds frequent this habitat mainly during planting and harvest seasons.

This soil is in capability subclass 2w and in the Loamy Bottomland ecological site.

PaC—Padina fine sand, 1 to 8 percent slopes

This very deep, very gently sloping to moderately sloping, well drained soil is on broad uplands. Areas are irregular in shape and range from about 10 to several hundred acres in size.

Typically, the surface layer is pale brown, slightly acid fine sand about 8 inches thick. The subsurface layer, from a depth of about 8 to 66 inches is very pale brown, slightly acid fine sand. The subsoil, from a depth of about 66 to 80 inches, is strongly acid sandy clay loam that is mottled light gray and reddish yellow in the upper part, and mottled light gray and red in the lower part.

This soil is well drained, has rapid permeability in the surface layer and moderately slow permeability in the subsoil, and has negligible to very low surface runoff . Available water capacity is low. The hazard of water erosion is slight; however, the hazard of wind erosion is severe.

Included with this soil in mapping are some areas of Jedd, Minerva, Rader, and Silstid soils. Also included is a soil similar to the Padina soil that has a sandy surface layer more than 80 inches thick. The Silstid soil and the similar soil are in about the same position on the landscape as the Padina soil. Jedd and Minerva soils are on ridges and the Rader soil is in low areas. The included soils make up as much as 25 percent of some areas of the map unit.

This soil is used mainly for rangeland. Some areas are used for improved pasture grasses and a few areas for cropland.

This soil is moderately suited to use as cropland. The major crops are small grains, forage sorghums, watermelons, peanuts, and truck crops. The soil has low available water capacity because of the thick sandy layers. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include using stripcropping, planting small grains in winter, and planting windbreaks along field borders.

This soil is well suited to use as pasture and hayland. Improved bermudagrass, weeping lovegrass, and kleingrass are the major forages. Droughtiness and low natural fertility can hinder the establishment of grasses. Improved pastures require several light applications of a complete fertilizer for optimum production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is suited to use as homesites and other urban uses, although it has some limitations. Leachate from septic systems can contaminate local water wells. The risk of corrosion is high for underground steel pipe. Adapted fruit trees, shade trees, ornamentals, and vegetables can be grown with proper applications of fertilizer and water. Fertilizer and water are also necessary to maintain lawns. Post oak, blackjack oak, and hickory trees are native in many areas.

This soil generally is too droughty to support the kind of grass cover needed for recreation areas. Grass requires irrigation to grow on this soil. The sandy surface, which is dry and loose most of the year, makes foot and vehicle traffic somewhat difficult. Conditions are only slightly better for vehicle traffic when the surface is wet.

This soil has fair potential as habitat for openland and rangeland wildlife; however, little food is available for small wild animals and birds that frequent the areas. Wooded areas provide cover and protection in winter.

This soil is in capability subclass 4e and in the Deep Sand ecological site.

Pc—Payne loam, 0 to 2 percent slopes

This very deep, nearly level and very gently sloping, well drained soil is on terraces. Areas are irregular in shape and range from about 10 to 50 acres in size.

Typically, the surface layer is brown, slightly acid loam about 7 inches thick. The subsoil, which is clay, extends from a depth of about 7 to 42 inches. It is reddish brown and slightly acid from a depth of 7 to 22 inches; it is brown and neutral from a depth of 22 to 34 inches; and brown and moderately alkaline from a depth of 34 to 42 inches. The lower part of the subsoil, from a depth of about 42 to 80 inches, is brown, moderately alkaline clay loam.

This soil is well drained, has very slow permeability, and has high to very high surface runoff. Available

water capacity is high, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Davilla, Lewisville, and Wilson soils. The Davilla and Wilson soils are in slightly depressed areas. The Lewisville soil is in positions on the landscape similar to those of the Payne soil. The included soils are less than 3 acres in size and make up less than 15 percent of the map unit.

This soil is used mainly for cropland and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, corn, forage sorghums, and small grains are the main crops. Grain sorghum or other crops that produce large amounts of residue are needed in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Diversion terraces and grassed waterways help control surface runoff from higher areas and provide outlets for terraces.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, or johnsongrass are the main forage. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately suited to urban and recreation uses. Limitations include the moderate potential for shrinking and swelling and high risk for corrosion of underground steel pipes. Septic systems function poorly in the dense, clayey subsoil. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and live oak trees are native in some areas. The very slow permeability causes the soil to stay wet for short periods during rainy seasons, limiting recreational uses.

The potential of this soil as habitat for openland and rangeland wildlife is fair. The wildlife includes mostly songbirds, game birds, and rabbits. Some migratory birds feed on the grain lost during harvesting. Rabbits are common along turnrows and in adjoining pastures where cover is available.

This soil is in capability subclass 3e and in the Claypan Prairie ecological site.

Pg—Pits, gravel

These areas consist of pits that have been excavated during the mining of gravel. They are mainly along terraces of the Brazos River, Little River, and San Gabriel River. The gravel is used as road and building material. The pits range from about 10 to more than 50 acres, and average about 12 feet deep. These pits are mostly on the Minwells, Riesel, and Travis soils.

These pits are poorly suited to most uses. Some could be reclaimed and used for wildlife habitat and recreational areas. Others could be smoothed and revegetated and used for grazing.

Pits, gravel is not assigned to a capability subclass or to an ecological site.

RaB—Rader loamy fine sand, 1 to 3 percent slopes

This very deep, very gently sloping, well drained soil is on terraces along drainageways. Areas are irregular in shape and range from about 10 acres to 300 acres in size.

Typically, the surface layer is brown, slightly acid loamy fine sand about 5 inches thick. The subsurface layer, from a depth of about 5 to 18 inches, is pale brown, slightly acid loamy fine sand. The upper part of the subsoil, from a depth of about 18 to 26 inches, is brownish yellow, moderately acid sandy clay loam that has pale brown mottles. The lower part of the subsoil, from a depth of about 26 to 80 inches, is mottled light gray, brownish yellow, and red sandy clay. It is strongly acid from a depth of 26 to 52 inches, moderately acid from a depth of 52 to 71 inches, and neutral below a depth of 71 inches.

This soil is moderately well drained, has very slow permeability, and has very high surface runoff. Available water capacity is moderate. The hazard of water or wind erosion is moderate. A perched water table is generally at a depth of 2 to 5 feet during winter and spring.

Included with this soil in mapping are small areas of Edge, Minerva, Padina, and Uhland soils. The Edge, Minerva, and Padina soils are higher on the landscape on hillsides. The Uhland soil is along narrow drainageways. Also included is a soil similar to the Rader soil that has a sandy surface layer 20 to 40 inches thick. The included soils make up less than 15 percent of the map unit.

Most areas of this soil are abandoned cropland now used as pasture or range. Brush encroachment is a problem. Some areas are used for cropland and improved pasture.

This soil is well suited to use as cropland. The main crops are small grains, forage sorghums, peanuts,

watermelons, and truck crops (fig. 15). Management practices that conserve moisture and protect the soil from erosion are needed. Returning crop residue to the soil helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Oats or other cover crops are needed to protect the soil from wind erosion in fall, winter, and spring.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, weeping lovegrass, kleingrass, and native grasses are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Applications of lime are needed in some areas. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah. This soil is suited to urban and recreational uses. However, the sandy clay subsoil has a moderate potential for shrinking and swelling. The risk of corrosion is high for underground steel pipe. The very slow permeability of the subsoil and seasonal wetness are severe limitations for septic tank absorption fields. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas. Very slow permeability is a limitation for most recreational uses.

This soil has good potential as habitat for openland and rangeland wildlife. Wildlife consists mainly of songbirds and small animals. Weed seeds and grasses are plentiful, and some wooded and brushy areas are used for shelter and cover.

This soil is in capability subclass 2e and in the Sandy Loam ecological site.

RgC—Riesel gravelly fine sandy loam, 1 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on stream terraces. Areas are long and narrow and range up to several hundred acres in size.

Typically, the surface layer is dark grayish brown, neutral gravelly fine sandy loam about 8 inches thick. The subsurface layer, from a depth of about 8 to 11 inches, is yellowish brown, neutral very gravelly fine sandy loam. The upper part of the subsoil, from a depth of about 11 to 27 inches, is red, neutral very gravelly clay. The lower part of the subsoil, from a depth of about 27 to 60 inches, is neutral extremely gravelly clay that is red from a depth of 27 to 37 inches and reddish brown with reddish yellow mottles from a depth of 37 to 60 inches. The underlying material, from a depth of about 60 to 80 inches, is pale brown, slightly alkaline very gravelly loamy fine sand.

This soil is well drained, has slow permeability, and has high surface runoff. Available water capacity is low. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Ferris, Heiden, Minwells, and Sunev soils. The Ferris and Heiden soils are along slopes and the Minwells and Sunev soils are in positions on the landscape similar to those of the Riesel soil. Also included is a soil that is similar to the Riesel soil but has less than 35 percent gravel in the upper part of the subsoil. The included soils make up as much as 15 percent of the map unit.

This soil is used mainly as unimproved pasture and rangeland. Some areas are mined for sand and gravel. The soil is poorly suited to growing crops.

This soil is suited to use as rangeland. Management practices include brush control, planned grazing, and proper stocking. The climax vegetation is mid and tall grasses with scattered oak and elm trees.

This soil is moderately suited to urban uses, although it has several limitations including the moderate potential for shrinking and swelling, which affects foundations and streets; the high risk for corrosion of underground steel pipes; and the slow permeability, which adversely affects septic systems. Fruit trees, ornamentals, and vegetables grow poorly because of the dense, clayey subsoil and the large amount of gravel in the soil. Adapted shade trees grow with proper applications of fertilizer and water during dry periods. Post oak, blackjack oak, and a few live oak trees are native in some areas.

This soil is poorly suited to use as pasture and hayland because of large amounts of gravel in the surface layers and subsoils. Improved grasses have been established in a few areas; however, in most areas, grass is difficult to establish and seedbeds are difficult to prepare.

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

This soil is not suited to use as cropland because of the gravelly surface layer and the very gravelly subsoil.

The potential of this soil as habitat for openland wildlife is fair and it is good for rangeland wildlife. Some areas are wooded. Grasses and seed-producing forbs in open areas and in abandoned gravel pits provide food and cover for wild birds and small animals.

This soil is in capability subclass 6s and in the Gravelly Loam ecological site.

Figure 15.—Forage sorghum grown on Rader loamy fine sand, 1 to 3 percent slopes, has been baled for hay.

Sa—Sandow clay loam, frequently flooded

This very deep, nearly level, moderately well drained soil is on the flood plain of East Yegua Creek. Areas are long and narrow and range up to several hundred acres in size. Slopes are less than 1 percent. Flooding occurs about once each year for brief periods of about 2 days, mainly during winter and spring.

Typically, the surface layer is brown, moderately acid clay loam about 8 inches thick. The subsoil extends to a depth of 80 inches. From a depth of 8 to 16 inches, it is brown, moderately acid loam that has yellowish red mottles. From a depth of 16 to 28 inches, it is grayish brown and brown, slightly acid clay loam that has brownish yellow and dark brown mottles. From a depth of 28 to 48 inches, it is light yellowish brown, slightly acid very fine sandy loam that has brownish yellow mottles. From a depth of 48 to 80 inches, it is light yellowish brown, slightly acid loam that has yellowish brown and gray mottles.

This soil is moderately well drained, has moderately slow permeability, and has slow surface runoff. Available water capacity is high. The hazard of water erosion is slight. An apparent water table is usually at a depth of 3.5 to 6 feet during the winter and spring.

Included with this soil in mapping are small areas of Gowen and Uhland soils. These soils are in positions on the landscape similar to those of the Sandow soil. The included soils make up as much as 15 percent of the map unit.

This soil is used mainly for rangeland and improved pasture.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Applications of lime are needed in some areas. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. Climax vegetation is tall grasses, with scattered pecan, cottonwood, and elm trees.

This soil is not suited to use as cropland because of frequent flooding.

This soil is not suited to urban and recreational uses because of the hazard of flooding. Local roads are often covered by floodwater during heavy rainfall, and damage to bridges is common. Most recreational uses

are severely limited because of the hazard of flooding, except for hiking trails and picnic areas where the hazard of flooding is moderate.

The potential of this soil as habitat for openland wildlife is poor; however, it is good for rangeland wildlife. Small wild amimals and birds inhabit the areas except during periods of flooding. The vegetation provides sufficient food for large populations of wildlife.

This soil is in capability subclass 5w and in the Loamy Bottomland ecological site.

SgB—Satin gravelly clay loam, 1 to 3 percent slopes

This deep, very gently sloping, well drained soil is on stream terraces. Areas are mainly long and narrow and range up to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, neutral gravelly clay loam about 9 inches thick. The subsoil extends to a depth of 60 inches. From a depth of about 9 to 42 inches, it is neutral very gravelly clay. It is dark gray from a depth of 9 to 20 inches and gray with dark red mottles from a depth of 20 to 42 inches. From a depth of about 42 to 60 inches, the subsoil is very gravelly clay, slightly alkaline, and light gray with yellow mottles. The underlying material, from a depth of 60 to 80 inches, is mottled olive yellow, brownish yellow, and light olive gray. It is moderately alkaline, weakly consolidated shale that has silty clay texture.

This soil is well drained, has slow permeability, and has high surface runoff. Available water capacity is low. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Burleson, Heiden, Houston Black, Tinn, and Wilson soils. The Burleson and Wilson soils are in positions on the landscape similar to those of the Satin soils. The Heiden and Houston Black soils are lower on the landscape on side slopes. The Tinn soil is along narrow drainageways. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for native rangeland and for pasture.

This soil is poorly suited to use as cropland due to the gravelly surface layer. Small grains and forage sorghums are the main crops. Terraces and contour tillage are needed in some areas to protect the soil from erosion. Grain sorghum or corn provide large amounts of residue if they are included in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding soils and to provide outlets for terraces.

This soil is moderately suited to use as pasture and hayland. Grasses are difficult to establish in this gravelly, droughty soil. Common bermudagrass, improved bermudagrass, improved bluestem, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is poorly suited to urban uses. Limitations are the high potential for shrinking and swelling, which affects foundations and streets; the high risk for corrosion to underground steel pipes; and the slow permeability, which adversely affects septic systems. Fruit trees, ornamentals, and vegetables grow poorly because of the dense, clayey subsoil and the large amount of gravel in the soil. Adapted shade trees grow with proper applications of fertilizer and water during dry periods. Elm, hackberry, and post oak trees are native in some areas. This soil is moderately suited to most recreational uses except playgrounds. The gravel on the surface is a severe limitation.

The potential of this soil as habitat for openland wildlife is poor; however, it is fair for rangeland wildlife. Wildlife consists mainly of quail, doves, and songbirds. Small animals sometimes frequent grass, brush, and wood areas.

This soil is in capability subclass 4s and in the Gravelly Loam ecological site.

SmC—Seawillow loam, 2 to 8 percent slopes

This very deep, very gently sloping to moderately sloping, well drained soil is on side slopes along drainageways on stream terraces. Areas are long and narrow and range from about 10 to 50 acres in size.

Typically, the surface layer is grayish brown loam about 8 inches thick. The subsoil, from a depth of about 8 to 80 inches, is loam that is very pale brown from a depth of about 8 to 38 inches and yellow from a depth of about 38 to 80 inches. The soil is moderately alkaline and calcareous throughout.

This soil is well drained, has moderate permeability, and has low or medium surface runoff. Available water capacity is moderate. The hazard of water erosion is moderate.

Included with this soil in mapping are areas of Altoga, Ferris, Lewisville, Minwells, and Sunev soils.

The Altoga, Ferris, Lewisville, and Sunev soils are in positions on the landscape similar to those of the Seawillow soil. Small areas of Minwells soil are along narrow ridges. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and rangeland. Some areas are mined for gravel and some areas are used for cropland.

This soil is well suited to use as pasture and hayland. Improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

The soil is only moderately suited to use as cropland because of the slope and hazard of erosion. Small grains, corn, grain sorghum, and forage sorghum are the main crops. The cropping system should include corn and grain sorghum, which produce large amounts of residue. Terraces and contour tillage are needed to protect the soil from water erosion. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. In some areas, diversion terraces and grassed waterways are needed to control runoff from surrounding soils and to provide outlets for terraces. Crops and pasture grasses respond best to fertilizers applied as recommended by soil test. The high content of lime makes some nutrients unavailable for plant use, causing some crops to develop chlorosis.

This soil is moderately suited to urban and recreational uses. Because of its high position on the landscape, it affords an esthetic view of the valley below. The moderate potential for shrinking and swelling will affect foundations and streets. Underground steel pipes are at moderate risk for corrosion. The moderate permeability affects use for septic systems. Because of the high lime content, chlorosis is a common problem for fruit trees, shade trees, ornamentals, and vegetables. A few elm, hackberry, and live oak trees are native in some areas. Slope is a limitation for playgrounds.

This soil has fair potential as habitat for openland and rangeland wildlife. Songbirds and small animals are fairly plentiful because many areas support grass, weeds, and brush that provide food and cover.

This soil is in capability subclass 4e and in the Clay Loam ecological site.

Sp—Ships clay, rarely flooded

This very deep, nearly level, moderately well drained soil is on the flood plain of the Brazos River. Flooding occurs once about every 50 to 100 years. Areas are several hundred acres in size. Slopes are less than 1 percent.

Typically, the surface layer extends to a depth of about 64 inches. It is reddish brown clay to a depth of about 6 inches. From a depth of about 6 to 28 inches, it is alternating thin strata of reddish brown and dark grayish brown clay. From a depth of about 28 to 64 inches, the surface layer is dark reddish gray clay. The subsoil, from a depth of about 64 to 80 inches, is reddish brown clay. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained, has very slow permeability, and has negligible surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Gaddy, Weswood, and Yahola soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for growing crops.

This soil is well suited to use as cropland. The main crops are cotton, corn, grain sorghum, small grains, and forage sorghums. This soil does have some management problems because of the high content of clay. It is wet for short periods following heavy rain because runoff is negligible and permeability is very slow. Plant roots, water, and air move through the soil very slowly. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. A cropping system that includes grain sorghum or corn that produces large amounts of residue is desirable. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Surface runoff from surrounding areas can be controlled by diversion terraces and grassed waterways.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is poorly suited to most recreational uses. When the soil is wet, the clayey surface generally is too slippery and sticky for foot or vehicle traffic. During dry periods, surface cracks restrict some playground activities.

This soil is not suited to homesites and urban uses because of the hazard of flooding.

This soil has good potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Most areas are used for growing crops, and little food and cover are available for wildlife. Quail and doves are common during grain harvest.

This soil is in capability subclass 2s and in the Clayey Bottomland ecological site.

SwB—Silawa loamy fine sand, 1 to 3 percent slopes

This very deep, very gently sloping, well drained soil is on terraces of the Brazos River. Areas are irregular in shape and range from about 10 to 80 acres in size.

Typically, the surface layer is brown, slightly acid loamy fine sand about 14 inches thick. The upper part of the subsoil, from a depth of about 14 to 22 inches, is red, moderately acid fine sandy loam. The middle part, from a depth of about 22 to 50 inches, is red, strongly acid sandy clay loam. The lower part of the subsoil from a depth of about 50 to 80 inches, is reddish yellow, very strongly acid fine sandy loam.

This soil is well drained, has moderate permeability, and has low surface runoff. Available water capacity is moderate. The hazard of water or wind erosion is moderate.

Included with this soil in mapping are small areas of Chazos, Desan, Gause, Silstid, and Travis soils. The Chazos and Gause soils are along footslopes. The Desan and Silstid soils are along side slopes. The Travis soil is along ridgetops. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and cropland. Some areas are mined for sand and gravel.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and weeping lovegrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Applications of lime are needed in some areas. Overseeding with legumes, such as arrowleaf clover, vetch and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to use as cropland. The major crops are small grains, forage sorghums, peanuts, watermelons, and truck crops. Leaving crop residue on the surface helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is moderately suited to homesites and urban uses. Underground steel pipes are at moderate risk for corrosion. The moderate permeability is a limitation for septic tank absorption fields. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas. This soil is suitable for recreational areas. Traction in unprotected areas during dry periods can be difficult because of the sandy surface.

This soil has good potential as habitat for openland and rangeland wildlife. Some wooded areas provide food and cover for wildlife. Brush and native grasses provide food and cover in other areas. Wildlife is mainly song birds and small animals.

This soil is in capability subclass 3e and in the Sandy Loam ecological site.

SwC—Silawa loamy fine sand, 3 to 8 percent slopes

This very deep, gently sloping to moderately sloping, well drained soil is on ridges and side slopes on terraces of the Brazos River. Areas are irregular in shape and range up to several hundred acres in size.

Typically, the surface layer is yellowish brown, slightly acid loamy fine sand about 11 inches thick. The subsoil, from a depth of about 11 to 42 inches, is reddish yellow and strongly acid. It is sandy clay loam in the upper part and fine sandy loam in the lower part. The underlying material, from a depth of about 42 to 80 inches, is reddish yellow, strongly acid loamy fine sand.

This soil is well drained, has moderate permeability, and has low or medium surface runoff. Available water capacity is moderate. The hazard of water erosion is severe and hazard of wind erosion is moderate.

Included with this soil in mapping are small areas of Chazos, Desan, Jedd, Silstid, and Travis soils. The Chazos and Silstid soils are along footslopes. The Desan soil is along upper slopes. The Jedd soil is along sharp breaks. The Travis soil is on ridgetops. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture. A few areas are used for rangeland. A few areas are used as cropland. Some areas are mined for sand and gravel.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, weeping lovegrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Applications of lime are needed in some areas. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to homesites and urban uses. Underground steel pipes are at moderate risk for corrosion. The moderate permeability can affect septic tank absorption fields. Adapted fruit trees, shade trees, ornamentals, and vegetables usually do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas.

This soil is suitable for most recreational uses. Some sloping areas are limited for use as playgrounds. During dry periods, the sandy surface can limit traction in unprotected areas.

This soil is poorly suited to use as cropland because of slope and hazard of erosion. A few areas are planted in small grains and forage sorghums. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

The potential as habitat for openland and rangeland wildlife is good. Some wooded areas provide food and cover for wildlife. Brush and native grasses provide food and cover in other areas. Wildlife is mainly songbirds and small animals.

This soil is in capability subclass 4e and in the Sandy Loam ecological site.

SyB—Silstid loamy fine sand, 1 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on uplands and stream terraces. Areas are irregular in shape and range from about 10 to 300 acres in size.

Typically, the surface layer is yellowish brown, neutral loamy fine sand about 8 inches thick. The subsurface layer, from a depth of about 8 to 32 inches, is light yellowish brown, neutral loamy fine sand. The subsoil, from a depth of about 32 to 80 inches, is moderately acid sandy clay loam. It is brownish yellow from a depth of 32 to 40 inches; mottled very pale brown, brownish yellow and red, from a depth of about 40 to 53 inches; and mottled red and brownish yellow from a depth of about 53 to 60 inches. The subsoil is mottled red and reddish yellow from a depth of about 60 to 72 inches and red from a depth of about 72 to 80 inches.

This soil is well drained, has moderate permeability, and has low surface runoff. Available water capacity is moderate. The hazard of water erosion is slight and the hazard of wind erosion is moderate.

Included with this soil in mapping are small areas of Desan, Edge, Padina, Rader, Silawa, and Travis soils. The Desan and Silawa soils are along slope breaks and the Edge soil is along upper hillsides. The Padina soil is near hilltops, the Rader soil is along footslopes, and the Travis soil is along ridgetops. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and cropland.

This soil is well suited to use as cropland. The main crops are small grains, forage sorghums, peanuts, watermelons, and truck crops. Management practices that conserve moisture and protect the soil from erosion are needed. Returning crop residue to the soil helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Oats or other cover crops are needed to protect the soil from wind erosion in fall, winter, and spring. Strip crops help control wind erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, weeping lovegrass, kleingrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Lime is needed in some places. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to homesites and urban uses. Underground steel pipes are at moderate risk for corrosion. Because the soil is a poor filter, it is severely limited for septic tank absorption fields. Adapted fruit trees, shade trees, ornamentals, and vegetables usually do well with proper applications of fertilizer and water during dry periods. Post oak, blackjack oak, and hickory trees are native in many areas. This soil is suitable for recreational areas, although the sandy surface layer is a moderate limitation. During dry periods, traction can be difficult in unprotected areas. In some places, slope is a limitation for playgrounds.

This soil has poor potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Some areas are wooded and provide food and cover for wild birds and animals. Grasses and seed-producing forbs in small clearings also provide food and cover.

This soil is in capability subclass 3e and in the Sandy ecological site.

SzC—Sunev loam, 2 to 5 percent slopes

This very deep, very gently sloping and gently sloping, well drained soil is on stream terraces on side slopes along drainageways. Areas are long and narrow and range from about 10 to 75 acres in size.

Typically, the surface layer is brown loam about 18 inches thick. The subsoil, from a depth of 18 to 30 inches, is strong brown loam. From a depth of 30 to 80 inches, it is reddish yellow loam. The soil is moderately alkaline and calcareous throughout.

This soil is well drained, has moderate permeability, and has low surface runoff. Available water capacity is moderate and the hazard of water erosion is moderate.

Included with this soil in mapping are areas of Frio, Lewisville, Minwells, Payne, and Seawillow soils. The Frio soil is along small drainageways. The Lewisville and Seawillow soils are in positions on the landscape similar to those of the Sunev soil. The Minwells and Payne soils are along small ridgetops. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland and improved pasture.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is well suited to most recreational uses. In some places, slope is a limitation for playgrounds.

This soil is moderately suited to use as cropland. Cotton, corn, grain sorghum, small grains, and forage sorghums are the main crops. Crops that produce large amounts of residue, such as corn or grain sorghum, are needed in the cropping system. Terraces and contour tillage are needed to protect the soil from water erosion. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. In some areas, diversion terraces and grassed waterways are needed to control runoff from surrounding soils and to provide outlets for terraces. Compacted plow layers form if the soil is plowed to the same depth each year or if it is plowed when wet. The high content of lime makes some nutrients unavailable for plant use, causing some crops to develop chlorosis.

This soil is moderately suited to homesites and urban uses. Most areas are near streams and make attractive homesites. Underground steel pipes are at severe risk for corrosion, and the moderate permeability is a limitation for septic systems. Landscaping and gardening are easily accomplished on this soil. Adapted shade trees, fruit trees, ornamentals, and vegetables do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and live oak trees are native in some areas.

This soil has good potential as habitat for openland and rangeland wildlife. Songbirds and small animals are fairly plentiful because many areas support grass, weeds, and brush that provide food and cover.

This soil is in capability subclass 3e and in the Clay Loam ecological site.

Tc—Tinn clay, occasionally flooded

This very deep, nearly level, moderately well drained soil is on flood plains of streams. These areas are about 1 to 2 feet higher in elevation on the landscape than the part of the flood plain that is frequently flooded. Flooding usually occurs about once every 7 to 10 years during the spring for brief periods of as much as 2 days. Areas are long and narrow and range from about 10 to 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer, about 17 inches thick, is dark gray, calcareous clay. The subsoil, from a depth of about 17 to 80 inches, is dark grayish brown, calcareous clay that has thin strata of lighter and darker sediments in the lower part.

This soil is moderately well drained, has very slow permeability, and has high surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is slight.

Included with this soil in mapping are areas of Branyon and Frio soils. The Branyon soil is in areas higher in elevation that are not subject to flooding. The Frio soil is in positions on the landscape similar to those of the Tinn soils. The included areas make up less than 15 percent of the map unit.

This soil is used for cropland, pasture, and rangeland.

This soil is well suited to use as cropland. Cotton, corn, wheat, and grain sorghum are the main crops. This soil is wet for short periods following heavy rain because permeability is very slow. Plant roots, water, and air move through the soil very slowly. The clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. Crops that produce large amounts of residue, such as grain sorghum or corn, are needed in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is not suited to homesites and urban uses because of the hazard of flooding.

This soil is not suited to recreational areas because it is severely limited by the clayey texture, very slow permeability, and flooding.

This soil has fair potential as habitat for openland wildlife. Most areas are used for growing crops, and little food and cover are available for wildlife. Quail and doves are common during grain harvesting.

This soil is in capability subclass 2w and in the Clayey Bottomland ecological site.

Tn—Tinn clay, frequently flooded

This very deep, nearly level, moderately well drained soil is on flood plains of creeks. Flooding occurs at least once each year for a brief period of 1 or 2 days, mainly during the spring. Areas are long and narrow and range up to several hundred acres in size. Slopes are less than 1 percent.

Typically, the surface layer is dark gray, calcareous clay about 24 inches thick. The subsoil, from a depth of about 24 to 52 inches, is dark grayish brown, calcareous clay. The underlying material, from a depth of about 52 to 80 inches, is dark grayish brown, calcareous clay that has thin strata of lighter and darker color clayey sediments.

This soil is moderately well drained, has very slow permeability, and has high surface runoff. Available water capacity is high. Water enters the soil rapidly during periods when the soil is dry and cracked and very slowly during periods when the soil is wet and the cracks have closed. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of a similar soil that has a brownish surface layer. Also included are areas of occasionally flooded Frio and Tinn soils that are slightly higher in elevation than this Tinn soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and rangeland.

This soil is well suited to use as pasture and hayland, although flooding can limit use. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is not suited to use as cropland because of frequent flooding.

This soil is not suited to homesites and urban uses because of the hazard of flooding. Local roads and bridges are occasionally damaged by floodwater. The clayey surface layer, very slow permeability, and flooding severely limits the use of this soil for recreational areas.

This soil has fair potential as habitat for openland wildlife. Small wild animals and birds inhabit the areas except during periods of flooding. The plant cover produces large quantities of seeds for food.

This soil is in capability subclass 5w and in the Clayey Bottomland ecological site.

TrB—Travis loamy fine sand, 1 to 3 percent slopes

This very deep, very gently sloping, well drained soil is on terraces of the Brazos River. Areas are irregular in shape and range from about 10 to 400 acres in size.

Typically, the surface layer is brown, moderately acid loamy fine sand and the subsurface layer is light brown, slightly acid loamy fine sand. The combined thickness of the surface and subsurface layers is about 17 inches. The subsoil, from a depth of about 17 to 33 inches, is red, strongly acid sandy clay. From a depth of about 33 to 50 inches, it is red, very strongly acid sandy clay that has reddish yellow mottles. From a depth of about 50 to 80 inches, it is red, very

strongly acid gravelly sandy clay loam that has reddish yellow mottles.

This soil is well drained, has slow permeability, and has medium surface runoff. Available water capacity is moderate. The hazard of water or wind erosion is moderate.

Included with this soil in mapping are small areas of Gause, Minwells, Rader, Silawa, and Silstid soils. The Gause and Rader soils are along footslopes. The Silawa soil is along slope breaks and the Silstid soil is on slight mounds. The Minwells soil is in positions on the landscape similar to those of the Travis soils. Also included are areas of a soil that has a fine sandy loam surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and for cropland. A few areas are wooded rangeland. Some areas are mined for sand and gravel.

This soil is well suited to homesites and urban uses. Most areas are at a high elevation on the landscape. Limitations include the moderate potential for shrinking and swelling and the high risk that underground steel pipes will corrode. The slow permeability is a severe limitation for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak trees are native in some areas. This soil is well suited to most recreational uses. During dry periods, the sandy surface can make traction difficult in unprotected areas.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and weeping lovegrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is moderately suited to use as cropland. The main crops are small grains, forage sorghums, peanuts, watermelons, and truck crops. Some areas are used as orchards. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, and reduce erosion.

This soil has good potential for use as habitat for openland and rangeland wildlife. A few areas are wooded. Grasses and seed-producing forbs provide food and cover for wild birds and animals.

This soil is in capability subclass 2e and in the Sandy Loam ecological site.

TrC2—Travis loamy fine sand, 3 to 8 percent slopes, eroded

This very deep, gently sloping and moderately sloping, well drained soil is on terraces of the Brazos River. Areas are irregular in shape and range from about 10 to 100 acres in size. Most areas have undergone both sheet and gully erosion. The surface layer has been thinned or completely eroded away in some places and the subsoil is exposed. Gullies are mainly 400 to 600 feet apart and 2 to 6 feet deep. Many of the gullies have been revegetated and are not actively eroding.

Typically, the surface layer is brown, slightly acid loamy fine sand about 5 inches thick. The subsoil, from a depth of about 5 to 23 inches, is red, strongly acid sandy clay. From a depth of about 23 to 34 inches, it is mottled red and reddish yellow, moderately acid sandy clay. From a depth of about 34 to 80 inches, it is yellowish red, moderately acid sandy clay loam.

This soil is well drained, has slow permeability, and has high to very high surface runoff. Available water capacity is moderate. The hazard of water erosion is severe and the hazard of wind erosion is moderate.

Included with this soil in mapping are small areas of Silawa and Minwells soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for improved pasture and rangeland.

This soil is well suited to homesites and urban uses. The moderate potential for shrinking and swelling and the high risk that underground steel pipes will corrode are limitations. The slow permeability is a severe limitation for septic systems. Adapted fruit trees, shade trees, ornamentals, and vegetables generally do well with proper applications of fertilizer and water during dry periods. Vegetable gardens do best in areas where the surface layer has not been thinned by erosion. Post oak and blackjack oak trees are native in some areas. This soil is moderately suitable for recreational areas. Slope is a limitation for use as playgrounds. During dry periods, the sandy surface can make traction difficult in unprotected areas.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, weeping lovegrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass with oak savannah.

This soil is poorly suited to use as cropland because of the slope and hazard of erosion. Some areas are planted in small grains or forage sorghums. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil has good potential as habitat for openland and rangeland wildlife. A few areas are wooded. Grasses and seed-producing forbs provide food and cover for wild birds and animals.

This soil is in capability subclass 4e and in the Sandy Loam ecological site.

TsC—Travis soils, graded, 1 to 8 percent slopes

These very deep, very gently sloping to moderately sloping, well drained soils are on ridges on terraces of the Brazos River. The gravelly surface layer has been mined for road building material from 50 to 90 percent of most areas (fig. 16). The areas are irregularly shaped and range up to several hundred acres in size.

In a typical area, most of the surface layer has been removed. A layer of brown, slightly acid gravelly sandy loam about 3 inches thick remains. In many areas, siliceous pebbles cover as much as 80 percent of the surface. The upper part of the subsoil, from a depth of about 3 to 50 inches, is red, strongly acid sandy clay. The lower part of the subsoil, from a depth of about 50 to 80 inches, is red, very strongly acid gravelly sandy clay loam.

These soils are well drained, have slow permeability, and have high to very high surface runoff. Available water capacity is moderate. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Chazos and Silawa soils. They are in positions on the landscape similar to those of the Travis soil. Also included are small areas of soils similar to the Travis soil that have not been stripped for gravel. They have a fine sandy loam surface layer or a gravelly loamy fine sand surface layer as much as 50 inches thick. The included soils make up less than 15 percent of the map unit.

These soils have been mined for gravel. Most areas have naturally healed with native vegetation and are now used as rangeland. These soils are not suited to growing crops because of the hazard of erosion. These soils are poorly suited to native range and to pasture grasses, such as coastal bermudagrass, kleingrass, and introduced bluestems.

These soils need a good vegetative cover to help reduce erosion. Pasture grasses are difficult to establish in the stripped areas because of the high content of gravel in the surface layer and because of the dense, gravelly and clayey layers that are exposed at the surface. Pasture grasses should be fertilized as recommended by soil test. Good pasture and range management requires rotational grazing, maintaining proper height of forage plants during grazing periods, weed and brush control, and an adequate supply of water for livestock.

These soils are poorly suited to homesites and urban uses. The moderate potential for shrinking and swelling will affect foundations and streets. Underground steel pipes are at high risk for corrosion. The slow permeability adversely affects septic systems. Fruit trees, ornamentals, and vegetables grow poorly because of the dense, clayey, and gravelly subsoil. Adapted shade trees grow with proper applications of fertilizer and water during dry periods. Post oak and blackjack oak are native in many areas.

These soils are poorly suited to recreational uses because of the gravelly surface and the sticky clayey layers that are exposed at the surface in stripped areas.

The potential of these soils as habitat for openland and rangeland wildlife is fair. Some areas are wooded. Grasses and seed-producing forbs in open areas provide food and cover for wild birds and small animals.

These soils are in capability subclass 6e. They have not been assigned an ecological site.

Uh—Uhland loam, frequently flooded

This very deep, nearly level, moderately well drained soil is on flood plains of small creeks. Areas are long and narrow and range up to several hundred acres in size. Slopes are less than 1 percent. Flooding occurs at least once a year, mainly during the spring for brief periods of about 2 days.

Typically, the surface layer is brown loam about 6 inches thick. The underlying material, from a depth of about 6 to 80 inches, is yellowish brown loam in the upper part, light yellowish brown, loamy fine sand in the middle part, and in the lower part is gray loam with thin strata of clayey sediments that are darker in color. The soil is slightly alkaline throughout. The surface layer is variable in texture because of continuous deposition and scouring. The textures range, in short distances, from fine sandy loam to sandy clay loam.

This soil is moderately well drained, has moderate permeability, and has low surface runoff. Available water capacity is moderate. The water table is within 36 inches of the surface in spring. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Gowen and Sandow soils. They are positioned in old

Figure 16.—Mounds of soil remain in an area of Travis soils, graded, 1 to 8 percent slopes, after the gravelly surface layer was removed for use as road building material. Native plants have revegetated the site.

channels and sloughs. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for rangeland and improved pasture.

This soil is not suited to use as cropland because of the hazard of flooding.

This soil is well suited to use as pasture and hayland, although frequent flooding can affect management. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Overseeding with legumes, such as arrowleaf clover, vetch, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall native grasses with scattered pecan, cottonwood, and elm trees.

This soil is not suited to homesites and urban uses because of the hazard of flooding. Local roads are often covered by floodwater during heavy rainfall and damage to bridges is common.

This soil is severely limited for most recreational uses because of the hazard of flooding; however, this limitation is moderate for hiking trails and picnic areas.

The potential of this soil as habitat for openland and rangeland wildlife is fair. Small wild animals and birds inhabit the areas except during flooding. The vegetation provides sufficient food for large populations of wildlife.

This soil is in capability subclass 5w and in the Loamy Bottomland ecological site.

We—Weswood silty clay loam, occasionally flooded

This very deep, nearly level, well drained soil is on flood plains of the Brazos River. Flooding occurs about once every 4 to 10 years for a period of about 2 days,

usually during the spring and summer. Areas are long and narrow and range from about 10 to 80 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is reddish brown, silty clay loam about 6 inches thick. The subsoil, from a depth of about 6 to 41 inches, is reddish brown silty clay loam in the upper part and reddish brown clay loam in the lower part. The underlying material, from a depth of about 41 to 80 inches, is reddish brown clay loam. The soil is moderately alkaline and calcareous throughout.

This soil is well drained, has moderate permeability, and has negligible surface runoff. Available water capacity is high. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Ships and Yahola soils. The Ships soil is at a higher elevation on the landscape than the Weswood soil, and the Yahola soil is on low ridges. Also included are small areas of a Weswood soil that has a silt loam surface layer and a soil similar to the Weswood soil except it has a clayey subsoil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland and improved pasture.

This soil is well suited to use as cropland. The main crops are cotton, corn, grain sorghum, small grains, and forage sorghums. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is well suited to use as picnic areas, playgrounds, paths, and trails. Flooding is a hazard for camp areas. The surface is sticky when wet, impeding foot and vehicle traffic.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is not suited to homesites and urban uses because of the hazard of flooding. Pecan trees are well adapted to this soil.

This soil has good potential as habitat for openland wildlife and fair potential as habitat for rangeland wildlife. Birds and small animals find food and cover in pastures and in weedy and wooded areas along the stream channels. Birds frequent this habitat mainly during the planting and harvest seasons.

This soil is in capability subclass 2w and in the Loamy Bottomland ecological site.

Wn—Wilson loam, 0 to 2 percent slopes

This very deep, nearly level and very gently sloping, moderately well drained soil is on stream terraces. Areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is gray, neutral loam about 9 inches thick. The subsoil, from a depth of about 9 to 32 inches, is dark gray, slightly alkaline clay loam. From a depth of about 32 to 47 inches, it is dark gray, slightly alkaline clay. From a depth of 47 to 58 inches it is light brownish gray, moderately alkaline clay. From a depth of about 58 to 80 inches, the subsoil is pale brown, moderately alkaline clay that has brownish yellow mottles.

This soil is moderately well drained, has very slow permeability, and has high to very high surface runoff. Available water capacity is moderate, although the movement of plant roots, water, and air is restricted in the clayey subsoil. The hazard of water erosion is slight. This surface layer is saturated for short periods during the winter and spring.

Included with this soil in mapping are small areas of Burleson, Crockett, Davilla, Normangee, and Payne soils. The Crockett, Normangee, and Payne soils are at slightly higher elevations on the landscape. The Burleson and Davilla soils are in positions on the landscape similar to those of the Wilson soil. Also included in some areas is a soil similar to the Wilson soil that has a surface layer 10 to 15 inches thick. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for cropland and improved pasture.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is tall grass prairie.

This soil is moderately suited to use as cropland. Grain sorghum, wheat, corn, and forage sorghums are the main crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter content, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Grassed waterways are needed in some areas to help control runoff and provide drainage outlets. This soil is easily compacted if plowed when wet.

This soil is moderately suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of nitrogen and phosphorus are needed to sustain forage production. Overseeding with legumes, such as sweet clover, vetch, berseem clover, and singletary peas, prolongs the grazing season and improves the soil.

This soil is poorly suited to homesites and urban uses. Limitations are the high potential for shrinking and swelling, which affects foundations and streets; the high risk for corrosion of underground steel pipes, and the very slow permeability, which adversely affects septic systems. Fruit trees and most ornamentals grow poorly on this soil because of the dense, clayey subsoil. Adapted shade trees and vegetables generally do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and post oak trees are native in some areas.

This soil is moderately suited to recreational uses because of very slow permeability.

The potential of this soil as habitat for openland and rangeland wildlife is fair. Wildlife consists mainly of quail, doves, and songbirds. Small animals sometimes frequent grass and brush areas.

This soil is in capability subclass 3e and in the Claypan Prairie ecological site.

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

These very deep, nearly level and very gently sloping, moderately well drained soils are on stream terraces. Areas are irregular in shape and range up to several hundred acres in size.

The areas of Wilson and Davilla soils are so intricately mixed and so small in size that it is impractical to separate them at the scale of mapping (fig. 17). Mapped areas are typically about 60 percent Wilson loam and 35 percent Davilla loam and other soils. The Davilla soils are on low ridges and mounds, 6 to 12 inches high, and the Wilson soils are in the slightly lower areas.

Included with these soils in mapping are small areas of Minwells, Payne, and Sunev soils, which are at slightly higher elevations on the landscape.

Typically, the surface layer of the Wilson soil is dark grayish brown, slightly acid loam about 4 inches thick. The upper part of the subsoil is clay loam. From a depth of about 4 to 9 inches it is dark gray and neutral and from a depth of 9 to 12 inches it is very dark gray and slightly alkaline. The middle part of the subsoil, from a depth of about 12 to 36 inches, is dark gray and slightly alkaline clay that has dark yellowish brown mottles. The lower part of the subsoil, from a depth of about 36 to 80 inches, is gray, moderately alkaline clay that has yellowish brown mottles.

Typically, the surface layer of the Davilla soil is dark brown, slightly acid loam about 10 inches thick. The clay loam subsoil extends to a depth of about 80 inches. From a depth of about 10 to 24 inches, it is brown with light gray and brownish yellow mottles and neutral. From a depth of about 24 to 34 inches, it is brown with light gray and reddish yellow mottles and neutral. From a depth of about 34 to 44 inches, it is light brownish gray with light gray and reddish yellow mottles and slightly alkaline. From a depth of 44 to 50 inches, it is light gray with brownish yellow mottles and slightly alkaline. From a depth of about 50 to 80 inches, it is light gray, moderately alkaline clay loam that has brownish yellow mottles.

These soils are moderately well drained, have very slow permeability, and have high to very high surface runoff. The Wilson soil has moderate available water capacity. The Davilla soil has high available water capacity. The movement of plant roots, water, and air are restricted in the clayey subsoil of both soils. The hazard of water erosion is slight. The surface layer of the Wilson soil is saturated for short periods in most years.

These soils are used mainly for cropland and improved pasture. Some areas are used as rangeland.

These soils are well suited to use as cropland. Seasonal wetness can delay planting some years. Corn, grain sorghum, small grains, and forage sorghums are the main crops. Crops that produce large amounts of residue, such as grain sorghum, are needed in the cropping system. Returning crop residue to the soil helps to maintain tilth and organic matter content, increase water intake, conserve moisture, and reduce erosion. Additional practices for erosion reduction include terraces and contour tillage. Diversion terraces and grassed waterways help control runoff and provide outlets for terraces.

This soil is well suited to use as pasture and hayland. Common bermudagrass, improved bermudagrass, kleingrass, and johnsongrass are the main forages. Applications of a complete fertilizer are needed to sustain forage production. Overseeding with legumes, such as vetch or singletary peas, prolongs the grazing season and improves the soil.

These soils are moderately suited to homesites and urban uses; however, many of the limitations are severe. The high potential for shrinking and swelling will affect foundations and streets. Underground steel pipes are at high risk for corrosion. The very slow

Figure 17.—The pattern of soils in the Wilson-Davilla complex, 0 to 2 percent slopes, is easily seen in this field. The Davilla soil is lighter in color.

permeability adversely affects septic systems. Fruit trees and most ornamentals grow poorly because of the dense, clayey subsoil of the Wilson soil. Adapted shade trees and vegetables do well with proper applications of fertilizer and water during dry periods. A few elm, hackberry, and post oak trees are native in some areas. The very slow permeability limits these soils for use as recreational areas.

The suitability of these soils as habitat for openland and rangeland wildlife is fair. Brush and grass areas provide food and cover for quail, doves, songbirds, and small animals.

The Wilson soil in capability subclass 3w and the Davilla soil is in capability subclass 2s. Both soils are in the Claypan Prairie ecological site.

Ya—Yahola loam, occasionally flooded

This very deep, nearly level, well drained soil is on flood plains of the Brazos River. Flooding occurs about once every 4 to 10 years for brief periods, usually during the spring, summer, or fall. Areas are long and narrow and range from about 10 to 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is brown loam about 12 inches thick. The underlying material, from a depth of about 12 to 28 inches, is stratified brown loam and yellowish red very fine sandy loam. From a depth of about 28 to 80 inches it is pink and light brown very fine sandy loam that has thin silty strata. The soil is moderately alkaline and calcareous throughout.

This soil is well drained, has moderately rapid permeability, and has negligible surface runoff. Available water capacity is high. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Gaddy, Ships, and Weswood soils. The Gaddy soil is lower on the landscape near the river. The Ships soil is in depressions and the Weswood soil is slightly lower

on the landscape than the Yahola soil. The included soils make up less than 15 percent of the map unit.

This soil is used for cropland and pasture. Some areas are used as rangeland.

This soil is suited to growing crops such as grain sorghum, cotton, wheat, and corn. It is suited to pasture grasses, such as common and coastal bermudagrass. Sudangrass and oats are suitable crops for supplemental pasture.

This soil is well suited to use as cropland. Corn, grain sorghum, small grains, and forage sorghums are the main crops. Leaving crop residue on the surface, as in minimum tillage systems, helps to maintain tilth and organic matter, conserve moisture, and reduce erosion.

This soil is well suited to use as rangeland. Management practices include brush and weed control, planned grazing, and proper stocking. The climax vegetation is native grass prairie with few scattered pecan, cottonwood, and elm trees.

This soil is not suited to homesites and urban uses because of the hazard of flooding.

This soil is moderately suited to recreational uses, such as picnic areas, paths, and trails for hiking. It is not suited to camping areas, because of the hazard of flooding.

This soil has good potential as habitat for openland and rangeland wildlife. Pastures and weedy and wooded areas provide food and cover for small wild animals and birds.

This soil is in capability subclass 2w and in the Loamy Bottomland ecological site.

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; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading “Detailed Soil Map Units.”

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, forestland, or other land, but it is not urban, 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.

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.

Crops and Pasture

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

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.” The extent of each listed

map unit is shown in table 4. Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1992, Milam County had about 200,000 acres in cropland; 245,000 acres as pasture; and 186,000 acres as rangeland according to the local office of the Natural Resources Conservation Service. Cotton, grain sorghum, small grains, corn, and hay are the most commonly grown crops. Production is steadily increasing. Farmers are planting high-yielding strains and are using more efficient equipment, fertilizers, insecticides, and herbicides.

Erosion and declining fertility are major concerns in agricultural land use. Most soils used for crops and pasture are fertilized regularly. Laboratory soil analyses and custom mixing of fertilizer are commonly used in production. Fertilizer is not used on rangeland.

Most sloping fields have been terraced and contoured, and grassed waterways have been established. Some nearly level fields have diversion terraces above them as an erosion-control measure.

All soils that are cultivated benefit from crops that produce large amounts of residue. Residue helps improve tilth, infiltration, and fertility and helps reduce erosion.

Terraces and diversions are used mainly to help control runoff.

Grasses commonly used for pastures are kleingrass, coastal bermudagrass, King Ranch bluestem, and Kleberg bluestem, and to a lesser extent, weeping lovegrass. Fertilizer applied to pastures increases production and improves the quality of the forage. Plant vigor and healthy grass stands can be maintained by controlling weeds and maintaining proper grazing heights.

A planned sequence of grazing and then resting pastures improves forage quality and production.

Pastures are sometimes used along with range or crops to balance yearlong forage needs. Forage produced in excess of that needed for grazing animals can be cut for hay. Some pastures are not grazed, but saved for hay.

Special crops, such as peanuts, watermelons, tomatoes, fruit, and pecans, are grown on a limited scale. Peanuts, watermelons, and tomatoes are grown mainly in areas of sandy soils; fruit trees are grown throughout the county. Pecan groves are mainly on bottom lands along the rivers and major creeks.

Crop Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification *(4)* 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 and for engineering purposes.

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

Capability classes, the broadest groups, are designated by numerals 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 1 soils are not in the survey area.

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 subject to little or no erosion but have other limitations, impractical to remove, that restrict their use.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use.

Class 7 soils have very severe limitations that make them unsuitable for cultivation. Class 7 soils are not in the survey area.

Class 8 soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. Class 8 soils are not in the survey area.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, or *s*, 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); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

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* or *s*, 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.

The capability classification of each map unit is given in the section “Detailed Soil Map Units” and in table 6.

Rangeland

Dalton Merz, range conservationist, Natural Resources Conservation Service, prepared this section.

On rangeland, the native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. Rangeland does not receive regular or frequent cultural treatment; however, management is needed to conserve the soil and water. Production can be improved by balancing grazing animal numbers to forage production and by rotational grazing. These measures allow desirable plants to improve vigor, produce seed, and establish seedlings.

About 28 percent or 186,000 acres of Milam County is in rangeland according to the Natural Resources Conservation Service. Rangeland acreage has increased in recent years in Milam County due to the high costs associated with cropland and pastureland.

Most of the ranches and livestock farms are cow-calf operations. However, there are some stocker calf enterprises, and many ranchers supplement their cattle herds with stockers. This practice permits greater flexibility in adjusting livestock numbers in periods of drought and times of grazing stress.

Most livestock operations supplement grazing of rangeland with tame pastures of bermudagrass, kleingrass, King Ranch bluestem; with hay or with small grain crops, which are generally grown in cultivated areas.

Most production of range forage takes place in two distinct growth periods. About 70 percent of the annual growth is produced in April, May, and June, when spring rains and moderate temperatures are favorable for the growth of warm-season plants. A secondary growth period is in September and October, when fall rains coincide with gradually cooling temperatures.

Droughts of varying duration are frequent in this area. Short mid-summer droughts are normal, but droughts that last for many months also occur.

Ecological Sites

An *ecological site,* sometimes called a range 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. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service.

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 historic climax 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 weedlike plants, can increase in abundance. 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 Natural Resources Conservation Service and other land management agencies assist landowners to identify problems and concerns, as well as opportunities to maintain or improve their rangeland resources. A rangeland ecological site may be evaluated by three distinct methods: similarity index, rangeland trend, and rangeland health.

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

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

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

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

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

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

The ecological sites in the survey area are the Blackland, Clayey Bottomland, Clay Loam, Claypan Prairie, Claypan Savannah, Deep Sand, Eroded Blackland, Gravelly, Gravelly Loam, Loamy Bottomland, Sandy, Sandy Bottomland, Sandy Loam, and Sandstone Hill.

Blackland ecological site

The Branyon, Burleson, Heiden, and Houston Black soils are in this site. The potential plant community is a tall grass prairie. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass and big bluestem, 25 percent; and eastern gamagrass, switchgrass, Texas cupgrass, sideoats grama, wildrye, Texas wintergrass, and vine-mesquite, 10 percent. Woody plants, such as live oak, elm, and hackberry make up 5 percent. Forbs, such as Maximilian sunflower, Engelmann daisy, gayfeather, bundleflower, snoutbean, wildbean, and western indigo make up 10 percent.

Under continuous heavy grazing, big bluestem and little bluestem, indiangrass, eastern gamagrass, switchgrass, Maximilian sunflower, and Engelmann daisy are grazed out of the plant community. These plants are replaced by silver bluestem, Texas wintergrass, tall dropseed, sideoats grama, and less palatable forbs. If heavy grazing continues for many years, the extent of buffalograss, Texas wintergrass, mesquite, elm, Texas grama, croton, and broomweed increases significantly.

If the site deteriorates further, mesquite and desert willow encroach in most places. Cool-season grasses, such as Texas wintergrass and rescuegrass fill the void left when shade and competition for moisture drive out the tall-growing, warm-season grasses. Generally, in areas that have been cropped, there is no natural seed source; therefore, the reseeding of desirable range grasses is the primary concern in management.

Clayey Bottomland ecological site

The Ships and Tinn soils are in this site. The potential plant community is a savannah. Typically, the dominant grasses are switchgrass, indiangrass, big bluestem, and little bluestem, which make up 30 percent of the vegetation; meadow dropseed, sideoats grama, vine-mesquite, and silver bluestem, 20 percent; wildrye, sedges, and Texas wintergrass, 20 percent; and buffalograss, white tridens, Scribner panicum, and eastern gamagrass, 10 percent. Woody plants, such as live oak, elm, hackberry, pecan, willows, and western soapberry make up 15 percent. Forbs, such as Maximilian sunflower, bundleflower, snoutbean, tickclover, and wildbean make up 5 percent.

Under continuous heavy grazing, eastern gamagrass, indiangrass, switchgrass, big bluestem, little bluestem, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by meadow dropseed, sideoats grama, silver bluestem, Texas wintergrass, vine-mesquite, buffalograss, and less palatable forbs. If heavy grazing continues for many years, the extents of the overstory canopy thickens and shade-tolerant species, such as wildrye, sedges, and low panicum increases significantly. If the site deteriorates further, the following plants may grow in the area: buffalograss, common bermudagrass, Texas grama, ragweed, sumpweeds, annual sunflower, cocklebur, broomweed, beebalm, iceweed, and croton.

Most areas have some common bermudagrass and weeds along with desirable tall grasses and forbs. Continuous, close grazing results in an increase of bermudagrass and other low-growing plants but a decrease in desirable, tall-growing native grasses.

Controlled grazing helps tall range grasses to reproduce and crowd out the less desirable bermudagrass.

Clay Loam ecological site

The Altoga, Lewisville, Seawillow, and Sunev soils are in this site. The potential plant community is a true prairie. Typically, the dominant grasses are little bluestem, which makes up 30 percent of the vegetation; indiangrass, 10 percent; big bluestem, 5 percent; and tall dropseed, silver bluestem, sideoats grama, buffalograss, perennial threeawn, and Texas wintergrass, 50 percent. Forbs, such as Engelmann daisy, bundleflower, sensitive briar, and bush sunflower make up 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, big bluestem, and Engelmann daisy are grazed out of the plant community. These plants are replaced mainly by sideoats grama and buffalograss. If heavy grazing continues for many years, the extent of such plants as silver bluestem, perennial threeawn, and Texas wintergrass increases significantly. If the site deteriorates further, woody invaders, such as blueberry juniper, ashe juniper, agarito, and persimmon, and annual weeds, such as broomweed encroach and may become dominant.

Most areas of this ecological site are in the western part of the county. Domestic animals apparently prefer grazing this ecological site. For this reason, extra emphasis needs to be placed on deferred grazing as a means of controlling brush and improving composition of the plant population.

Claypan Prairie ecological site

The Crockett, Davilla, Normangee, Payne, and Wilson soils are in this site. The potential plant community is a tall grass prairie. A few oaks, elms, and hackberry trees are along watercourses or in widely scattered motts. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 15 percent; Florida paspalum, wildrye, sideoats grama, silver bluestem, meadow dropseed, and Texas wintergrass, 15 percent; and purpletop, brownseed paspalum, and buffalograss, 5 percent. Woody plants, such as oak, elm, hackberry, and bumelia make up 5 percent. Forbs, such as Maximilian sunflower, Engelmann daisy, partridge pea, guave, and vetch make up 10 percent.

Under continuous heavy grazing, big bluestem, little bluestem, indiangrass, Florida paspalum, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by silver bluestem, meadow dropseed, Texas wintergrass, sideoats grama, and less palatable forbs. If heavy grazing continues for many years, the extent of Texas wintergrass, buffalograss, mesquite, post oak, osage-orange, desert willow, yaupon, and other woody plants increases significantly.

Brush control is the main concern in range management.

Claypan Savannah ecological site

The Edge and Lufkin soils are in this site. The potential plant community is a post oak and blackjack oak savannah. The trees shade 15 to 20 percent of the ground. Typically, the dominant grasses are little bluestem and indiangrass, which make up 50 percent of the vegetation; brownseed paspalum, 10 percent; Florida paspalum, switchgrass, and purpletop, 10 percent; and sideoats grama, arrowfeather threeawn, silver bluestem, and Texas wintergrass, 10 percent.

Woody plants, such as post oak and blackjack oak make up 10 percent. Other woody plants, such as blackberry, American beautyberry, greenbriar, grape, and Alabama supplejack make up 5 percent. Forbs, such as Engelmann daisy, gayfeather, bundleflower, and wildbean make up 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, Florida paspalum, switchgrass, and purpletop are grazed out of the plant community. These plants are replaced by brownseed paspalum and woody species, such as post oak, blackjack oak, elm, yaupon, and American beautyberry. In addition to climax woody species, the following plants are likely to dominate the site in its deteriorated condition: mesquite, broomsedge bluestem, red lovegrass, bitter sneezeweed, eastern red cedar, and baccharis.

Brush encroachment and low fertility are particular problems on this site. Yaupon, American beautyberry, and hawthorn form dense stands under a scattered canopy of post oak and blackjack oak. A management system that includes brush control and favors an increase in legumes and forbs is important in managing this site.

Deep Sand ecological site

The Desan and Padina soils are in this site. The potential plant community produces a savannah plant community of oak, hickory, and tall grasses as well as some shrubs and forbs. The approximate composition, by weight, of the climax plant community is post oak, blackjack oak, hickory, American beautyberry, greenbriar, and other shrubs, 15 percent; little bluestem, 50 percent; indiangrass, 10 percent; sand lovegrass, beaked panicum, crinkleawn, switchgrass, brownseed paspalum, and purpletop, 10 percent; fringeleaf paspalum, mourning lovegrass, fall switchgrass, and other grassess, 10 percent; and forbs, such as tickclover, snoutbean, tephrosia, and annuals, 5 percent.

Under continued heavy grazing, little bluestem, indiangrass, switchgrass, and sand lovegrass decrease in the plant community. If continuous heavy grazing for many years, the extent of oak and annual forbs, and such plants as yankeeweed, smutgrass, pricklypear, cactus, and low brush increases significantly.

Soil blowing and rapid drying of the surface layer makes natural reproduction difficult on this site. The woody plant cover can be managed by mechanical and chemical means.

Eroded Blackland ecological site

The Ferris and Heiden soils in the Ferris-Heiden map unit are in this site. The potential plant community is a tall grass prairie. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass and big bluestem, 29 percent; and sideoats grama, wildrye, tall dropseed, silver bluestem, Texas wintergrass, and vine-mesquite, 15 percent. Woody plants, such as live oak, hackberry, and elm make up 5 percent. Forbs, such as Engelmann daisy, Maximilian sunflower, gayfeather, snoutbean, and wildbean make up 10 percent.

Under continuous heavy grazing, little bluestem, indiangrass, big bluestem, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by vine-mesquite, silver bluestem, and tall dropseed. If heavy grazing continues for many years, the extent of buffalograss, Texas wintergrass, and mesquite increases significantly.

A particular problem in improving this site is the inadequacy of seed sources in most places. Also, recovery is slow because fertility in the gullied areas is very low. Brush is a minor problem; most areas have only a scattering of desert willow and mesquite. Management generally includes reseeding, proper grazing use, and rotational grazing.

Gravelly ecological site

The Travis soils, graded, are in this site. The potential plant community is an open stand of oak trees and a sparse stand of grasses and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 50 percent little bluestem; 5 percent beaked panicum; 5 percent indiangrass; 5 percent purpletop; 10 percent blackjack oak and post oak; 5 percent greenbriar, vines, and shrubs; 5 percent forbs, such as lespedeza, snoutbean, and tickclover; 10 percent crinkleawn and brownseed paspalum; and 5 percent other grasses.

Under heavy grazing by cattle, the woody vegetation increases. If heavy grazing continues for many years, the extent of grasses such as red lovegrass, windmillgrass, threeawn, and annual grasses and forbs and woody shrubs, such as baccharis, eastern red cedar, yaupon, American beautyberry, and greenbriar increases significantly.

Gravelly Loam ecological site

The Satin and Riesel soils are in this site. The potential plant community is a very open savannah consisting of scattered individual trees and motts of live oak. Typically, the dominant grasses are little bluestem which make up 50 percent of the vegetation; indiangrass, 10 percent; sideoats grama, silver bluestem, and Texas wintergrass, 20 percent; Texas cupgrass, low panicum, buffalograss, fall witchgrass,

and sedges, 5 percent; woody plants, such as live oak, elm, hackberry, post oak and bumelia make up 5 percent. Forbs, such as sensitive briar, gayfeather, Engelmann daisy, halfshrub sundrop, and bundleflower make up 10 percent.

Under continuous heavy grazing, little bluestem, indiangrass, and palatable forbs are grazed out of the plant community. These plants are replaced by sideoats grama, silver bluestem, Texas wintergrass, and less palatable forbs. If heavy grazing continues for many years, the extent of Texas wintergrass, mesquite, Texas grama, and threeawn increases significantly. If the site deteriorates further, woody vegetation, such as mesquite, baccharis, eastern red cedar, elm, and greenbriar increase or invade the site.

Loamy Bottomland ecological site

The Bosque, Frio, Gowen, Oakalla, Sandow, Uhland, Weswood, and Yahola soils are in this site. The potential plant community is a savannah. Oak, pecan, hackberry, elm, cottonwood, sycamore, and other woody plants shade about 30 percent of the ground. Typically, the grasses are Virginia wildrye and sedges, which make up 25 percent of the vegetation; rustyseed paspalum and beaked panicum, 15 percent; switchgrass, indiangrass, big bluestem, and little bluestem, 15 percent; white tridens and knotroot bristlegrass, 10 percent; eastern gamagrass, 5 percent; and uniola, 5 percent. Woody plants, such as pecan, oak, hackberry, elm, cottonwood, sycamore, greenbriar, and Alabama supplejack make up 25 percent.

Under continuous heavy grazing, big bluestem, little bluestem, eastern gamagrass, and other palatable forage plants are grazed out of the plant community. These plants are replaced by trees, shrubs, and woody vines. As the overstory continues to close in, production of grasses and forbs is reduced proportionately. If the site is in a deteriorated condition, broomsedge bluestem, bushy bluestem, vaseygrass, cocklebur, sumpweed, osage-orange, and woody plants dominate the site.

One problem in managing this site is extensive shading by trees and thicket-forming plants, such as greenbriar, sapling elm, ash, and sycamore. Brush control and deferred grazing are necessary in many places to improve the stand of grasses.

Sandy ecological site

The Silstid soils are in this site. The potential plant community is an open savannah that has scattered post oak and blackjack oak trees. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 10 percent; switchgrass, crinkleawn, purpletop, brownseed paspalum, and sand lovegrass, 10 percent; and balsamscale, mourning lovegrass, splitbeard bluestem, broomsedge bluestem, and low panicum, 10 percent. Woody plants, such as post oak and blackjack oak make up 10 percent; other woody plants, such as American beautyberry, greenbriar, and yaupon make up 5 percent. Forbs, such as partridge pea, western indigo, snoutbean, and sensitive briar make up 5 percent.

Under continuous heavy grazing, indiangrass, little bluestem, switchgrass, and crinkleawn are grazed out of the plant community. These plants are replaced mostly by brownseed paspalum, fringeleaf paspalum, threeawns, splitbeard bluestem, broomsedge bluestem, and low panicum. If the site has deteriorated, any or all of the following can be present: red lovegrass, yankeeweed, bullnettle, snakecotton, and croton. If retrogression continues, oak, yaupon, hawthorns, greenbriar, American beautyberry, and persimmon form dense thickets.

The sandy texture, reaction, and low fertility of the soils in this site favor woody plants over grasses. The trees and brush are mainly yaupon, greenbriar, and American beautyberry. Historically, this site was probably maintained as a savannah by occasional fires that cleared areas of brush and trees so that grasses could grow. Practices that improve the kinds and amount of desirable range grasses and forbs are mechanical or chemical brush control and rotational grazing.

Sandy Bottomland ecological site

The Gaddy soils are in this site. The climax plant community is an open stand of trees and grasses and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 25 percent switchgrass; 15 percent indiangrass, big bluestem, and little bluestem; 10 percent Virginia wildrye and sedges; 15 percent broadleaf and longleaf uniolas, beaked panicum and other panicum species, and paspalum; 10 percent purpletop; 20 percent oak, elm, sycamore, vines, and shrubs; and 5 percent tickclover, snoutbean, and other forbs.

Under continuous heavy grazing by cattle, there is an increase in shrubs, vines, other woody vegetation, and such shade-tolerant grasses as beaked panicums, purpletop, Virginia wildrye, sedges, and uniolas. If heavy grazing continues for many years, the extent of grasses and weeds, such as broomsedge bluestem, vaseygrass, bloodweed, beebalm, and yankeeweed,

and such woody plants as yaupon, winged elm, and baccharis increases significantly.

Sandy Loam ecological site

The Bastsil, Chazos, Gause, Minerva, Minwells, Rader, Silawa, and Travis soils are in this site. The potential plant community is a post oak and blackjack oak savannah. Typically, the dominant grasses are little bluestem, which make up 50 percent of the vegetation; indiangrass, 10 percent; switchgrass, big bluestem, eastern gamagrass, purpletop, and brownseed paspalum, 10 percent; and sideoats grama, tall dropseeds, silver bluestem, low paspalum, low panicum, mourning lovegrass, arrowfeather threeawn, knotroot bristlegrass, sedges, and fall witchgrass, 10 percent. Such woody plants as post oak and blackjack oak make up 10 percent; other woody plants, such as elm, hackberry, American beautyberry, and greenbriar make up 5 percent. Forbs, such as Engelmann daisy, sensitive briar, bundleflower, wildbean, and snoutbean make up 5 percent.

Under continuous heavy grazing, indiangrass, big bluestem, little bluestem, and eastern gamagrass are grazed out of the plant community. These plants are replaced by brownseed paspalum and woody plants, such as oak, elm, hackberry, and American beautyberry until the site resembles a scrub forest. Shade-tolerant plants, such as longleaf uniola, sedges, and low panicum generally increase along with the canopy until the shade becomes too dense for them. In addition to the climax woody plants, the following may be present if the site has deteriorated: broomsedge bluestem, red lovegrass, yankeeweed, eastern red cedar, persimmon, sesbania, and winged elm.

Much of this ecological site was formerly in cultivation; thus, seed sources are seriously lacking. Other problems in developing rangeland from idle cropland include surface crusting, low fertility, and encroachment of hawthorn, yaupon, and other brush. These problems make recovery slow and difficult. Historically, occasional brush fires helped maintain this site as a savannah. Management includes mechanical or chemical brush control and rotational grazing.

Sandstone Hill ecological site

The Jedd soils are in this site. The potential plant community is a savannah of post oak and blackjack oak trees and grasses and forbs. The approximate composition, by weight, is little bluestem, 45 percent; indiangrass, purpletop, and sand lovegrass, 15 percent; silver bluestem, 10 percent; fringeleaf paspalum, threeawn, and windmillgrass, 10 percent; post oak, blackjack oak, and catclaw acacia, 15 percent; and sensitive briar, snoutbean, Aster, knotweed, leafflower, and annuals, 5 percent.

Under continuous heavy grazing, bluestem, indiangrass, and sand lovegrass decrease. Threeawn, red lovegrass, gummy lovegrass, and annual forbs increase and dominate the site.

Table 7 shows, for each soil that supports rangeland vegetation suitable for grazing, the ecological site and the potential annual production of vegetation in favorable, average, and unfavorable years. The following paragraphs are explanations of the column headings in table 7.

An *ecological site* is indicated for each soil map unit listed in table 7. The relationship between soils and vegetation was established during this survey; thus, ecological sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important considerations.

Total dry-weight 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 also 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 temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Gardening and Landscaping

Homeowners and others who garden and landscape need to know the suitability of soils for growing flowers and ground cover, vines, shrubs, trees, and fruits and vegetables. In some areas, plants may be needed for erosion control as well as for esthetic purposes.

The ideal soils for yard and garden plants are those that have a deep root zone, a loamy texture, and a balanced supply of plant nutrients. Also desirable are plenty of organic matter in various stages of decomposition, an adequate available water capacity,

good drainage, and a granular structure that allows free movement of water, air, and roots.

The degree of acidity or alkalinity suitable for the particular plant to be grown is also important. For example, roses and most annual flowers, vegetables, and grasses generally grow best in soils that are neutral or only slightly acid in reaction. Azaleas, camellias, and similar plants need acid soils. Some plants grown on soils that have a high content of lime, such as Altoga or Seawillow soils, develop chlorosis, or yellowing of the leaves. However, many flowers, shrubs, and trees that are grown in Milam County are well suited to these types of soils. Canna, hollyhocks, zinnias, and gladioli are examples of lime-tolerant flowers, and crepe myrtle, nandina, duranta, crabapple, live oak, and pecan are examples of lime-tolerant shrubs and trees.

Some of the flowers and ground cover, vines, shrubs, trees, and fruits and vegetables suitable for the soils in Milam County are listed in table 8. Some of these plants are native to the county.

The first column in table 8 lists the soils of Milam County in groups based on similarities in limitations and suitabilities for gardening and landscaping.

Flowers and ground cover are the more common flowers and ground cover plants adapted to each group of soils. *Vines, shrubs, trees*, and *vegetables* and *fruits* are those most commonly grown in the county. Soil texture, drainage, permeability, structure, and other characteristics are given in the map unit descriptions in the section “Detailed Soil Map Units” and the series descriptions in the section “Soil Series and Their Morphology.” Soil reaction (pH), permeability, and available water capacity are given in table 16.

Many different kinds of soils are in Milam County, and many of them differ considerably from the ideal in texture, depth, permeability, and other characteristics that affect their suitability for garden and landscape plants. Success in gardening and landscaping depends on recognition of the limitations of the soils for such uses and the use of management practices appropriate to offset the limitations.

Conditioning the native soil generally is preferable and more economical than replacing it with man-made soil material. The soil should be tested, and the fertility needs of the plants to be grown should be determined. Organic matter is the most important amendment that can be added to the soil. This may be peat moss, compost, rotted sawdust, or manure. Compost of leaves, grass clippings, sawdust, and organic materials from the kitchen are an excellent source of organic matter.

At least 2 inches of organic matter should be added to the soil. For clayey soils, at least 2 inches of fertile loam or sand, perlite, calcined clay, or vermiculite should be added in addition to the organic matter. Clayey soils can also be improved by adding 10 pounds of gypsum and 5 pounds of superphosphate (0-20-0) or 5 pounds of 16-20-0 fertilizer per 100 square feet broadcast over the surface. This material should be incorporated into the native soil to a depth of about 8 inches.

Iron chelates can also be added to soils with a high lime content to correct chlorosis problems in plants. If an acid soil is needed, 1 to 2 pounds of sulfur per 100 square feet should be incorporated. Soil that is too strongly acid can be neutralized by adding bonemeal, lime, wood ashes, or topsoil from limy soil such as the Sunev or Seawillow soils.

In some areas of the county, the soils are so clayey, or poorly drained, that raised beds need to be constructed in order to grow flowers, vegetables, and some types of shrubs. Brick, tile, metal, railroad ties, cedar, or redwood makes a good retainer along the edge of the bed. Beds should be filled with soil material that has been well balanced with physical and chemical amendments.

Gardening and landscaping should be considered when sites for homes and other buildings are selected. Large, healthy trees are a valuable asset to the property and should be protected during the period of construction. Many trees are killed or damaged beyond restoration because of carelessness in the process of excavation, filling, and construction.

Recreation

The soils of the survey area are rated in table 9 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 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations

are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

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

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

Frank Sprague, Biologist, Natural Resources Conservation Service, Temple, Texas, prepared this section.

A variety of fish and wildlife inhabit Milam County. Those inhabiting the Blackland Prairie are primarily openland species, such as mourning dove. Quail, rabbits, furbearers, and songbirds inhabit the stream courses and wooded draws which dissect the Blackland Prairie. A limited white-tailed deer population exists along major drainages in the western part of the county. The Claypan Area in the eastern and southern parts of the county supports higher deer numbers and a variety of other wildlife.

Farm ponds and small lakes in the county support good fish populations and provide fishing opportunities when properly stocked and managed. Primary species are largemouth bass, channel catfish, and various sunfish. Waterfowl, wading birds, and shorebirds frequently inhabit these ponds.

Agricultural practices directly affect the quality of wildlife habitat in the survey area. The trend away from cotton and toward sorghums, corn, and small grain crops in recent years has been beneficial to wildlife. Improved tillage methods and other conservation practices are providing better habitat for many species.

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

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

The potential of the soil is rated *good, fair, poor*, or *very poor*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or

kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

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

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

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

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, hackberry, pecan, mesquite, blackberry, and grapes. Examples of fruit-producing shrubs that are suitable for planting on soils rated good are Russian-olive, plum, and mulberry.

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

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 elbow bush, sumac, 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, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, 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, and areas that include grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, mourning dove, meadowlark, field sparrow, cottontail, and hawks.

Habitat for woodland wildlife consists of areas of deciduous plants and/or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include owls, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy, or swampy shallow water areas. Wildlife attracted to these areas include ducks, geese, herons, shore birds, nutria, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, quail, meadowlark, cattle egrets, skunks, and coyotes.

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 data in the tables described under the heading “Soil Properties.”

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 between the surface and 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 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and potential for shrinking and swelling can cause the movement of footings. A high water table, depth to bedrock, 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, 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, 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, and the available water capacity in the upper 40 inches, affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for 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, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

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

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

Table 12 shows 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, 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. Excessive slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

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

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

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

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

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

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent; 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 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight,

large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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

Plant growth is affected by 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, and bedrock.

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

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

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. 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, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock 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; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Drainage 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. The performance of a system is affected by the depth of the root zone 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 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 affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, 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 the tables, are explained on the following pages.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

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

Engineering Index Properties

Table 15 shows 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 the 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 *(ASTM) (2)*; and the system adopted by the American Association of State Highway and Transportation Officials *(AASHTO) (1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter 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, then the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is shown in table 18.

Rock fragments larger than 10 inches in diameter and 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 oven dry 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 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate 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 affects 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* if 3 to 6 percent; *high* if 6 to 9 percent; and *very high* if more 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 0.10 to 0.43. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

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

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

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 17 shows 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 17 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 or *brief* if 2 to 7 days. 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 is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table–that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated.

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. “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. Structural steel that intersects soil boundaries or soil layers is more susceptible to corrosion than structural steel that is 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.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the

series described in the section “Soil Series and Their Morphology.” The soil samples were tested by Texas Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) (1) or the American Society for Testing and Materials (ASTM) (2).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Specific gravity (particle density)—T 100 (AASHTO), D 653 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

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

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustalf (*Ust*, meaning intermediate between dry and moist, 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 Paleustalfs (*Pale*, meaning well developed horizonation, plus *ustalf*, the suborder of the Alfisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Ultic Paleustalfs, the subgroup of Paleustalfs that is an intergrade to the Ultisols order.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, thermic Ultic Paleustalfs.

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" *(7)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(5)* and in "Keys to Soil Taxonomy" *(6)*. 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.

Altoga Series

The Altoga series consists of very deep, well drained, clayey soils on breaks of high terraces. These soils formed in calcareous, clayey sediments. Slopes range from 5 to 8 percent.

Typical pedon of Altoga silty clay, 5 to 8 percent slopes, eroded; 0.8 mile south of San Gabriel on Farm Road 486, and 1,200 feet west on Farm Road 1331, about 200 feet, in an area of cropland:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine granular and subangular blocky structure; hard, firm; few fine roots; few fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.
Bk1—7 to 16 inches; brownish yellow (10YR 6/6) silty clay, yellowish brown (10YR 5/6) moist; strong fine granular and subangular blocky structure; hard, firm; few fine roots; common wormcasts; about 10 percent fine and medium concretions and masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
Bk2—16 to 36 inches; brownish yellow (10YR 6/6) silty clay, yellowish brown (10YR 5/6) moist; moderate medium granular and fine subangular blocky structure; hard, firm; few fine roots; few wormcasts; about 20 percent fine and medium concretions and masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
Bk3—36 to 62 inches; yellow (10YR 7/6) silty clay loam, brownish yellow (10YR 6/6) moist; weak medium granular and fine subangular blocky structure; hard, firm; few fine roots; few wormcasts; about 10 percent fine and medium concretions and masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
BCk—62 to 80 inches; yellow (10YR 7/6) loam, brownish yellow (10YR 6/6) moist; weak fine subangular blocky structure; massive; slightly hard, friable; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. The clay content decreases with depth. The calcium carbonate equivalent in the 10- to 40-inch control section is 40 to 60 percent.

The A horizon is 6 to 14 inches thick. It is very dark grayish brown, dark grayish brown, dark brown, brown, grayish brown, light brownish gray, pale brown, or light yellowish brown. If the A horizon is less than 10 inches thick, it is very dark grayish brown, dark grayish brown, or dark brown.

The B horizon is brown, yellowish brown, light yellowish brown, light brownish gray, pale brown, brownish yellow, very pale brown, or yellow silty clay, silty clay loam, or clay loam.

The BCk horizon is silty clay loam, loam, or clay loam in shades of brown or yellow.

Bastsil Series

The Bastsil series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in gravelly, stratified sandy and loamy alluvial sediments. Slopes range from 0 to 2 percent.

Typical pedon of Bastsil fine sandy loam, 0 to 2 percent slopes; from the junction of Farm Road 1915 and Farm Road 437, about 0.7 mile north of Davilla, 3.0 miles north on Farm Road 437 to Val Verde, 2.4 miles east and northeast of Val Verde on gravel road, 200 feet north, in an area of cropland:

Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; moderate fine granular structure; hard, friable; common fine roots; neutral; clear smooth boundary.
A—6 to 16 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; hard, friable; few fine roots; neutral; clear wavy boundary.
Bt1—16 to 41 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; many fine pores; few thin clay films on faces of peds; few fine siliceous pebbles; neutral; clear wavy boundary.
Bt2—41 to 80 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine and medium siliceous pebbles; thinly stratified clayey and loamy sediments; slightly alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is 12 to 20 inches thick. It is dark brown, brown, or reddish brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, yellowish red, reddish yellow, or red. It is sandy clay loam, loam or clay loam. Reaction is neutral or slightly alkaline. In some places the soils are underlain by sandy, loamy, and gravelly sediments.

Bigbrown Series

The Bigbrown series consists of very deep, well drained, loamy soils that are developing in reclaimed lignite mine spoil materials. Slopes range from 2 to 8 percent.

Typical pedon of Bigbrown clay loam, 2 to 5 percent slopes; 3 miles northeast on Farm Road 2116 from its junction with Farm Road 1786 at Aluminum Company of America plant, and 3,000 feet southeast of road, in an area of pastureland:

A—0 to 2 inches; yellowish brown (10YR 5/6) clay loam, dark yellowish brown (10YR 4/6) moist; weak

fine granular and platy structure; hard, firm; few fine roots; few 0.25- to 2.0-inch fragments of lignite, pyrite, shale, and sandstone in horizon and scattered on surface; moderately acid; gradual wavy boundary.

C—2 to 80 inches; brownish yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; many strata and pockets of sandy and clayey materials in shades of red, gray, brown, and yellow; massive; hard, firm; few fine roots in upper part; few 0.25- to 2.0-inch fragments of lignite, pyrite, shale, and sandstone; moderately acid.

Within very short distances, the soil materials change in texture, color, and reaction and content of lignite, pyrite, shale, and sandstone fragments. Texture is mainly clay loam, sandy clay loam, or silty clay loam having strata and pockets of sandy and clayey materials. Soil materials are in shades of red, gray, brown, and yellow. Reaction ranges from moderately acid to slightly alkaline. There are few to many lignite, pyrite, shale, and sandstone fragments.

Bosque Series

The Bosque series consists of very deep, well drained, loamy soils on flood plains of streams (fig. 18). These soils formed in loamy alluvium. Slopes are mainly less than 1 percent.

Typical pedon of Bosque clay loam, occasionally flooded; from the junction of Farm Road 1915 and Farm Road 437, about 0.7 mile north of Davilla, 3.0 miles north on Farm Road 437 to Val Verde, 3.7 miles east and northeast of Val Verde on gravel road, 200 feet west, in an area of cropland:

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; slightly hard, friable; few fine roots; few fine fragments of snail shells; common films and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 21 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; slightly hard, friable; few fine roots; few fine fragments of snail shells; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A2—21 to 52 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular and subangular blocky structure; slightly hard, friable; few fine roots; few fine fragments of snail shells; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bw—52 to 80 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; common films and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 28 to 60 inches thick. It is very dark grayish brown, dark grayish brown, or grayish brown. Some pedons have thin sandy or clayey strata.

The Bw horizon is brown, pale brown, yellowish brown, or light yellowish brown. Texture is clay loam or loam. Some pedons do not have a Bw horizon.

Some pedons have a C horizon below a depth of 30 inches. This horizon has color and texture similar to those of the Bw horizon.

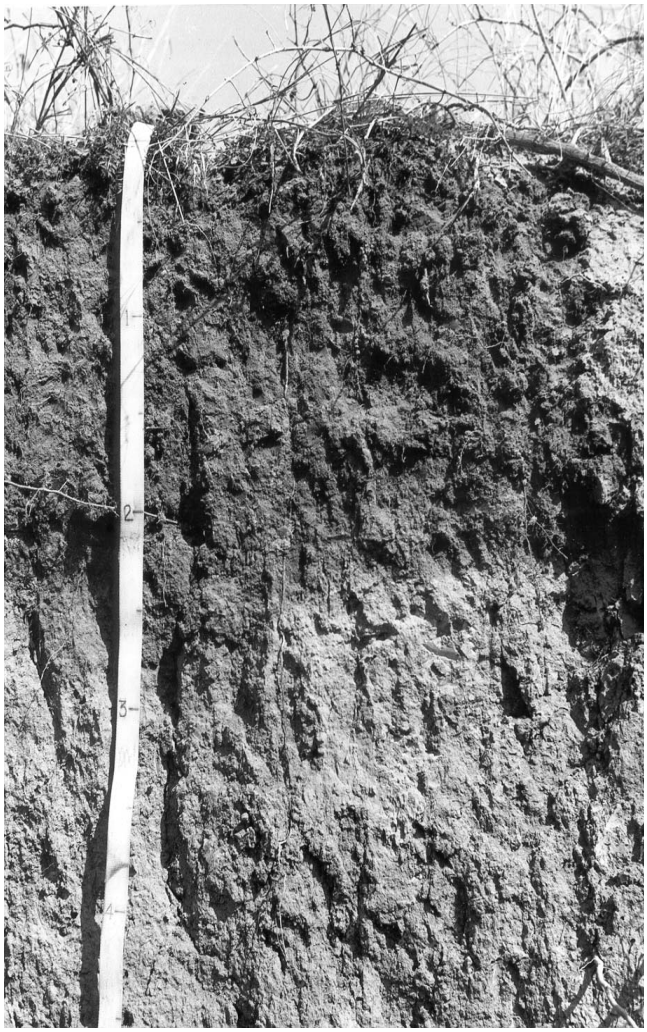

Figure 18.—Profile of Bosque clay loam. The surface layer is thick and dark in color. The scale is in feet.

Branyon Series

The Branyon series consists of very deep, moderately well drained, clayey soils on stream terraces. These soils formed in clayey alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Branyon clay, 0 to 1 percent slopes; from the intersection of Highway 36 and Farm Road 1915 in Buckholts, 4.5 miles north on Farm Road 1915, about 0.75 mile west on gravel road, 200 feet in an area of cropland:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky, very plastic; few fine roots; few fine fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 22 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, very sticky, very plastic; few fine roots; few fine fragments of snail shells; few fine black concretions; few fine siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

A2—22 to 58 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, very sticky, very plastic; few fine roots; common slickensides; few fine fragments of snail shells; few fine black concretions; few fine siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Bk—58 to 80 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine faint very pale brown mottles in lower part; few medium streaks of dark gray in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common slickensides; few fine black concretions; few fine and medium concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Within a horizontal distance of 8 to 10 feet, the A horizon ranges in thickness from 10 inches in the center of the microknoll to 58 inches in the center of the microdepression. When the soils are dry, cracks range from 0.4 inch to 4.0 inches in width and extend to a depth of 20 inches or more.

The A horizon is dark gray or very dark gray. It is predominantly moderately alkaline and is calcareous. It is slightly alkaline in microdepressions.

The Bk horizon is gray, light gray, grayish brown, or light brownish gray. It is mottled in shades of yellow or brown. Streaks of dark gray or very dark gray are in filled cracks. This horizon is clay or silty clay.

Some pedons have a C horizon, which is clay, silty clay, or silty clay loam in shades of gray, yellow, or brown. Some areas are underlain by water-bearing beds of sand and gravel at a depth of 15 to 25 feet.

Burleson Series

The Burleson series consists of very deep, moderately well drained, clayey soils on stream terraces. These soils formed in clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Burleson clay, 0 to 2 percent slopes; 1.5 miles north of Burlington on U.S. Highway 77, about 4.0 miles southeast on Farm Road 1445, about 200 feet west, in an area of cropland:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; light gray (10YR 6/1) silty clay surface crust about 1 inch thick; weak fine granular and subangular blocky structure; very hard, firm, very sticky, very plastic; few fine roots; few siliceous pebbles; slightly alkaline; abrupt smooth boundary.

A1—6 to 26 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few siliceous pebbles; few fine black concretions; slightly alkaline; gradual wavy boundary.

A2—26 to 38 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine streaks of dark gray (10YR 4/1) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common slickensides; few siliceous pebbles; few fine black concretions; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk1—38 to 60 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine streaks of dark gray (10YR 4/1) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few slickensides; few siliceous pebbles; few fine black concretions; few fine concretions of calcium carbonate; few threads and gypsum crystals; calcareous; moderately alkaline; gradual wavy boundary.

Bk2—60 to 80 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; few fine streaks of gray (10YR 5/1) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine

roots; few slickensides; few siliceous pebbles; few fine black concretions; few fine concretions and soft masses of calcium carbonate; few threads and gypsum crystals; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. Within a horizontal distance of 5 to 15 feet, the A horizon ranges in thickness from 10 inches in the center of the microknoll to 50 inches in the center of the microdepression. When the soils are dry, cracks range from 1 to 3 inches in width and extend to a depth of 25 to 60 inches.

The A horizon is very dark gray, dark gray, or gray. Reaction is neutral or mildly alkaline in microdepressions and slightly alkaline or moderately alkaline on microknolls.

The Bw or Bk horizon is gray, light gray, grayish brown, or light brownish gray, with streaks of very dark gray or dark gray in filled cracks. It is clay or silty clay. Reaction is slightly alkaline or moderately alkaline. Most areas are underlain by beds of gravel and sand at a depth of 15 to 25 feet.

Chazos Series

The Chazos series consists of very deep, moderately well drained, sandy soils on stream terraces. These soils formed in sandy and clayey alluvial sediments. Slopes range from 1 to 3 percent.

Typical pedon of Chazos loamy fine sand, 1 to 3 percent slopes; northwest of Baileyville; from the intersection of Farm Road 2027 and the Falls County line, 1.2 miles south on Farm Road 2027, 0.3 mile east on private road, 400 feet north, in a pasture:

A—0 to 9 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary.

E—9 to 17 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—17 to 26 inches; mottled red (2.5YR 5/6), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) sandy clay; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—26 to 36 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/6), and red (2.5YR 5/6) sandy clay; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; slightly acid; clear smooth boundary.

BC—36 to 56 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common medium faint brownish yellow (10YR 6/6) and few fine prominent red (2.5YR 5/6) mottles; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; slightly alkaline; clear smooth boundary.

BCk—56 to 80 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common medium faint brownish yellow (10YR 6/6) mottles; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few fine concretions of calcium carbonate; few fine siliceous pebbles; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 10 to 20 inches. The A horizon is brown, pale brown, light yellowish brown, or light brownish gray. The E horizon is pale brown, very pale brown, light brown, or light gray. Reaction is moderately acid or slightly acid in the A and E horizons.

The Bt horizon is yellowish red, red, yellowish brown, or brownish yellow with few to many reddish, yellowish, grayish, or brownish mottles. It is sandy clay or clay. In some pedons, the Bt horizon is mottled in shades of red, yellow, gray, or brown. Reaction is moderately acid or slightly acid in the upper part and ranges from moderately acid to neutral in the lower part.

The BC horizon is mottled in shades of red, gray, brown, or yellow. It is sandy clay, sandy clay loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline.

Crockett Series

The Crockett series consists of moderately well drained, loamy soils on uplands. These soils are deep to weathered shale. They formed in interbedded clay and shale. Slopes range from 1 to 5 percent.

Typical pedon of Crockett fine sandy loam, 1 to 3 percent slopes; 3.5 miles north of Rockdale on Farm Road 487, about 200 feet east of road, in a brushy pasture:

Ap—0 to 7 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure when moist, massive when dry; very hard, friable; common fine roots; neutral; abrupt wavy boundary.

Bt1—7 to 13 inches; brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; many thick clay

films on faces of peds; few streaks of dark brown fine sandy loam in filled cracks; few fine black concretions; neutral; gradual wavy boundary.

Bt2—13 to 22 inches; brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; few fine distinct reddish brown (5YR 5/4) and light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; many thick clay films on faces of peds; few pressure faces; few streaks of dark brown fine sandy loam in filled cracks; few fine black concretions; few fine siliceous pebbles; neutral; gradual wavy boundary.

Bt3—22 to 33 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common fine prominent red (2.5YR 5/6) and few fine distinct light brown (7.5YR 6/4) mottles; moderate fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few pressure faces; few streaks of dark brown fine sandy loam in filled cracks; few fine black concretions; few fine siliceous pebbles; slightly alkaline; gradual wavy boundary.

BC—33 to 42 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few fine faint light brownish gray and yellow mottles; weak fine and medium angular blocky and subangular blocky structure; hard, firm; few fine roots; few fine pores; few streaks of dark brown fine sandy loam in filled cracks; few interbedded sandy and weathered shale layers in lower part; few fine black concretions; few fine concretions and masses of calcium carbonate; slightly alkaline; gradual wavy boundary.

C—42 to 80 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, firm; common interbedded weathered shale layers; few fine masses of calcium carbonate; moderately alkaline.

The solum ranges from 40 to 80 inches in thickness. The A horizon is 4 to 8 inches thick. It is dark brown, brown, pale brown, dark grayish brown, grayish brown, yellowish brown, or light yellowish brown. Reaction is slightly acid or neutral.

The Bt horizon is extremely variable in color within short distances. Matrix colors are reddish brown, dark brown, or brown throughout, with grayish colors in the lower part. Mottles in shades of red, brown, yellow, or gray range from few to many. The Bt horizon is clay, clay loam, or sandy clay. Reaction ranges from slightly acid to neutral in the upper part and from slightly acid to slightly alkaline in the lower part.

The BC horizon has mottles in shades of red, brown, yellow, and gray. Matrix colors are light yellowish brown, yellowish brown, dark brown, or brown. This horizon is clay, clay loam, or sandy clay. Reaction range from slightly acid to moderately alkaline.

The C horizon is clay, clay loam, or sandy loam interbedded with weathered shale material. Shades of yellow, olive, gray, or brown predominate. Reaction is slightly alkaline or moderately alkaline.

Davilla Series

The Davilla series consists of very deep, moderately well drained, loamy soils on stream terraces. These soils formed in loamy alluvial sediments. Slopes range from 0 to 2 percent.

Typical pedon of Davilla loam in an area of Wilson-Davilla complex, 0 to 2 percent slopes; from the junction of Farm Road 487 and Farm Road 437 in Davilla, 3.6 miles southeast on Farm Road 487, about 50 feet north, in an area of brushy rangeland:

Ap—0 to 10 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/4) moist; weak fine granular structure when moist, massive when dry; very hard, friable; few fine roots; few wormcasts; few siliceous pebbles up to 1 centimeter across; slightly acid; clear wavy boundary.

Bt1—10 to 24 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; few fine distinct light gray (10YR 7/1) and brownish yellow (10YR 6/6) mottles; weak fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few wormcasts; few thin clay films on faces of peds; few fine black concretions; few siliceous pebbles up to 5 millimeters across; neutral; gradual wavy boundary.

Bt2—24 to 34 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; common fine distinct light gray (10YR 7/1) and few fine prominent reddish yellow (5YR 6/6) mottles; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine black concretions; few siliceous pebbles up to 5 millimeters across; neutral; gradual wavy boundary.

Btg1—34 to 44 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; few fine faint light gray and common fine distinct reddish yellow (7.5YR 6/8) mottles; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine black concretions; few siliceous pebbles up to 5 millimeters across; slightly alkaline; gradual wavy boundary.

Btg2—44 to 50 inches; light gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; common fine distinct

brownish yellow (10YR 6/6) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine black concretions; few thin clay films on faces of peds; few siliceous pebbles up to 5 millimeters across; slightly alkaline; gradual wavy boundary.

Btg3—50 to 60 inches; light gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; few fine distinct brownish yellow (10YR 6/6) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine black concretions; few faint clay films on faces of peds; few fine concretions of calcium carbonate; few siliceous pebbles up to 5 millimeters across; slightly alkaline; gradual wavy boundary.

Btg4—60 to 80 inches; light gray (10YR 7/1) clay loam, light gray (10YR 6/1) moist; few fine distinct brownish yellow (10YR 6/6) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine black concretions; few fine concretions of calcium carbonate; few faint clay films on faces of peds; few siliceous pebbles up to 5 millimeters across; slightly alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The clay content of the control section ranges from 27 to 35 percent. Some pedons contain up to 15 percent siliceous pebbles. Depth to secondary carbonates is more than 36 inches.

The A horizon is mainly less than 10 inches thick, but can range to 16 inches. It is brown, dark brown, light brown, pale brown, light brownish gray, light yellowish brown, or yellowish brown. Reaction is slightly acid or neutral.

The B horizon is widely varied in shades of gray, brown, olive, or yellow. Some pedons are mottled in shades of red, gray, brown, or yellow. The B horizon is clay loam or sandy clay loam. Reaction ranges from slightly acid to slightly alkaline in the upper part and from neutral to moderately alkaline in the lower part.

Some pedons have a C horizon, which consists of stratified sandy, silty, and clayey sediments that are mainly clay loam, sandy clay loam, or silty clay loam and are in shades of gray, brown, olive, or yellow. Reaction is slightly alkaline or moderately alkaline.

Desan Series

The Desan series consists of very deep, somewhat excessively drained, sandy soils on stream terraces. These soils formed in sandy and loamy alluvial sediments. Slopes range from 1 to 5 percent.

Typical pedon of Desan loamy fine sand, 1 to 5 percent slopes; northwest of Baileyville; from the intersection of Farm Road 2027 and the Falls County line, 1.2 miles south on Farm Road 2027, about 1.2 miles east on private road, 200 feet north, in a pasture:

A—0 to 8 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; single grained; loose; common fine roots; few fine siliceous pebbles; slightly acid; clear smooth boundary.

E—8 to 50 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; few fine roots; few fine siliceous pebbles; slightly acid; clear wavy boundary.

Bt—50 to 80 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; few thin clay films on faces of peds; slightly acid.

The solum ranges from 66 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 40 to 80 inches. The A horizon is brown, light yellowish brown, or reddish yellow. The E horizon is very pale brown, light brown, or reddish yellow. Reaction is slightly acid or neutral in the A and E horizons.

The Bt horizon is red, reddish yellow, or yellowish red fine sandy loam or sandy clay loam. Reaction is moderately acid or slightly acid.

Edge Series

The Edge series consists of well drained, loamy soils on uplands (fig. 19). These soils are deep to weathered siltstone. They formed in interbedded loamy and clayey sediments. Slopes range from 2 to 8 percent.

Typical pedon of Edge fine sandy loam, 2 to 5 percent slopes, eroded; 2.5 miles northwest of Milano on Texas Highway 36, about 1.0 mile northeast on unpaved road, 75 feet east of road, in a pasture:

A—0 to 8 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine and medium roots; few fine and medium pores; few fine ironstone pebbles; moderately acid; clear smooth boundary.

E—8 to 11 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; common fine and medium roots; few fine and medium pores; few fine ironstone pebbles; few fine fragments of red (2.5YR 4/6) Bt material; slightly acid; abrupt smooth boundary.

Bt1—11 to 19 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few fine distinct pale brown

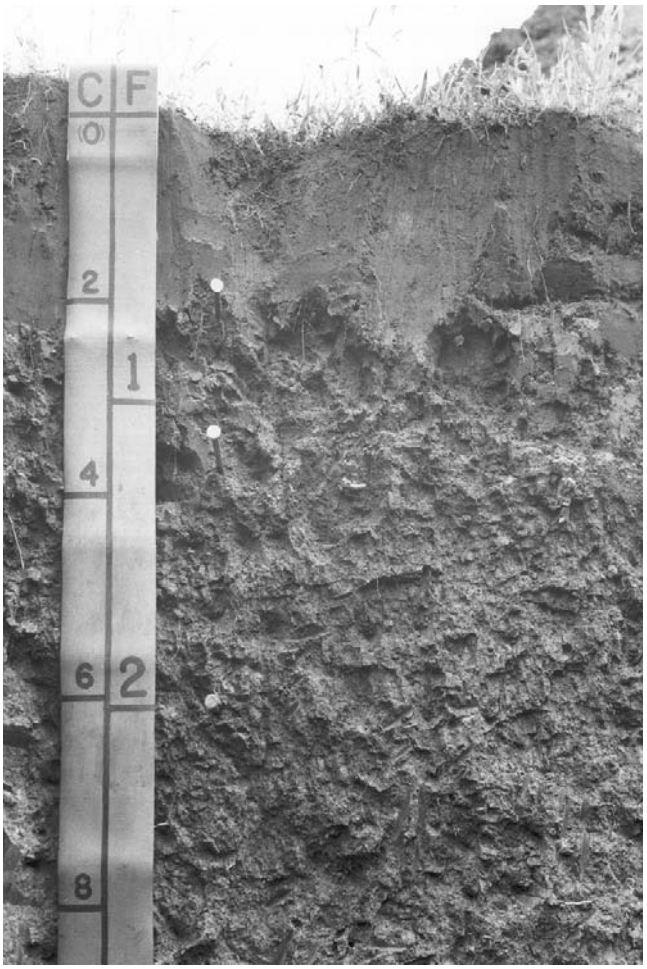

Figure 19.—Profile of Edge fine sandy loam. The clayey subsoil has angular blocky structure.

(10YR 6/3) mottles; moderate medium angular blocky structure parting to moderate fine angular blocky; extremely hard, firm; few fine and very fine roots; few fine pores; common medium distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—19 to 29 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; common medium distinct pale brown (10YR 6/3) and few fine distinct yellowish brown (10YR 5/4) mottles; weak medium and coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm; few fine and very fine roots; few fine pores; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—29 to 37 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; common fine distinct light yellowish brown (10YR 6/4) and common fine distinct brown (10YR 5/3) mottles; weak medium and coarse prismatic structure parting to moderate fine angular blocky; very hard, firm; few fine and very fine roots; few fine pores; few very dark gray (10YR 3/1) organic stains along root channels; common distinct reddish brown (5YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt4—37 to 43 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, firm; few fine and very fine roots; few medium pores; common medium distinct dark brown (7.5YR 4/4) clay films on vertical faces of peds; few medium very dark gray (10YR 3/1) organic stains; few fine light brownish gray (10YR 6/2) seams along old shale planes; slightly acid; gradual smooth boundary.

BCt—43 to 48 inches; reddish yellow (5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few fine faint light yellowish brown and few fine distinct light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; few fine and very fine roots; common medium dark brown (7.5YR 4/4) clay films on vertical faces of peds; few fine light brownish gray (10YR 6/2) seams along old shale bedding planes; platy, inherited structure dominates in places; neutral; gradual smooth boundary.

C/B1—48 to 58 inches; strong brown (7.5YR 5/6) weakly consolidated siltstone that has loam texture; few medium distinct red (2.5YR 5/6) mottles; weak very coarse prismatic structure; very hard, friable; few very fine roots; few brown (7.5YR 5/4) clay films on vertical faces of peds; few medium segregations of barite; horizon becomes stratified with depth in strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) with thin discontinuous gray (N 6/0) seams of shale; slightly alkaline; gradual smooth boundary.

C/B2—58 to 75 inches; light yellowish brown (10YR 6/4) weakly consolidated siltstone that has loam texture; massive; very hard, friable; few very fine roots; few thin horizontal streaks of strong brown (7.5YR 5/6); slightly alkaline; gradual smooth boundary.

C—75 to 80 inches; light brownish gray (10YR 6/2) weakly consolidated siltstone that has silt loam texture; massive; very hard, friable; slightly alkaline.

The solum ranges from 40 to 60 inches in thickness. The combined thickness of the A and E horizons ranges from 6 to 15 inches in uneroded areas. The A

horizon is dark brown, brown, grayish brown, or pale brown. The E horizon, is slightly lighter in color than the A horizon. Reaction ranges from moderately acid to neutral in the A and E horizons. Some pedons do not have an E horizon.

The Bt horizon is red, reddish brown, light reddish brown, or yellowish red. In some places, it is mottled in shades of red, brown, and yellow in the lower part. It is clay or sandy clay in the upper part and sandy clay, sandy clay loam, or clay loam in the lower part. Reaction ranges from very strongly acid to moderately acid in the upper part and from very strongly acid to neutral in the lower part.

The C/B and C horizons are fine sandy loam, loam, or sandy clay loam. Some pedons are interbedded with sandy, clayey, silty, and stratified siltstone sediments. These horizons are in shades of red, gray, yellow, or brown. Reaction ranges from neutral to moderately alkaline.

Ferris Series

The Ferris series consists of well drained soils on uplands. These soils are deep to weathered shale. They formed in shale and marl. Slopes range from 5 to 15 percent.

Typical pedon of Ferris clay in an area of Ferris-Heiden complex, 5 to 15 percent slopes, eroded; 0.4 mile east of Yarrelton on Farm Road 485, about 1.1 miles north on gravel road, 0.4 mile east, in a pasture:

A—0 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular and angular blocky structure; very hard, very firm, very sticky, very plastic; many fine roots; few fine black concretions; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Bw—10 to 40 inches; olive (5Y 5/4) clay, olive (5Y 4/4) moist; common streaks of grayish brown (2.5Y 5/2) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common slickensides; few fine black concretions; few fine concretions and soft masses of calcium carbonate in lower part; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

C—40 to 80 inches; mottled light yellowish brown (2.5Y 6/4) and pale olive (5Y 6/3) shale that has clay texture; massive; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few fine black concretions; few chert pebbles; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Cracks extend to a depth of more than 20 inches when this soils are dry.

The A horizon is 4 to 12 inches thick. It is grayish brown, dark grayish brown, light olive brown, or light olive gray.

The Bw horizon is light yellowish brown, light olive brown, olive yellow, pale olive, or olive clay or silty clay that can have mottles in shades of gray, brown, olive or yellow. Streaks of dark grayish brown or very dark grayish brown are in filled cracks.

The C horizon is dominantly pale olive or light yellowish brown clay, marl, or weathered shale that has clay texture. Mottles in shades of gray, brown, olive, or yellow may be present.

Frio Series

The Frio series consists of very deep, well drained, clayey soils on flood plains of streams. These soils formed in clayey alluvium. Slopes are mainly less than 1 percent.

Typical pedon of Frio silty clay, occasionally flooded; 6.2 miles north of Davilla on Farm Road 437, about 1,200 feet west, in an area of cropland:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; weak fine granular and subangular blocky structure; hard, firm; few fine roots; few fine fragments of snail shells; calcareous; moderately alkaline; diffuse wavy boundary.

A1—6 to 26 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine fragments of snail shells; calcareous; moderately alkaline; diffuse wavy boundary.

A2—26 to 50 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few thin loamy strata; few fine fragments of snail shells; calcareous; moderately alkaline; diffuse wavy boundary.

Bw—50 to 80 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few thin loamy strata; few fine fragments of snail shells; calcareous; moderately alkaline.

The A horizon is 28 to more than 40 inches thick. It is dark brown, dark grayish brown, or very dark grayish brown. Some pedons have thin loamy or clayey strata.

The B horizon is grayish brown, dark grayish brown, or pale brown with or without brownish mottles. It is silty clay, silty clay loam, or clay loam. Some pedons do not have a B horizon.

Gaddy Series

The Gaddy series consists of very deep, somewhat excessively drained, loamy soils on flood plains of streams. These soils formed in stratified sandy and loamy alluvial sediments. Slopes are mostly 0 to 3 percent.

Typical pedon of Gaddy fine sandy loam, frequently flooded; 7.3 miles east of Maysfield on Farm Road 485, about 1.5 miles northeast on gravel road to Port Sullivan cemetery, 0.9 mile northeast on private road, 100 feet north, in a pasture:

A—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; common fine roots; calcareous; moderately alkaline; gradual wavy boundary.

C1—7 to 29 inches; light brown (7.5YR 6/4) loamy fine sand that has few 0.5- to 2.0-inch strata of brown (7.5YR 4/4) silt loam and fine sandy loam; massive; slightly hard, very friable; few fine roots; calcareous; moderately alkaline; gradual wavy boundary.

C2—29 to 60 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; common thin silty strata; calcareous; moderately alkaline; gradual wavy boundary.

C3—60 to 80 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; loose; few thin silty strata; calcareous; moderately alkaline.

The A horizon is 7 to 12 inches thick. It is brown, light brown, light yellowish brown, or reddish yellow.

The C horizon is very pale brown, pink, light brown, light yellowish brown, or yellow. It is fine sand or loamy fine sand that has thin strata of finer textured material.

Gause Series

The Gause series consists of very deep, moderately well drained, sandy soils on stream terraces. These soils formed in loamy and clayey alluvial sediments. Slopes range from 0 to 3 percent.

Typical pedon of Gause loamy fine sand, 1 to 3 percent slopes; 1.2 miles southwest of Gause on U.S. Highway 79 to railroad crossing, 0.4 mile southwest on unpaved county road to bend in road, 200 feet southeast, in a cultivated field:

Ap—0 to 14 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; loose, very friable; common fine and medium roots; few fine siliceous pebbles; slightly acid; clear smooth boundary.

Bt1—14 to 17 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few fine distinct reddish yellow (7.5YR 6/8) mottles; weak fine angular blocky structure; hard, firm; few fine and medium roots; few fine pores; few thin clay films on faces of peds; few fine siliceous pebbles; strongly acid; clear smooth boundary.

Bt2—17 to 27 inches; reddish yellow (7.5YR 6/8) clay, strong brown (7.5YR 5/8) moist; few medium distinct yellowish red (5YR 5/6) and few fine distinct light yellowish brown (10YR 6/4) mottles; weak fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine siliceous pebbles; strongly acid; gradual wavy boundary.

Bt3—27 to 48 inches; mottled red (2.5YR 4/6), reddish yellow (7.5YR 6/8), and light yellowish brown (10YR 6/4) clay; weak fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine siliceous pebbles; strongly acid; gradual wavy boundary.

BCt—48 to 80 inches; mottled red (2.5YR 4/6), reddish yellow (7.5YR 6/6), and very pale brown (10YR 7/3) clay loam; weak fine and medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; few thin sandy and clayey strata; few siliceous pebbles up to 5 centimeters across; moderately acid.

The solum ranges from 60 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 10 to 18 inches. The A horizon is pale brown or brown. Some pedons have a pale brown or very pale brown E horizon. Reaction is moderately acid or slightly acid in the A and E horizons. Some pedons have a few ironstone fragments at the lower boundary of the A or E horizon.

The B horizon is yellowish brown, light yellowish brown, brownish yellow, or reddish yellow. Mottles are in shades of red, yellow, and brown. Some pedons are mottled in shades of red, yellow, and brown in the lower part. The B horizon is sandy clay, clay, or clay loam in the upper part and sandy clay loam, clay loam, or sandy clay in the lower part. Reaction ranges from very strongly acid to moderately acid.

Gowen Series

The Gowen series consists of very deep, well drained, loamy soils on flood plains of streams. These soils formed in stratified loamy sediments. Slopes are mainly less than 1 percent.

Typical pedon of Gowen clay loam, frequently flooded; 0.45 mile northwest of Baileyville on Farm Road 2027, about 1 mile southwest on gravel road, 200 feet north, in a pasture:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, firm; common fine roots; few fine pores; few wormcasts; neutral; clear smooth boundary.

A2—9 to 26 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; hard, firm; common fine roots; few fine pores; few thin brown (10YR 5/3) sandy strata; slightly alkaline; clear smooth boundary.

A3—26 to 37 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin brown (10YR 5/3) sandy strata; slightly alkaline; clear smooth boundary.

Bw1—37 to 50 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm; few fine roots; few fine pores; few fine concretions of calcium carbonate; few fine siliceous pebbles; slightly alkaline; clear smooth boundary.

Bw2—50 to 80 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine faint light yellowish brown mottles; massive; hard, firm; few fine roots; few fine pores; few fine concretions of calcium carbonate; few fine siliceous pebbles; slightly alkaline.

The A horizon ranges from 24 to 40 inches thick. It is very dark grayish brown, dark grayish brown, dark brown, or dark gray. In some pedons, the lower part is stratified with sandy, loamy, or clayey materials. Reaction is neutral or slightly alkaline.

The Bw horizon is brown, dark brown, yellowish brown, grayish brown, or dark grayish brown loam or clay loam. In some pedons, it is stratified with sandy, silty, or clayey materials. Reaction is neutral or slightly alkaline.

Heiden Series

The Heiden series consists of well drained soils on uplands. These soils are deep to weathered shale. They formed in shale and marl. Slopes range from 2 to 15 percent.

Typical pedon of Heiden clay, 2 to 5 percent slopes; 1.8 miles west of Buckholts on Texas Highway 36, about 2 miles north on gravel road, 0.4 mile east and north on gravel road, 200 feet west, in a pasture:

A1—0 to 10 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine subangular and angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few fine fragments of snail shells; few fine black concretions; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

A2—10 to 21 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few fine fragments of snail shells; few fine black concretions; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Bw1—21 to 32 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; few fine faint light gray mottles; few streaks of dark grayish brown (2.5Y 4/2) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common slickensides; few fine fragments of snail shells; few fine black concretions; few fine white crystals; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—32 to 44 inches; pale yellow (5Y 7/3) clay, pale olive (5Y 6/3) moist; few fine faint light gray and few fine prominent brownish yellow (10YR 6/8) mottles; few streaks of dark grayish brown (2.5Y 4/2) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common slickensides; few fine fragments of snail shells; few fine black concretions; few fine white crystals; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 80 inches; pale olive (5Y 6/3) weathered shale that has clay texture, olive (5Y 5/3) moist; few fine faint light gray and few fine distinct olive yellow (2.5Y 6/6) mottles; massive; extremely hard, very firm, very sticky, very plastic; few fine black concretions; few fine white crystals; calcareous; moderately alkaline.

The combined thickness of the A and B horizons ranges from about 40 to 64 inches. The microknolls have the thinnest horizons and the microdepressions have the thickest. When the soils are dry, cracks 0.4 inch to 4.0 inches wide extend to a depth of 20 inches or more.

The A horizon is 12 to 32 inches thick and is dark grayish brown, very dark grayish brown, or olive gray.

The B horizon is grayish brown, light olive brown, light olive gray, pale olive, olive, pale yellow, or light yellowish brown. Mottles are in shades of gray, brown, yellow, or olive. Streaks of dark grayish brown, very dark grayish brown, or olive gray are in filled cracks.

The C horizon is dominantly pale olive or light yellowish brown weathered shale or marl with mottles in shades of gray, brown, olive, or yellow.

Houston Black Series

The Houston Black series consists of very deep, moderately well drained, clayey soils on uplands. These soils formed in weathered shale and marl. Slopes range from 1 to 3 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; 0.7 mile west of Buckholts on Texas Highway 36, about 1.9 miles south and west on winding gravel road, 200 feet west, in an area of cropland:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium granular and subangular blocky structure; very hard, firm, very sticky, very plastic; common fine roots; few fine fragments of snail shells; few fine black concretions; few chert pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 24 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, very sticky, very plastic; few fine roots; few fine fragments of snail shells; few chert pebbles; few fine black concretions; calcareous; moderately alkaline; gradual wavy boundary.

A2—24 to 46 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few fine fragments of snail shells; common slickensides; few fine black concretions; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Bw1—46 to 55 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; common fine streaks of dark gray (10YR 4/1) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few fine fragments of snail shells; few slickensides; few fine black concretions; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—55 to 67 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; few fine faint brownish yellow mottles; few fine streaks of gray (10YR 5/1) clay in filled cracks; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few slickensides; few fine black concretions; few fine white crystals; calcareous; moderately alkaline; gradual wavy boundary.

C—67 to 80 inches; yellow (10YR 8/8) weathered shale that has clay texture, yellow (10YR 7/8) moist; few fine faint light yellowish brown mottles; massive; extremely hard, very firm; few fine white crystals; calcareous; moderately alkaline.

The combined thickness of the A and B horizons ranges from 60 to more than 100 inches. Within a horizontal distance of about 8 to 10 feet, thickness of the A horizon ranges from 10 inches in the center of the microknoll to 50 inches in the center of the microdepression. When the soils are dry, cracks range from 0.4 inch to 4.0 inches in width and extend to a depth of 20 inches or more.

The A horizon is dark gray or very dark gray. The soil is calcareous. Reaction is dominantly moderately alkaline; however, it is slightly alkaline in microdepressions.

The B horizon is grayish brown, dark grayish brown, light yellowish brown, light olive brown, or pale yellow, with or without mottles in shades of gray, yellow, or olive. Streaks of gray, dark gray, or very dark gray are in filled cracks. Texture is clay or silty clay.

The C horizon is dominantly yellow, olive yellow, pale olive, or olive weathered shale or marl that has clay texture with mottles or thin strata in shades of gray, brown, yellow, or olive.

Jedd Series

The Jedd series consists of moderately deep, well drained, loamy soils on uplands (fig. 20). These soils formed in weakly cemented sandstone.

Typical pedon of Jedd very gravelly sandy loam, 3 to 15 percent slopes; from the intersection of Farm Road 3242 and U.S. Highway 79 in Milano, 6.7 miles east on U.S. Highway 79, about 2.5 miles northwest on unpaved road, 20 feet west of road, in a pasture:

A—0 to 5 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; about 40 percent angular sandstone and ironstone fragments ranging from 0.25 inch to 6.0 inches across; many fragments the size of gravel, cobbles, stones, and boulders scattered on surface; slightly acid; clear wavy boundary.

Figure 20.—Profile of Jedd very gravelly sandy loam. Weakly cemented sandstone bedrock underlies this soil at a depth of 25 inches. The scale is in feet.

E—5 to 11 inches; yellowish red (5YR 5/6) very gravelly sandy loam, yellowish red (5YR 4/6) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; about 40 percent angular sandstone and ironstone fragments ranging from 0.25 inch to 6.0 inches across; moderately acid; abrupt wavy boundary.

Bt1—11 to 21 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate fine and medium angular blocky structure; hard, firm; few fine roots; few fine pores; many thick clay films on faces of peds; few small angular sandstone and ironstone fragments; strongly acid; clear wavy boundary.

Bt2—21 to 25 inches; red (2.5YR 4/8) sandy clay loam, dark red (2.5YR 3/6) moist; weak fine and medium angular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few small angular sandstone and ironstone fragments; strongly acid; clear wavy boundary.

Cr—25 to 80 inches; red (2.5YR 5/8) weakly cemented sandstone; very strongly acid.

The solum ranges from 20 to 36 inches in thickness. The combined thickness of the A and E horizons ranges from 6 to 12 inches. The A horizon is brown, dark brown, yellowish brown, or dark yellowish brown. The E horizon is light brown, light yellowish brown, pale brown, or yellowish red. Sandstone and ironstone fragments range from 30 to 50 percent by volume. Reaction ranges from moderately acid to neutral in the A and E horizons.

The Bt horizon is red, reddish brown, reddish yellow, or yellowish red. It is sandy clay or clay in the upper part and ranges to sandy clay loam in the lower part. In some pedons, mottles in shades of red, brown, or yellow are in the lower part of the horizon. Reaction is strongly acid or moderately acid.

The Cr horizon is weakly cemented sandstone in shades of red, brown, or yellow.

Lewisville Series

The Lewisville series consists of very deep, well drained, clayey soils on stream terraces. These soils formed in clayey alluvium. Slopes range from 1 to 3 percent.

Typical pedon of Lewisville silty clay, 1 to 3 percent slopes; from the intersection of State Highway 6 and Farm Road 486, about 6.4 miles south on Farm Road 486, and 0.6 mile east and north on gravel road, 400 feet west, in an area of cropland:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; few fine roots; few fine fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

A—6 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, firm; few fine roots; few wormcasts; few fine fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

Bk1—14 to 26 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few reddish yellow wormcasts; few fine streaks of dark grayish brown; few fine fragments of snail shells; about 4 percent fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk2—26 to 51 inches; reddish yellow (7.5YR 6/6) silty clay, strong brown (7.5YR 5/6) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few wormcasts; few fine dark grayish brown streaks; few fine fragments of snail shells; about 6 percent fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk3—51 to 80 inches; reddish yellow (7.5YR 6/6) silty clay, strong brown (7.5YR 5/6) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few wormcasts; few fine dark grayish brown streaks; few fine fragments of snail shells; about 8 percent fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to 80 inches thick. Thickness of the A horizon ranges from 10 to 20 inches. It is dark brown, dark grayish brown, or very dark grayish brown.

The Bk horizon is light brown, brown, pale brown, very pale brown, yellowish brown, light yellowish brown, or reddish yellow silty clay, silty clay loam, or clay loam.

Some pedons have a Ck horizon that is silty clay loam or clay loam in shades of yellow or brown.

Lufkin Series

The Lufkin series consists of very deep, moderately well drained, loamy soils on stream terraces. These soils formed in loamy and clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Lufkin loam in an area of Lufkin-Gause complex, 0 to 1 percent slopes; from the intersection of Farm Road 2095 and State Highway 79 in Gause, 1 mile east on Highway 79, about 0.8 mile southeast on gravel road, 300 feet, in a pasture:

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure when moist, massive when dry; very hard, friable; common fine roots; slightly acid; abrupt wavy boundary.

Btg1—6 to 16 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few thin clay films on faces of peds; few pressure faces; few streaks of grayish brown fine sandy loam in filled cracks; few fine black concretions; neutral; clear smooth boundary.

Btg2—16 to 29 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few thin clay films on faces of peds; few pressure faces; few streaks of grayish brown fine sandy loam in filled cracks; few fine black concretions; mildly alkaline; clear smooth boundary.

Btg3—29 to 41 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine faint brownish yellow mottles; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine black concretions; few fine concretions of calcium carbonate; many gypsum crystals; mildly alkaline; clear smooth boundary.

Btg4—41 to 55 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common fine faint brownish yellow (10YR 6/8) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine black concretions; few fine concretions of calcium carbonate; few gypsum crystals; moderately alkaline; gradual smooth boundary.

BC—55 to 80 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; common fine faint brownish yellow (10YR 6/8) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine black concretions; few gypsum crystals; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The A horizon is 4 to 10 inches thick. It is grayish brown, dark grayish brown, or dark gray.

The B horizon is dark gray, gray, light gray, light brownish gray, grayish brown, or dark grayish brown. Mottles in the lower part are in shades of gray, brown, or yellow. The B horizon is clay or clay loam. Reaction is slightly acid or neutral in the upper part, and ranges from neutral to moderately alkaline in the lower part.

These soils are outside the range of the Lufkin series. The reaction is neutral in the upper part of the argillic horizon. Use and management, however, are not significantly influenced by this difference.

Minerva Series

The Minerva series consists of very deep, well drained, sandy soils on uplands (fig. 21). These soils formed in sandy and loamy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Minerva loamy fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 77 and U.S. Highway 190 in Cameron, 10 miles south on U.S. Highway 190, about 2.3 miles northeast on unpaved road, 1,100 feet, in a pasture:

A—0 to 4 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; loose, very friable;

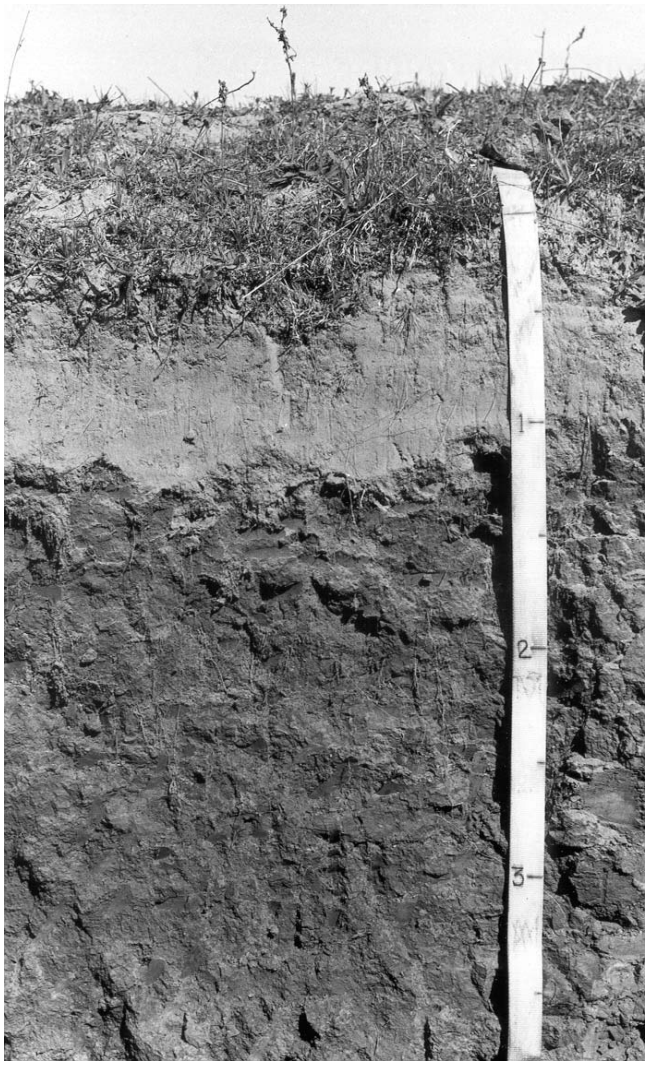

Figure 21.—Profile of Minerva loamy fine sand. There is an abrupt change from a sandy subsurface layer to a loamy subsoil at a depth of 12 inches. The scale is in feet.

common fine roots; slightly acid; clear smooth boundary.

E—4 to 14 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; weak fine granular structure; loose, very friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—14 to 28 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; common fine pores; few thin clay films on faces of peds; moderately acid; gradual wavy boundary.

Bt2—28 to 48 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; common fine pores; few thin clay films on faces of peds; moderately acid; gradual wavy boundary.

Bt3—48 to 78 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; strongly acid; gradual wavy boundary.

BCt—78 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; few fine distinct very pale brown (10YR 7/3) mottles; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; moderately acid.

The solum ranges from 60 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 10 to 20 inches. The A horizon is dark brown, brown, pale brown, or light yellowish brown. The E horizon is light yellowish brown or very pale brown. Reaction is slightly acid or neutral.

The B horizon is red, reddish yellow, or yellowish red. In some pedons, it is mottled in the lower part in shades of red, brown, or yellow. It is typically sandy clay loam or clay loam but includes sandy clay in the upper part and fine sandy loam and loam in the lower part. Reaction is strongly acid or moderately acid.

Some pedons have a C horizon that is sandy clay loam, fine sandy loam, or loamy sand. Some pedons contain thin interbedded layers of sandstone. The C horizon is in shades of red, gray, brown, or yellow. Reaction ranges from very strongly acid to moderately acid.

Minwells Series

The Minwells series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in gravelly, stratified sandy and clayey alluvial sediments. Slopes range from 1 to 5 percent.

Typical pedon of Minwells fine sandy loam, 1 to 5 percent slopes; 0.7 mile north of Davilla on Farm Road 437, about 3.8 miles east on Farm Road 1915 to the old Friendship school, 200 feet south of road, on the school grounds:

A1—0 to 5 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; many fine and medium roots; few fine siliceous pebbles; slightly acid; clear smooth boundary.

A2—5 to 10 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable; many fine and medium roots; few fine siliceous pebbles; slightly acid; abrupt wavy boundary.

Bt1—10 to 22 inches; reddish brown (2.5YR 4/4) sandy clay, dark reddish brown (2.5YR 3/4) moist; few fine faint yellowish red mottles; moderate medium

angular blocky structure; very hard, firm; few fine roots; few fine pores; thick continuous clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—22 to 38 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; few fine faint yellowish red mottles; weak medium angular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine siliceous pebbles; slightly alkaline; clear wavy boundary.

Bt3—38 to 50 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; few fine faint red mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine masses of calcium carbonate in lower part; few fine siliceous pebbles; slightly alkaline; clear wavy boundary.

BCk1—50 to 66 inches; mottled yellowish red (5YR 5/8) and reddish yellow (7.5YR 6/8) sandy clay loam; weak medium subangular blocky structure; hard, firm; few fine pores; about 5 percent masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

BCk2—66 to 80 inches; mottled yellowish red (5YR 5/8) and reddish yellow (7.5YR 6/8) sandy clay loam; weak medium subangular blocky structure; hard, firm; about 30 percent masses of calcium carbonate; moderately alkaline.

The solum ranges from 40 to about 80 inches in thickness. Beds of sand, clay, and gravel are below this depth.

The A horizon is 7 to 15 inches thick. It is dark brown, brown, pale brown, or light brown. Reaction is slightly acid or neutral. Siliceous pebbles make up 0 to 10 percent by volume.

The Bt horizon is reddish brown, red, or yellowish red. Mottles are in shades of red or yellow. This horizon is clay, sandy clay, or clay loam. Clay content of the upper 20 inches ranges from 35 to 45 percent. Siliceous pebbles make up 0 to 10 percent by volume. Reaction ranges from slightly acid to slightly alkaline.

The BCk horizon is typically mottled in shades of red, yellow, or brown. It is sandy clay loam, gravelly sandy clay loam, or very gravelly sandy clay loam. Siliceous pebbles range from 5 to 50 percent by volume. Concretions and masses of calcium carbonate make up 5 to 20 percent. Reaction is slightly alkaline or moderately alkaline.

Normangee Series

The Normangee series consists of moderately well drained, loamy soils on uplands. They are deep to weakly consolidated shale. These soils formed in clay and shale sediments. Slopes range from 1 to 3 percent.

Typical pedon of Normangee clay loam, 1 to 3 percent slopes; from the junction of Farm Road 3242 and U.S. Highway 79 in Milano,1 mile north on Farm Road 3242, about 1,400 feet west, in an area of cropland:

Ap—0 to 6 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak fine granular and subangular blocky structure; very hard, firm; few fine roots; few fine pores; few wormcasts; slightly acid; clear wavy boundary.

Bt1—6 to 14 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; many thick clay films on faces of peds; many pressure faces; neutral; gradual smooth boundary.

Bt2—14 to 27 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; few fine prominent yellowish red (5YR 4/6) and light olive brown (2.5Y 5/4) mottles; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; many thick clay films on faces of peds; many pressure faces; few fine black concretions; neutral; gradual smooth boundary.

Bt3—27 to 40 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; few thin clay films on faces of peds; few pressure faces; few fine black concretions; few fine concretions of calcium carbonate; few fine siliceous rock fragments; moderately alkaline; clear smooth boundary.

C—40 to 80 inches; light yellowish brown (2.5Y 6/4) weakly consolidated shale that has clay texture, light olive brown (2.5Y 5/4) moist; few fine faint yellow mottles; weak medium platy structure; very hard, firm; few fine decayed roots; few fine concretions of calcium carbonate; few fine siliceous rock fragments; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The A horizon ranges from 4 to 8 inches in thickness. It is dark grayish brown, dark brown, or brown. Reaction is slightly acid or neutral.

The upper part of the B horizon is reddish brown, yellowish brown, or brown and the lower part is grayish brown, brown, pale brown, very pale brown, dark yellowish brown, light yellowish brown, light brown, or light olive brown. Mottles are in shades of red, gray, brown, or yellow. Reaction is slightly acid or neutral in the upper part and ranges from neutral to moderately alkaline in the lower part.

The C horizon is in shades of gray, brown, olive, or yellow and is weakly consolidated interbedded shale

that has clay texture stratified with clay, silty clay, or clay loam.

Oakalla Series

The Oakalla series consists of very deep, well drained, loamy soils on flood plains of streams. These soils formed in loamy alluvium. Slopes are mainly less than 1 percent.

Typical pedon of Oakalla silty clay loam, occasionally flooded; from the intersection of County Road 421 and Farm Road 486 in San Gabriel, 2.0 miles west, 1,800 feet south on field road, 200 feet west, in a pasture:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard; friable; common fine roots; common fine fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

Ak1—6 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; common fine fragments of snail shells; few fine threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Ak2—22 to 38 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; common fine fragments of snail shells; few fine threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk—38 to 80 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; common fine fragments of snail shells; common fine threads and masses of calcium carbonate; few siliceous pebbles; few fine decayed roots; calcareous; moderately alkaline.

The A horizon ranges from 28 to more than 40 inches in thickness. It is very dark grayish brown, dark grayish brown, grayish brown, or dark brown. Some pedons have thin sandy or clayey strata.

The B horizon is brown, pale brown, yellowish brown, or light yellowish brown. It is silty clay loam, clay loam, or loam. Some pedons do not have a B horizon.

In some pedons, a C horizon is at a depth of 40 inches or more. It is similar in color and texture to the B horizon; however, it does not have soil structure. It is silty clay loam, clay loam, or loam. Some pedons are underlain by sandy strata.

Padina Series

The Padina series consists of very deep, well drained, sandy soils on uplands. These soils formed in thick sandy beds that have apparently been reworked by wind. Slopes range from 1 to 8 percent.

Typical pedon of Padina fine sand, 1 to 8 percent slopes; from the intersection of Texas Highway 36 and Highway 79 in Milano, south on Highway 36 for 5 miles to the Elevation community, 3.7 miles south and west on county road, 1.2 miles south on county road, 1.6 miles west on county road, 0.6 mile northwest on private road, 100 feet east, in an area of wooded rangeland:

A—0 to 8 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine and medium roots; slightly acid; clear smooth boundary.

E—8 to 66 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; common fine and medium roots; slightly acid; clear wavy boundary.

Bt1—66 to 74 inches; mottled light gray (10YR 7/2) and reddish yellow (7.5YR 6/8) sandy clay loam; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—74 to 80 inches; mottled light gray (10YR 7/2) and red (2.5YR 5/6) sandy clay loam; weak fine subangular blocky structure; hard, firm; few fine pores; few thin clay films on faces of peds; strongly acid.

The thickness of the solum is more than 80 inches. The combined thickness of the A and E horizons ranges from 40 to 80 inches. The A and E horizons are pale brown, very pale brown, light yellowish brown, or light brownish gray. Reaction is slightly acid or neutral.

The Bt horizons are mainly mottled in shades of gray, red, brown, and yellow. They are sandy clay loam or fine sandy loam. Reaction ranges from strongly acid to slightly acid.

Payne Series

The Payne series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in clayey sediments. Slopes range from 0 to 2 percent.

Typical pedon of Payne loam, 0 to 2 percent slopes; 0.2 mile south of Val Verde on Farm Road 437, about 200 feet west, in an area of cropland:

Ap—0 to 7 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; massive when dry, weak fine granular structure when moist; very hard, firm; few fine roots; slightly acid; abrupt smooth boundary.
Bt1—7 to 22 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; few pressure faces; slightly acid; clear smooth boundary.
Bt2—22 to 34 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; few pressure faces; neutral; clear smooth boundary.
Btk1—34 to 42 inches; brown (7.5YR 5/2) clay, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; few fine concretions and masses of calcium carbonate; moderately alkaline; clear smooth boundary.
Btk2—42 to 80 inches; brown (7.5YR 5/2) clay loam, brown (7.5YR 4/2) moist; weak fine and medium subangular blocky structure; hard, firm; few fine concretions and masses of calcium carbonate; moderately alkaline.

The solum ranges from 60 to 80 inches in thickness. The A horizon ranges from 6 to 10 inches in thickness. It is dark grayish brown, brown, or dark brown. Reaction is slightly acid or neutral.

The B horizon is dark reddish brown, reddish brown, dark brown, or brown. It is clay or clay loam. Reaction is slightly acid or neutral in the upper part and slightly alkaline or moderately alkaline in the lower part.

Rader Series

The Rader series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in interbedded sandy and clayey sediments. Slopes range from 1 to 3 percent.

Typical pedon of Rader loamy fine sand, 1 to 3 percent slopes; 10 miles south of Cameron on U.S. Highway 190, about 2.3 miles northeast on unpaved road, 200 feet west, in a pasture:

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; loose, very friable; common fine roots; slightly acid; clear wavy boundary.
E—5 to 18 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; loose, very friable; common fine roots; slightly acid; clear wavy boundary.
Bt/E—18 to 26 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common fine faint pale brown mottles (10YR 6/3); weak fine granular and subangular blocky structure; hard, firm; common fine roots; common fine pores; common streaks and pockets of very pale brown (10YR 7/4) clean sand (E part) from overlying horizon; few fine black concretions; moderately acid; clear wavy boundary.
Bt1—26 to 52 inches; mottled light gray (10YR 7/2), brownish yellow (10YR 6/6), and red (2.5YR 4/6) sandy clay; moderate fine and medium subangular blocky structure; very hard, very firm; few fine roots; many fine pores; common thin clay films on faces of peds; few fine black concretions; strongly acid; gradual wavy boundary.
Bt2—52 to 71 inches; mottled light gray (10YR 7/2), brownish yellow (10YR 6/6), and red (2.5YR 4/6) sandy clay; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; common thin clay films on faces of peds; few fine black concretions; moderately acid; gradual wavy boundary.
Bt3—71 to 80 inches; mottled light gray (10YR 7/2), brownish yellow (10YR 6/6), and red (2.5YR 4/6) sandy clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine pores; few thin clay films on faces of peds; few fine black concretions; few fine masses of calcium carbonate in lower part; neutral.

The solum ranges from more than 60 inches in thickness. The combined thickness of the A and E horizons ranges from 14 to 20 inches. The A and E horizons are light brown, brown, yellowish brown, light yellowish brown, pale brown, very pale brown, or light brownish gray. Reaction is moderately acid or slightly acid.

The Bt/E horizon is 70 to 85 percent Bt material and 15 to 30 percent E material. The Bt material is brownish yellow, light yellowish brown, yellowish brown, or light brownish gray. It is sandy clay loam. It is mottled in shades of red, gray, brown, or yellow. The E material is very pale brown, pale brown, or light yellowish brown loamy fine sand or fine sandy loam. Reaction is moderately acid or slightly acid.

The Bt horizon is mottled in shades of red, gray, brown, or yellow. It is sandy clay or clay in the upper part and sandy clay or sandy clay loam in the lower

part. Reaction is strongly acid to moderately acid in the upper part and moderately acid or slightly alkaline in the lower part. Some pedons are underlain by a BC horizon that contains concretions of calcium carbonate.

Riesel Series

The Riesel series consists of very deep, well drained, gravelly, loamy soils on stream terraces. These soils formed in gravelly, sandy, and clayey alluvium. Slopes range from 1 to 5 percent.

Typical pedon of Riesel gravelly fine sandy loam, 1 to 5 percent slopes; 1.7 miles west of Sharp on Farm Road 487, about 0.2 mile north on gravel road, 100 feet east of road, in a pasture:

A—0 to 8 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; common fine roots; about 30 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; clear smooth boundary.

AE—8 to 11 inches; yellowish brown (10YR 5/4) very gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable; few fine roots; about 50 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; abrupt smooth boundary.

Bt1—11 to 20 inches; red (2.5YR 4/6) very gravelly clay, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few fine pores; thin clay films on faces of peds and pebbles; about 45 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; clear wavy boundary.

Bt2—20 to 27 inches; red (2.5YR 5/6) very gravelly clay, red (2.5YR 4/6) moist; weak fine subangular blocky structure; extremely hard, very firm; few fine roots; few fine pores; thin clay films on faces of peds and pebbles; about 35 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; clear wavy boundary.

Bt3—27 to 37 inches; red (2.5YR 5/6) extremely gravelly clay, red (2.5YR 4/6) moist; common fine prominent reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; about 65 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; clear wavy boundary.

Bt4—37 to 60 inches; reddish brown (5YR 5/4) extremely gravelly clay, reddish brown (5YR 4/4) moist; few fine distinct reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds and pebbles; about 65 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; abrupt wavy boundary.

2C—60 to 80 inches; pale brown (10YR 6/3) very gravelly loamy fine sand, brown (10YR 5/3) moist; about 50 percent siliceous pebbles; slightly alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The combined thickness of the A and E horizons ranges from 10 to 20 inches. The A and E horizons are very dark grayish brown, dark grayish brown, grayish brown, or brown. Siliceous pebbles and limestone fragments range from 15 to as much as 65 percent by volume. Reaction is slightly acid or neutral.

The Bt horizon is dusky red, dark red, red, weak red, or reddish brown. Mottles are in shades of red, yellow, or brown. The Bt horizon is very gravelly clay loam or very gravelly clay. Siliceous pebbles range from 10 to 70 percent by volume. Reaction is slightly acid or neutral.

The solum is underlain by gravelly beds of sand, or sand and gravel that contain 25 to 90 percent coarse fragments. It is gravelly fine sand or very gravelly loamy fine sand. Reaction is neutral to moderately alkaline.

Sandow Series

The Sandow series consists of very deep, moderately well drained, loamy soils on flood plains of streams. These soils formed in stratified loamy alluvium.

Typical pedon of Sandow clay loam, frequently flooded; from the intersection of U.S. Highway 79 and U.S. Highway 77 in Rockdale, 5.9 miles south on U.S. Highway 77 to flood plain of East Yegua Creek, 300 feet south of bridge on Highway 77, about 250 feet east, in a pasture:

A—0 to 8 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky, plastic; common fine roots; few fine pores; few wormcasts; moderately acid; clear smooth boundary.

Bw—8 to 16 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; few fine prominent yellowish red (5YR 5/6) and few fine faint pale brown mottles; weak medium subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; few fine pores; moderately acid; abrupt smooth boundary.

A'b—16 to 19 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; common fine and medium faint brown (10YR 4/3) mottles; weak fine subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; few fine pores; slightly acid; clear smooth boundary.

Bwb1—19 to 28 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; common medium and coarse distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; few fine pores; few mica flakes; slightly acid; clear smooth boundary.

Bwb2—28 to 48 inches; light yellowish brown (10YR 6/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; few medium and coarse faint brownish yellow (10YR 6/6) and few fine distinct pale brown (10YR 6/3) mottles; fine subangular blocky structure; hard, very friable, sticky, plastic; few fine roots; few fine and medium pores; few mica flakes; slightly acid; gradual smooth boundary.

Bwb3—48 to 62 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; common fine distinct yellowish brown (10YR 6/8) and common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak fine and medium subangular blocky structure; hard, very friable, sticky, plastic; few fine roots; few fine pores; few mica flakes; few fine iron-manganese concretions and masses; slightly acid; gradual smooth boundary.

Bwb4—62 to 80 inches; light yellowish brown (10YR 6/4) loam with discontinuous strata and spots of clay loam, yellowish brown (10YR 5/4) moist; many fine and medium distinct gray (10YR 6/1) and common fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, very friable, sticky, plastic; few fine roots; few fine pores; few mica flakes; few fine iron-manganese concretions and masses; slightly acid.

The solum is more than 80 inches in thickness. Depth to loamy alluvium is 7 to about 15 feet. Buried A horizons are in the control section of most pedons.

The A horizon is dark gray, dark grayish brown, dark brown, or brown. Reaction ranges from moderately acid to neutral.

The Bw horizon is brown, pale brown, light yellowish brown, yellowish brown, light brown, reddish yellow, or strong brown. Mottles in shades of brown, gray, yellow, and red range from few to many. This horizon is fine sandy loam, very fine sandy loam, loam, clay loam, or sandy clay loam. Reaction ranges from moderately acid to slightly alkaline.

A buried A horizon having moist colors of brown or gray ranges in thickness from 2 to about 12 inches. It is fine sandy loam, very fine sandy loam, sandy clay loam, or clay loam. Reaction is slightly acid or neutral.

The Bwb horizon has color, texture, and reaction similar to the Bw horizon.

Satin Series

The Satin series consists of well drained, gravelly, loamy soils on ancient stream terraces. They are deep to weakly consolidated shale. These soils formed in gravelly sediments. Slopes range from 1 to 3 percent.

Typical pedon of Satin gravelly clay loam, 1 to 3 percent slopes; 2.6 miles northwest of Buckholts on Texas Highway 36, about 300 feet east, in a pasture:

A—0 to 9 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, very dark brown (10YR 2/2) moist; moderate fine granular and subangular blocky structure; very hard, firm; common fine roots; about 25 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; clear wavy boundary.

Bt1—9 to 20 inches; dark gray (10YR 4/1) very gravelly clay, very dark gray (10YR 3/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; few fine roots; thin clay films on faces of peds and pebbles; few fine black concretions; about 50 percent siliceous pebbles 0.25 inch to 2.0 inches across; neutral; gradual wavy boundary.

Bt2—20 to 42 inches; gray (10YR 5/1) very gravelly clay, dark gray (10YR 4/1) moist; few fine prominent dark red (2.5YR 3/6) mottles; few fine streaks of very dark grayish brown (10YR 3/2) clay loam in filled cracks; weak fine and medium angular blocky structure; few fine roots; thin clay films on faces of peds and pebbles; few fine black concretions; about 55 percent siliceous pebbles 0.25 inch to 3.0 inches across; neutral; gradual wavy boundary.

Bt3—42 to 60 inches; light gray (2.5Y 7/2) very gravelly clay, light brownish gray (2.5Y 6/2) moist; few fine distinct yellow (10YR 7/8) mottles; weak fine and medium angular blocky structure; extremely hard, very firm; few fine roots; thin clay films on faces of peds and pebbles; few fine black concretions; about 55 percent siliceous pebbles 0.25 inch to 3.0 inches across; slightly alkaline; clear wavy boundary.

2Ck—60 to 80 inches; mottled olive yellow (2.5Y 6/6), brownish yellow (10YR 6/6) and light olive gray (5Y 6/2) weakly consolidated shale that has silty clay texture; massive; very hard, firm; many masses of calcium carbonate; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The A horizon ranges from 6 to 12 inches in thickness. The A horizon is black, dark gray, or very dark grayish brown. Siliceous pebbles range from few to 35 percent. Reaction is neutral or slightly alkaline.

The Bt horizon is dark gray, gray, dark brown, dark grayish brown, or grayish brown. Some pedons have a few mottles in shades of red, brown, or yellow. It is very gravelly clay or extremely gravelly clay. Siliceous pebbles range from 35 to 75 percent by volume. Reaction ranges from neutral to moderately alkaline.

The C horizon is mainly weathered shale which is mottled in shades of olive, yellow, brown, and gray and contains masses of calcium carbonate.

Seawillow Series

The Seawillow series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in loamy alluvium. Slopes range from 2 to 8 percent.

Typical pedon of Seawillow loam, 2 to 8 percent slopes; 1.7 miles west of San Gabriel on gravel road, 0.2 mile north on gravel road, 100 feet west, in an area of rangeland:

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular and subangular blocky structure; slightly hard, friable; common fine roots; few fine snail shell fragments; few wormcasts; few fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline; clear smooth boundary.

Bk1—8 to 20 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; few wormcasts; few fine and medium concretions of calcium carbonate; few fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

Bk2—20 to 30 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; few wormcasts; about 5 percent fine and medium concretions and masses of calcium carbonate; few fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

Bk3—30 to 38 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; about 10 percent fine and medium concretions and masses of calcium carbonate; few fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

Bk4—38 to 50 inches; yellow (10YR 7/6) loam, brownish yellow (10YR 6/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; about 5 percent fine and medium concretions and masses of calcium carbonate; few fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

BCk—50 to 80 inches; yellow (10YR 7/6) loam, brownish yellow (10YR 6/6) moist; weak fine subangular blocky structure; slightly hard, friable; about 5 percent fine and medium concretions and masses of calcium carbonate; about 15 percent fine and medium limestone and siliceous pebbles; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. Calcium carbonate equivalent in the 10- to 40-inch control section is 40 to 60 percent.

The A horizon ranges from 6 to 14 inches in thickness. It is very dark grayish brown, dark brown, brown, grayish brown, light brownish gray, pale brown, or light yellowish brown. If the A horizon is very dark grayish brown or dark brown, it is less than 10 inches thick.

The B horizon is brown, yellowish brown, light yellowish brown, light brownish gray, pale brown, brownish yellow, very pale brown, yellow, or yellowish brown. It is loam, silty clay loam, or clay loam.

The BC horizon consists of loamy sediments in shades of brown or yellow. In some pedons, sand and gravel beds are at a depth of 8 to 10 feet.

Ships Series

The Ships series consists of very deep, moderately well drained, clayey soils on flood plains of streams. These soils formed in clayey alluvial sediments. Slopes are less than 1 percent.

Typical pedon of Ships clay, rarely flooded; from the Brazos River bridge on Farm Road 485 at Port Sullivan, 0.2 mile west on Farm Road 485, about 800 feet south on field road, 50 feet west, in an area of cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky and angular blocky structure;

very hard, firm, very sticky, very plastic; few fine roots; few fine snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.
A1—6 to 28 inches; reddish brown (2.5YR 4/4) with few 1- to 4-inch thick strata of dark grayish brown (10YR 4/2) clay; moderate fine and medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few slickensides in lower part; few fine snail shell fragments; calcareous; moderately alkaline; diffuse wavy boundary.
A2—28 to 44 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; moderate fine and medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few fine snail shell fragments; few slickensides; calcareous; moderately alkaline; diffuse wavy boundary.
A3—44 to 64 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; moderate fine and medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few fine snail shell fragments; few slickensides; few very fine concretions and masses of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.
Bk—64 to 80 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine snail shell fragments; few slickensides; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The average clay content of the 10- to 40-inch control section is 60 to 80 percent. Some pedons are thinly stratified with silty and loamy sediments.

Thickness of the A horizon ranges from 30 to more than 60 inches. It is dark reddish brown, reddish brown, reddish gray, or dark reddish gray.

The Bk horizon is reddish brown, dark reddish brown, dark red, or red. In some pedons, it is thinly stratified with silty, sandy, and clayey sediments below a depth of 40 inches. Calcium carbonate concretions range from none to few.

Silawa Series

The Silawa series consists of very deep, well drained, sandy soils on stream terraces. These soils formed in sandy and loamy alluvial sediments. Slopes range from 1 to 8 percent.

Typical pedon of Silawa loamy fine sand, 1 to 3 percent slopes; from the intersection of Farm Road 2095 and U.S. Highway 79 in Gause, 3.2 miles northeast on U.S. Highway 79, about 0.4 mile northwest on unpaved road, 100 feet north, in a pasture:

Ap—0 to 14 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine granular structure; loose, very friable; few fine roots; few fine and medium siliceous gravel and fragments of ironstone; slightly acid; clear smooth boundary.
Bt1—14 to 22 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; few thin clay films on faces of peds; few fine and medium siliceous gravel and fragments of ironstone; moderately acid; gradual smooth boundary.
Bt2—22 to 50 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine and medium siliceous gravel and fragments of ironstone; strongly acid; gradual smooth boundary.
Bt3—50 to 80 inches; reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 5/8) moist; weak fine subangular blocky structure; slightly hard, friable; few fine pores; few fine and medium siliceous gravel and fragments of ironstone; very strongly acid.

The solum ranges from 40 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 6 to 18 inches. The A horizon is pale brown, brown, dark brown, yellowish brown, light brown, light yellowish brown, or very pale brown. Some pedons have an E horizon. Reaction of the A and E horizons is moderately acid or slightly acid.

The B horizon is reddish brown, red, light red, yellowish red, reddish yellow, or strong brown. It is fine sandy loam or sandy clay loam. Reaction ranges from very strongly acid to moderately acid.

Some pedons have a C horizon that consists of sandy and gravelly sediments in shades of red, brown, and yellow.

Silstid Series

The Silstid series consists of very deep, well drained, sandy soils on uplands and stream terraces. These soils formed in sandy and loamy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Silstid loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 2027 with the Falls County line, 1.2 miles south on

Farm Road 2027, 0.5 mile east on private road, 200 feet north, in a pasture:

A—0 to 8 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; loose, very friable; many fine roots; few fine siliceous pebbles; neutral; clear wavy boundary.
E—8 to 32 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; loose, very friable; many fine roots; few fine siliceous pebbles; neutral; abrupt wavy boundary.
Bt1—32 to 40 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; few fine faint reddish yellow mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; common thin clay films on faces of peds; few fine black concretions; moderately acid; gradual wavy boundary.
Bt2—40 to 53 inches; mottled very pale brown (10YR 7/4), brownish yellow (10YR 6/8), and red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine black concretions; moderately acid; gradual wavy boundary.
Bt3—53 to 60 inches; mottled red (2.5YR 5/8) and brownish yellow (10YR 6/8) sandy clay loam; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine black concretions; moderately acid; gradual wavy boundary.
Bt4—60 to 72 inches; mottled red (2.5YR 5/8) and reddish yellow (7.5YR 6/8) sandy clay loam; weak medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few fine black concretions; moderately acid; gradual wavy boundary.
Bt5—72 to 80 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; few medium distinct very pale brown (10YR 7/4) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; few thin clay films on faces of peds; moderately acid.

The solum ranges from 60 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 24 to 38 inches. The A horizon is dark brown, dark yellowish brown, yellowish brown, brown, pale brown, or light brown. The E horizon is very pale brown, pale brown, or light yellowish brown. Reaction is slightly acid or neutral.

The B horizon is brownish yellow, very pale brown, reddish yellow, yellowish red, or strong brown. Mottles are in shades of red, brown, or yellow. A few gray mottles are in the lower part of the B horizon in some pedons. The B horizon is sandy clay loam or fine sandy loam. Reaction is strongly acid or moderately acid.

Some pedons have a C horizon that consists of stratified sandy and clayey sediments in shades of red, gray, brown, and yellow. Reaction ranges from strongly acid to slightly acid.

Sunev Series

The Sunev series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in loamy alluvium. Slopes range from 2 to 5 percent.

Typical pedon of Sunev loam, 2 to 5 percent slopes; from the intersection of Farm Road 437 and Farm Road 2268 west of Val Verde, 1.6 miles north on Farm Road 437, about 300 feet west on county road, 100 feet, in an area of rangeland:

A1—0 to 11 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; common fine roots; few wormcasts; few limestone and siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.
A2—11 to 18 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores, few wormcasts; few fine concretions of calcium carbonate; calcareous; moderately alkaline, clear wavy boundary.
Bk1—18 to 30 inches; strong brown (7.5YR 5/6) loam, strong brown (7.5YR 4/6) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; few wormcasts; about 5 percent fine concretions and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.
Bk2—30 to 40 inches; reddish yellow (7.5YR 6/6) loam, strong brown (7.5YR 5/6) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; common fine pores; few wormcasts; about 15 percent fine and medium concretions and masses of calcium carbonate; few limestone and siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.
Bk3—40 to 80 inches; reddish yellow (7.5YR 7/6) loam, reddish yellow (7.5YR 6/6) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; few fine

pores; common wormcasts; about 25 percent fine and medium concretions and masses of calcium carbonate; few limestone and siliceous pebbles; calcareous; moderately alkaline.

The solum ranges from 40 to 80 inches in thickness. The A horizon ranges from 10 to 18 inches in thickness. It is dark brown, very dark grayish brown, or dark grayish brown.

The B horizon is brown, strong brown, light brown, reddish yellow, light yellowish brown, yellowish brown, pale brown, or very pale brown silty clay loam, loam, or clay loam.

In some pedons, a reddish yellow, light brown, or very pale brown silty clay loam, clay loam, or loam C horizon overlies beds of sand and gravel.

Tinn Series

The Tinn series consists of very deep, moderately well drained, clayey soils on flood plains of streams. These soils formed in clayey alluvial sediments. Slopes range from 0 to 1 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Farm Road 485 and Farm Road 2269 at Yarrelton, 2.1 miles south on Farm Road 2269, about 0.8 mile west and south on gravel road, 100 feet west, in an area of wooded rangeland:

A—0 to 24 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular and angular blocky structure; very hard, very firm, very sticky, very plastic; common fine and medium roots; common pressure faces and common slickensides; few fine fragments of snail shells; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

Bw—24 to 52 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak fine subangular and angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few fine pores; common pressure faces and common slickensides; few cracks filled with light colored clayey material; few fine fragments of snail shells; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

C—52 to 80 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; extremely hard, very firm, very sticky, very plastic; few fine roots; few fine pores; few thin strata of lighter and darker colored clayey materials; few fine fragments of snail shells; few fine black concretions; calcareous; moderately alkaline.

The A horizon ranges from 24 to more than 80 inches in thickness. It is dark gray or very dark gray. Lighter colors along filled cracks are common. Reaction is slightly alkaline or moderately alkaline.

The Bw and C horizons are grayish brown, dark grayish brown, or very dark grayish brown clay or silty clay. In some pedons, they are mixed and stratified with sand and gravel below a depth of 50 inches.

Travis Series

The Travis series consists of very deep, well drained, sandy and loamy soils on stream terraces. These soils formed in stratified loamy and clayey alluvial sediments. Slopes range from 1 to 8 percent.

Typical pedon of Travis loamy fine sand, 1 to 3 percent slopes; from the intersection of Farm Road 2095 and U.S. Highway 79 in Gause, 3.7 miles northeast on U.S. Highway 79, about 1.3 miles east and northwest on unpaved road to bend in road, 200 feet south, in a pasture:

Ap—0 to 9 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine granular structure; loose, very friable; common fine and medium roots; few fine siliceous pebbles; moderately acid; clear smooth boundary.

E—9 to 17 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; loose, very friable; common fine and medium roots; few fine siliceous pebbles; slightly acid; abrupt smooth boundary.

Bt1—17 to 33 inches; red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; weak fine and medium subangular blocky structure; very hard, firm; few fine and medium roots; few fine pores; thick continuous clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—33 to 50 inches; red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; few fine prominent reddish yellow (7.5YR 6/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; about 10 percent fine and medium siliceous pebbles; very strongly acid; clear wavy boundary.

Bt3—50 to 80 inches; red (2.5YR 4/6) gravelly sandy clay loam, dark red (2.5YR 3/6) moist; few fine prominent reddish yellow (7.5YR 6/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; about 15 percent fine and medium siliceous pebbles; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. The combined thickness of the A and E horizons ranges from 5 to 20 inches. The A horizon is brown, pale brown, light yellowish brown, or yellowish brown. The E horizon is pale brown, light brown, or light yellowish brown. Textures range from loamy fine sand to very gravelly loamy fine sand. Siliceous pebble content ranges from a few to 35 percent. Reaction is moderately acid or slightly acid.

The B horizon is red, yellowish red, or reddish brown. Mottles in shades of gray, brown, or yellow are in the lower part of the Bt horizon in some pedons. The B horizon is sandy clay or clay or their gravelly counterparts in the upper part; and sandy clay loam or sandy clay or their gravelly, very gravelly, or extremely gravelly counterparts in the lower part. Siliceous pebbles range from a few in the upper part to as much as 75 percent in the lower part. Reaction ranges from very strongly acid to moderately acid.

Uhland Series

The Uhland series consists of very deep, moderately well drained, loamy soils on bottom lands. These soils formed in stratified sandy and loamy sediments. Slopes are less than 1 percent.

Typical pedon of Uhland loam, frequently flooded; 3.6 miles west of Hanover on Farm Road 2095, about 200 feet north, in a pasture:

A—0 to 6 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular and subangular blocky structure; hard, firm; common fine roots; common fine pores; few thin strata of darker colored clayey materials; few fine black concretions; slightly alkaline; clear smooth boundary.

2C1—6 to 20 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; few fine distinct grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; hard, firm; few fine roots; common fine pores; few thin strata of darker colored clayey materials; few fine black concretions; slightly alkaline; clear smooth boundary.

2C2—20 to 44 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; few fine roots; few thin strata of darker colored clayey materials; slightly alkaline; clear smooth boundary.

Ab—44 to 80 inches; gray (10YR 5/1) loam, dark grayish brown (10YR 4/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm; few fine black concretions; slightly alkaline.

The A horizon ranges from 4 to 12 inches in thickness. It is dark grayish brown, dark brown, or brown. Reaction ranges from slightly acid to slightly alkaline.

Between a depth of 10 to 40 inches, the soil material averages less than 18 percent clay; more than 15 percent of the sand is coarser than very fine sand. An individual stratum in the 2C horizon is dark brown, brown, pale brown, grayish brown, dark grayish brown, light brownish gray, gray, dark gray, yellowish brown, dark yellowish brown, light yellowish brown, or strong brown. Mottles are in shades of gray, brown, or yellow. The individual stratum is loamy fine sand, fine sandy loam, loam, sandy clay loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline.

An Ab horizon is below a depth of 40 inches. It is gray, grayish brown, or dark grayish brown and may contain brown and gray mottles. It is loam or clay loam. The reaction is slightly acid to slightly alkaline. Some pedons do not have an Ab horizon.

Weswood Series

The Weswood series consists of very deep, well drained, loamy soils on flood plains of streams. These soils formed in stratified loamy alluvial sediments.

Typical pedon of Weswood silty clay loam, occasionally flooded; from the intersection of Farm Road 2027 and Farm Road 979 at Crossroads Community, 2.1 miles northeast on Farm Road 979, about 1.7 miles north on a private oil field road, 200 feet south, in an area of cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine granular and subangular blocky structure; slightly hard, friable; many fine roots; few fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

Bw1—6 to 15 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; calcareous; moderately alkaline; clear smooth boundary.

Bw2—15 to 35 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; few thin sandy and clayey strata in lower part; calcareous; moderately alkaline; clear smooth boundary.

Bw3—35 to 41 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable;

few fine roots; few fine pores; few thin sandy and clayey strata; calcareous; moderately alkaline; clear smooth boundary.
C—41 to 80 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; few fine roots; few thin sandy and clayey strata; calcareous; moderately alkaline.

All horizons are silty clay loam, clay loam, or silt loam. Stratification with sandy, loamy, and clayey sediments is mainly below a depth of 20 inches.

The A horizon is reddish brown or light reddish brown.

The Bw and C horizons are reddish brown, light reddish brown, yellowish red, or reddish yellow.

Wilson Series

The Wilson series consists of very deep, moderately well drained, loamy soils on stream terraces. These soils formed in clayey alluvial sediments. Slopes range from 0 to 2 percent.

Typical pedon of Wilson loam, 0 to 2 percent slopes; from the intersection of Farm Road 486 and U.S. Highway 79 in Thorndale, 3.8 miles north on Farm Road 486, about 200 feet west, in an area of cropland:

Ap—0 to 9 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate fine granular structure when moist, massive when dry; very hard, firm; common fine roots; few fine siliceous pebbles; neutral; abrupt smooth boundary.
Btg—9 to 32 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; many thick clay films on faces of peds; few pressure faces; few streaks of gray clay loam in filled cracks; few fine black concretions; slightly alkaline; clear wavy boundary.
Btkg—32 to 47 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; common thin clay films on faces of peds; common pressure faces; few streaks of gray clay loam in filled cracks; few fine black concretions; about 5 percent fine concretions of calcium carbonate; few fine siliceous pebbles; slightly alkaline; clear wavy boundary.
Btk—47 to 58 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak coarse angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; few thin clay films on faces of peds; few pressure faces; few fine black concretions; about 8 percent fine concretions of calcium carbonate; few fine siliceous pebbles; moderately alkaline; clear wavy boundary.
BCk—58 to 80 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; few fine faint brownish yellow mottles; weak coarse subangular blocky structure; extremely hard, very firm; about 8 percent fine concretions of calcium carbonate; common fine siliceous pebbles; moderately alkaline.

The solum ranges from 60 to 80 inches or more in thickness. When dry, these soils have cracks 0.4-inch or more in width in the upper part of the subsoil.

The A horizon is 4 to 15 inches thick, and is dark gray, very dark gray, gray, dark grayish brown, or grayish brown. Areas in cultivation have a 0.25-inch thick, light colored crust on the surface. Reaction is slightly acid or neutral.

The Bt horizon is very dark gray, dark gray, or gray in the upper part and light brownish gray, light olive brown, olive gray, gray, or grayish brown in the lower part. Some pedons have brownish, yellowish, and olive mottles and typically increase with depth. This horizon is clay, silty clay, or clay loam. Reaction is neutral or slightly alkaline in the upper part and ranges to moderately alkaline in the lower part.

The BCk horizon is clay loam or clay in shades of gray, olive, brown, or yellow. In some pedons sandy and gravelly sediments occur below a depth of 8 feet.

Yahola Series

The Yahola series consists of very deep, well drained, loamy soils on bottom lands. These soils formed in stratified sandy and loamy alluvial sediments.

Typical pedon of Yahola loam, occasionally flooded; 7.3 miles east of Maysfield on Farm Road 485, about 1.5 miles northeast on gravel road to Port Sullivan Cemetery, 0.8 mile northeast on private road, 200 feet west, in a pasture:

Ap—0 to 12 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; calcareous; moderately alkaline; gradual wavy boundary.
C1—12 to 28 inches; alternating 1- to 3-inch thick strata of brown (7.5YR 5/4) loam and yellowish red (5YR 5/6) very fine sandy loam; massive; slightly

hard, very friable; few fine roots; calcareous; moderately alkaline; gradual wavy boundary.

C2—28 to 48 inches; pink (7.5YR 7/4) very fine sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; few fine roots; few thin silty strata; calcareous; moderately alkaline; diffuse wavy boundary.

C3—48 to 80 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; common thin silty strata; calcareous; moderately alkaline.

Weighted average clay content of the 10- to 40-inch control section ranges from 5 to 18 percent.

The A horizon is 6 to 18 inches thick. It is brown, light brown, reddish brown, reddish yellow, or yellowish red. Reaction is slightly alkaline or moderately alkaline. The soil is calcareous.

The C horizon is brown, light brown, reddish brown, light reddish brown, yellowish red, reddish yellow, or pink. It is fine sandy loam, very fine sandy loam, loam, or loamy fine sand.

Formation of the Soils

This section describes the factors of soil formation and relates them to the formation of the soils in Milam County.

The five major factors of soil formation are the climate under which the soil material accumulated and weathered; the living organisms on and in the soil; the composition of the parent material; the topography, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. The relative importance of each factor differs from place to place, and each modifies the effect of the other four. In some cases one factor may dominate in the formation of a soil.

Climate and living organisms, chiefly vegetation, are the active factors of soil formation. They alter the parent material and bring about the formation of genetically related horizons. Topography, mainly by its influence on temperature and runoff, modifies the effect of climate and vegetation. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Generally, a long time is required for the development of distinct horizons.

Climate

The Milam County climate is humid and subtropical, characterized by hot summers and continental winters. Precipitation is well distributed throughout the year, and peak rainfall occurs late in spring and early in fall. Evaporation is high, and rainfall seldom wets the soil below the root zone. Rainfall is sufficient to leach some of the lime from the upper horizons of many soils, such as Altoga and Sunev soils, but not sufficient to leach it entirely from the soils. Consequently, many of the soils have a layer in which lime has accumulated. Other soils, such as Edge and Rader soils, have been leached, and fine clay particles have moved down in the profile and accumulated to form a dense, very slowly permeable horizon.

Wind has been a minor factor in the formation of the Padina soils. It has contributed to weathering of the parent materials, has reworked some deposits, and has shifted material from place to place.

Living Organisms

The living organisms on and in the soils are plants and animals of various sizes. The plants that live in the soils range from trees to bacteria, fungi, or other microscopic plants. In the Blackland Prairie in the northern part of the county, tall prairie grasses had more influence than other plants on soil formation. These tall grasses provided litter that protected the surface and added organic matter to the soil. Their roots reached deep into the soil and extracted minerals from lower depths. When the grasses died, large amounts of these minerals were left near the surface. Lime or other minerals and organic matter were distributed through the soil profile as the plants died, decomposed, and were replaced by new plants. When the roots of plants decomposed, they left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms feed on the decomposed roots. The borings of earthworms also help to channel water and air through the soil. In the sandy areas in the southern part of the county, an open savannah of tall grasses and hardwoods influenced soil formation. Soils in this area tend to be acid and low in content of organic matter.

The processes of soil formation were well balanced under natural conditions before human influence. Vegetation covered the soils and soil-forming processes were active. These processes, however, have been disturbed where clean tilling and overgrazing have been allowed. The native vegetation has been destroyed, and accelerated erosion has removed much of the surface layer of many soils. On many fields used mainly for row crops, the activity of micro-organisms and earthworms has been reduced greatly in the surface layer.

Parent Material

The soils of Milam County formed in material from three geological periods *(8,9)*. These are the Upper Cretaceous, Tertiary, and Quaternary periods.

From the Upper Cretaceous period are the Kemp Clay, Marlbrook Marl, Navarro, and Taylor Formations. The Blackland Prairie soils in the northern part of the county formed in the marl, clay, and shale of these formations. They are mainly deep, dark colored clays of the Ferris, Heiden, and Houston Black series.

From the Tertiary period are the Queen City Sand, Sparta Sand, Carrizo Sand, Weches, Reklaw, Wilcox, and Midway Formations. The soils in the mesquite and oak regions in the southern part of the county formed in clay, silt, sand, sandstone, and sandy shale of the Reklaw, Wilcox, and Midway Formations. They are mainly deep soils that have a sandy or loamy surface layer underlain by dense, clayey lower layers. The principal soils are in the Crockett, Rader, and Edge series. The sandy soils of the oak and hickory regions in the southern part of the county formed in sand, sandstone, silt, clay, and shale of the Queen City, Sparta, Carrizo, and Weches Formations. The principal soils are the Padina and Silstid series.

From the Quaternary period are the fluviatile terrace deposits and alluvium. The soils of terraces of the Little River, San Gabriel River, Brazos River, Elm Creek, Brushy Creek, Donahoe Creek, and Pond Creek formed in stratified clay, silt, sand, and gravel. Soils formed in these terrace deposits are mainly deep clays, silty clays, loams, sandy loams, and gravelly sandy loams. The principal soils are the Branyon, Venus, Minwells, Riesel, Travis, and Wilson series. The soils formed in alluvium are deep, dark colored silty clay loams, silty clays, and clays. The principal soils are the Bosque, Frio, Oakalla, Tinn, and Ships series.

Relief

Relief, or the lay of the land, influences soil formation through its effect on drainage and runoff. If other factors of soil formation are equal, the degree of profile formation depends mainly upon the average amount of moisture in the soil. Steep soils absorb less moisture, and most have less distinct profiles than gently sloping or nearly level soils. Some steep soils have so much runoff that geologic erosion almost keeps pace with the weathering of rocks and the formation of soils. Conversely, more nearly level soils absorb more rainwater and are less likely to erode. Depressions or other concave areas receive extra water through runoff from adjacent soils, and soils in these areas can be wet for long periods. The wetness affects the rate of horizon formation.

Thus, through the general influence of runoff and drainage, relief inhibits some processes of horizon differentiation and hastens others. Soils that formed in the same kind of parent material but in different positions on the landscape are likely to have dissimilar profiles.

The distinctness of horizons within a soil profile and the total thickness of the solum are closely related to relief. Ordinarily, soils that have a thick solum and distinct horizons are gently sloping. Steeper soils have a thinner solum and less distinct horizons. Except for sandy soils, which are permeable and generally well drained, level or nearly level soils are likely to be dense, less permeable, and more poorly drained.

Some soils in the Blackland Prairie and on stream terraces, such as Houston Black, Branyon, and Burleson soils, have a gilgai microrelief of low circular knolls and depressed areas between the knolls. The knolls and depressions are the result of the shrinking and swelling of the clay. When these soils dry, the clay particles shrink, pull apart, and leave wide, deep cracks. When moisture is available, the cracks fill with water. The heavy clay in the lower layers absorbs the water and swells. It then buckles upward in an uneven, wavy pattern and forms the small knolls.

Time

Time is required for the formation of a mature soil from parent material. Some soils that have been in place for only a short time have not been influenced enough by climate, relief, and living organisms to have formed well defined, genetically related horizons. Examples are soils on flood plains, such as Oakalla and Frio soils.

Some deep soils that have indistinct horizons are considered young and poorly formed. Bigbrown soils, which are developing in mine spoil material, are examples.

The steeper soils show less evidence of horizon differentiation because geologic erosion resulting from relief has overcome the influence of other soil-forming factors. Ferris and Jedd soils are examples. Soils that have been in place for a long time and have approached equilibrium with their environment are considered mature soils. These soils show marked horizon differentiation. Edge and Rader soils are examples.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Aspect. The direction in which a slope faces.

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

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Backslopes 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.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

Canopy. The leafy crown of trees or shrubs. See Crown, for additional information.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

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.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

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.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

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.

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.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

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.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Ecological site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site (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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It does not receive a long-continued supply from melting snow or other sources, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
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.
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 pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

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 horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay,

sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is

allowed to flow onto an area without controlled distribution.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

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.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

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.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

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.

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 3.6
Extremely acid	3.6 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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

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, for additional information.

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.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Classes for complex slopes are as follows:

Nearly level	0 to 1 percent
Gently undulating	1 to 5 percent
Undulating	1 to 8 percent
Rolling	5 to 10 percent
Strongly rolling	5 to 16 percent
Hilly	10 to 30 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

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.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. See Underlying material.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

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.

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 foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Underlying material. The part of the soil below the solum.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along 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

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-90 at Cameron, Texas)

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average number of	2 years in 10 will have--			Average number of	Average
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	growing degree days*	Average	less than--	more than--	days with 0.1 inch or more	total snow fall
	°F	*°F*	*°F*	*°F*	*°F*	*Units*	*In*	*In*	*In*		*In*
January---	59.9	37.6	48.7	83	14	121	2.22	1.02	3.39	4	0.1
February--	64.5	41.0	52.8	86	18	161	2.59	1.32	3.71	4	0.0
March-----	72.9	48.9	60.9	90	25	356	2.23	0.86	3.38	4	0.0
April-----	80.1	57.2	68.6	94	34	559	3.29	0.89	5.22	4	0.0
May-------	85.3	64.2	74.8	95	46	767	4.71	2.20	6.87	5	0.0
June------	91.1	70.1	80.6	100	57	912	2.87	0.88	4.48	4	0.0
July------	95.5	72.5	84.0	103	64	1,049	1.90	0.40	3.43	2	0.0
August----	96.1	72.3	84.2	104	63	1,061	1.68	0.35	2.81	2	0.0
September-	89.6	67.5	78.5	100	48	856	4.17	1.50	6.39	4	0.0
October---	81.3	57.6	69.4	95	36	601	3.21	1.22	4.88	4	0.0
November--	71.3	48.6	59.9	88	26	320	2.98	1.19	4.50	4	0.0
December--	62.8	40.2	51.5	82	16	151	2.33	0.97	3.49	4	0.0
Yearly:---											
Average-	79.2	56.5	67.8	---	---	---	----	----	----	---	---
Extreme-	109	2	---	105	11	---	----	----	----	---	---
Total---	---	---	---	---	---	6,914	34.20	27.39	40.34	45	0.1

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 50.0 deg. F)

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Cameron, Texas)

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 8	March 16	March 30
2 years in 10 later than--	February 29	March 9	March 23
5 years in 10 later than--	February 15	February 24	March 10
First freezing temperature in fall:			
1 year in 10 earlier than--	November 29	November 14	November 2
2 years in 10 earlier than--	December 6	November 21	November 9
5 years in 10 earlier than--	December 20	December 5	November 21

Table 3.--Growing Season

(Recorded in the period 1961-90 at Cameron, Texas)

Probability	Daily minimum temperature during growing season		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	268	251	228
8 years in 10	278	260	237
5 years in 10	298	278	256
2 years in 10	317	295	274
1 year in 10	327	304	284

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AgD2	Altoga silty clay, 5 to 8 percent slopes, eroded	1,984	0.3
Ba	Bastsil fine sandy loam, 0 to 2 percent slopes	656	0.1
BbC	Bigbrown clay loam, 2 to 5 percent slopes	1,395	0.2
BcC	Bigbrown-Slickspots complex, 2 to 8 percent slopes	1,349	0.2
Be	Bosque clay loam, occasionally flooded	2,326	0.4
BrA	Branyon clay, 0 to 1 percent slopes	25,053	3.8
BrB	Branyon clay, 1 to 3 percent slopes	8,775	1.3
Bu	Burleson clay, 0 to 2 percent slopes	18,542	2.8
ChB	Chazos loamy fine sand, 1 to 3 percent slopes	8,046	1.2
CrB	Crockett fine sandy loam, 1 to 3 percentlopes	23,767	3.6
CrC2	Crockett fine sandy loam, 2 to 5 percent slopes, eroded	4,821	0.7
DeC	Desan loamy fine sand, 1 to 5 percent slopes	2,186	0.3
Dp	Dumps-Pits complex	2,434	0.4
EdC2	Edge fine sandy loam, 2 to 5 precent slopes, eroded	71,431	11.0
EdC3	Edge-Gullied land complex, 2 to 8 percent slopes	9,814	1.5
FeE2	Ferris-Heiden complex, 5 to 15 percent slopes, eroded	27,813	4.3
Fr	Frio silty clay, occasionally flooded	53,509	8.3
Ga	Gaddy fine sandy loam, frequently flooded	1,411	0.2
GuB	Gause loamy fine sand, 1 to 3 percent slopes	3,798	0.6
Gw	Gowen clay loam, frequently flooded	2,868	0.4
HeC	Heiden clay, 2 to 5 percent slopes	10,356	1.6
HoB	Houston Black clay, 1 to 3 percent slopes	40,711	6.2
JeE	Jedd very gravelly sandy loam, 3 to 15 percent slopes	5,488	0.8
LeB	Lewisville silty clay, 1 to 3 percent slopes	3,860	0.6
Lu	Lufkin-Gause complex, 0 to 1 percent slopes	2,481	0.4
MnC	Minerva loamy fine sand, 1 to 5 percent slopes	5,891	0.9
MwC	Minwells fine sandy loam, 1 to 5 percent slopes	21,828	3.3
NoB	Normangee clay loam, 1 to 3 percent slopes	2,791	0.4
Oa	Oakalla silty clay loam, occasionally flooded	682	0.1
PaC	Padina fine sand, 1 to 8 percent slopes	63,834	9.9
Pc	Payne loam, 0 to 2 percent slopes	1,442	0.2
Pg	Pits, gravel	698	0.1
RaB	Rader loamy fine sand, 1 to 3 percent slopes	50,400	7.7
RgC	Riesel gravelly fine sandy loam, 1 to 5 percent slopes	3,349	0.5
Sa	Sandow clay loam, frequently flooded	2,543	0.4
SgB	Satin gravelly clay loam, 1 to 3 percent slopes	6,527	1.0
SmC	Seawillow loam, 2 to 8 percent slopes	4,062	0.6
Sp	Ships clay, rarely flooded	5,054	0.8
SwB	Silawa loamy fine sand, 1 to 3 percent slopes	1,597	0.2
SwC	Silawa loamy fine sand, 3 to 8 percent slopes	1,349	0.2
SyB	Silstid loamy fine sand, 1 to 5 percent slopes	16,154	2.5
SzC	Sunev loam, 2 to 5 percent slopes	1,612	0.2
Tc	Tinn clay, occasionally flooded	16,790	2.6
Tn	Tinn clay, frequently flooded	26,681	4.1
TrB	Travis loamy fine sand, 1 to 3 percent slopes	7,767	1.2
TrC2	Travis loamy fine sand, 3 to 8 percent slopes, eroded	2,387	0.4
TsC	Travis soils, graded, 1 to 8 percent slopes	3,442	0.5
Uh	Uhland loam, frequently flooded	19,720	3.0
We	Weswood silty clay loam, occasionally flooded	682	0.1
Wn	Wilson loam, 0 to 2 percent slopes	26,138	4.0
Wv	Wilson-Davilla complex, 0 to 2 percent slopes	22,666	3.5
Ya	Yahola loam, occasionally flooded	1,194	0.2
	Water areas more than 40 acres in size	1,132	0.2
	Total	653,286	100.0

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

Map symbol	Soil name
Ba	Bastsil fine sandy loam, 0 to 2 percent slopes
BbC	Bigbrown clay loam, 2 to 5 percent slopes
Be	Bosque clay loam, occasionally flooded
BrA	Branyon clay, 0 to 1 percent slopes
BrB	Branyon clay, 1 to 3 percent slopes
Bu	Burleson clay, 0 to 2 percent slopes
ChB	Chazos loamy fine sand, 1 to 3 percent slopes
Fr	Frio silty clay, occasionally flooded
GuB	Gause loamy fine sand, 1 to 3 percent slopes
HeC	Heiden clay, 2 to 5 percent slopes
HoB	Houston black clay, 1 to 3 percent slopes
LeB	Lewisville silty clay, 1 to 3 percent slopes
MnC	Minerva loamy fine sand, 1 to 5 percent slopes
MwC	Minwells fine sandy loam, 1 to 5 percent slopes
Oa	Oakalla silty clay loam, occasionally flooded
RaB	Rader loamy fine sand, 1 to 3 percent slopes
Sp	Ships clay, rarely flooded
SwB	Silawa loamy fine sand, 1 to 3 percent slopes
SzC	Sunev loam, 2 to 5 percent slopes
Tc	Tinn clay, occasionally flooded
TrB	Travis loamy fine sand, 1 to 3 percent slopes
We	Weswood silty clay loam, occasionally flooded
Ya	Yahola loam, occasionally flooded

Table 6.--Land Capability and Yields per Acres of Crops and Pasture

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

Map symbol and soil name	Land capability	Corn	Cotton lint	Grain sorghum	Wheat	Sorghum hay	Improved bermudagrass	Klein-grass
		Bu	*Lbs*	*Bu*	*Bu*	*Tons*	*AUM**	*AUM**
AgD2---------- Altoga	6e	---	---	---	---	2.0	3.5	3.0
Ba---------- Bastsil	2e	70	350	80	45	4.0	7.0	6.0
BbC---------- Bigbrown	4e	---	---	---	25	3.0	6.0	4.0
BcC:								
Bigbrown----------	6e	---	---	---	---	---	6.0	---
Slickspots----------	---	---	---	---	---	---	---	---
Be---------- Bosque	2w	65	450	65	45	4.0	7.0	6.0
BrA---------- Branyon	2w	100	550	100	50	5.0	7.0	6.0
BrB---------- Branyon	2e	90	550	90	45	5.0	7.0	6.0
Bu---------- Burleson	2e	80	450	90	40	5.0	6.0	6.0
ChB---------- Chazos	2e	65	---	45	30	4.0	7.0	5.0
CrB---------- Crockett	3e	55	300	55	35	3.5	6.0	5.0
CrC2---------- Crockett	4e	30	200	45	20	3.0	5.0	5.0
DeC---------- Desan	3e	---	---	---	20	3.5	5.5	4.0
Dp---------- Dumps	---	---	---	---	---	---	---	---
EdC2---------- Edge	4e	---	---	25	20	3.0	5.0	4.0
EdC3:								
Edge----------	6e	---	---	---	---	---	3.5	2.5
Gullied land----------	7e	---	---	---	---	---	---	---
FeE2:								
Ferris----------	6e	---	---	---	---	---	3.5	---
Heiden----------	4e	---	---	---	20	2.0	3.5	3.0
Fr---------- Frio	2w	65	450	55	---	5.0	7.0	5.0

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Cotton lint	Grain sorghum	Wheat	Sorghum Hay	Improved bermudagrass	Klein-grass
		Bu	*Lbs*	*Bu*	*Bu*	*Tons*	*AUM**	*AUM**
Ga Gaddy	5w	---	---	---	---	---	5.0	5.0
GuB Gause	2e	70	300	55	30	3.5	6.5	5.0
Gw Gowen	5w	---	---	---	---	4.0	7.0	6.0
HeC Heiden	3e	60	350	65	40	4.0	6.0	5.0
HoB Houston Black	2e	100	550	100	45	5.0	7.0	6.0
JeE Jedd	6e	---	---	---	---	---	---	---
LeB Lewisville	2e	70	500	80	40	5.0	5.0	5.0
Lu:								
Lufkin	3w	40	200	45	30	5.0	5.0	4.0
Gause	2e	75	350	55	30	3.5	6.5	5.0
MnC Minerva	3e	45	200	45	25	3.0	6.5	5.0
MwC Minwells	3e	40	---	35	40	3.0	5.0	5.0
NoB Normangee	3e	50	300	50	30	4.0	5.0	5.0
Oa Oakalla	2w	50	350	65	25	4.0	6.5	6.0
PaC Padina	4e	---	---	---	---	3.0	6.0	---
Pc Payne	4e	---	---	---	---	3.0	6.0	---
Pg Pits	---	---	---	---	---	---	---	---
RaB Rader	2e	60	200	70	30	4.0	7.0	5.0
RgC Riesel	6s	---	---	---	---	2.0	3.5	3.0
Sa Sandow	5w	---	---	---	---	4.0	7.0	6.0
SgB Satin	4s	30	250	35	30	3.0	4.0	4.0
SmC Seawillow	4e	30	250	35	30	2.0	4.5	3.0

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Cotton lint	Grain sorghum	Wheat	Sorghum Hay	Improved bermudagrass	Klein-grass
		Bu	*Lbs*	*Bu*	*Bu*	*Tons*	*AUM**	*AUM**
Sp Ships	2s	115	750	100	40	5.0	6.0	6.0
SwB Silawa	3e	55	350	50	---	3.0	6.0	5.0
SwC Silawa	4e	25	---	---	25	2.5	5.0	5.0
SyB Silstid	3e	35	---	30	25	3.5	6.0	5.0
SzC Sunev	3e	40	200	35	30	4.0	5.0	5.5
Tc Tinn	2w	90	500	90	35	5.0	7.0	6.0
Tn Tinn	5w	---	---	---	---	5.0	7.0	6.0
TrB Travis	2e	65	300	55	40	4.0	6.0	4.0
TrC2 Travis	4e	30	---	40	35	3.5	3.0	4.0
TsC Travis	6e	---	---	---	---	---	2.0	---
Uh Uhland	5w	---	---	---	---	3.5	7.0	6.0
We Weswood	2w	100	500	95	40	5.0	7.0	6.0
Wn Wilson	3e	55	300	45	30	3.0	6.0	5.0
Wv: Wilson	3e	55	300	45	30	3.0	6.0	5.0
Davilla	2s	75	400	70	---	---	7.0	5.0
Ya Yahola	2w	50	425	50	35	4.0	7.0	6.0

*Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Table 7.--Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are listed.)

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	*Lb/acre*	*Lb/acre*
AgD2---Altoga	Clay Loam Pe 44-64	6,500	5,000	3,800
Ba---Bastsil	Sandy Loam	6,500	5,000	3,500
Be---Bosque	Loamy Bottomland	6,500	5,000	3,500
BrA---Branyon	Blackland Pe 44-64	7,000	5,500	3,500
BrB---Branyon	Blackland Pe 44-64	7,000	5,500	3,500
Bu---Burleson	Blackland Pe 44-64	7,000	5,500	4,000
ChB---Chazos	Sandy Loam	5,500	4,500	3,000
CrB---Crockett	Claypan Prairie Pe 44-64	6,000	5,000	3,000
CrC2---Crockett	Claypan Prairie Pe 44-64	6,000	5,000	3,000
DeC---Desan	Deep Sand	3,000	2,000	1,000
EdC2---Edge	Claypan Savannah	5,000	3,500	2,500
EdC3:				
Edge	Claypan Savannah	5,000	3,500	2,500
Gullied land	---	---	---	---
FeE2:				
Ferris	Eroded Blackland Pe 44-64	7,000	5,500	4,000
Heiden	Eroded Blackland Pe 44-64	7,000	6,000	3,500
Fr---Frio	Loamy Bottomland	5,500	4,000	3,000
Ga---Gaddy	Sandy Bottomland	3,800	2,700	2,000
GuB---Gause	Sandy Loam	5,000	4,000	2,500
Gw---Gowen	Loamy Bottomland	8,000	5,500	4,000
HeC---Heiden	Blackland Pe 44-64	7,000	6,000	3,500
HoB---Houston Black	Blackland	7,000	6,000	3,500

Table 7.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	*Lb/acre*	*Lb/acre*
JeE Jedd	Sandstone Hill	5,000	4,000	3,000
LeB Lewisville	Clay Loam Pe 44-64	6,500	5,500	3,000
Lu:				
Lufkin	Claypan Savannah	5,000	4,000	2,500
Gause	Sandy Loam	6,000	4,500	3,000
MnC Minerva	Sandy Loam	5,500	4,500	2,500
MwC Minwells	Sandy Loam	4,000	3,000	2,000
NoB Normangee	Claypan Prairie Pe 44-64	5,500	4,000	3,000
Oa Oakalla	Loamy Bottomland	7,000	5,500	3,500
PaC Padina	Deep Sand	4,500	3,500	2,250
Pc Payne	Claypan Prairie Pe 44-64	6,000	5,000	3,000
RaB Rader	Sandy Loam	6,000	4,500	3,500
RgC Riesel	Gravelly Loam Pe 44-64	4,500	3,500	2,000
Sa Sandow	Loamy Bottomland	7,500	6,500	4,000
SgB Satin	Gravelly Loam Pe 44-64	4,500	3,500	2,000
SmC Seawillow	Clay Loam Pe 44-64	5,000	4,000	2,500
Sp Ships	Clayey Bottomland Pe 44-64	7,500	6,000	4,500
SwB Silawa	Sandy Loam	5,500	4,500	2,500
SwC Silawa	Sandy Loam	5,500	4,500	2,500
SyB Silstid	Sandy	4,500	4,000	2,000
SzC Sunev	Clay Loam Pe 44-64	7,000	5,500	3,500
Tc Tinn	Clayey Bottomland Pe 44-64	7,000	6,000	4,000

Table 7.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	*Lb/acre*	*Lb/acre*
Tn---------- Tinn	Clayey Bottomland Pe 44-64----	7,000	6,000	4,000
TrB---------- Travis	Sandy Loam----------	6,000	4,000	3,000
TrC2---------- Travis	Sandy Loam----------	6,000	4,000	3,000
TsC---------- Travis	Gravelly----------	1,500	1,000	500
Uh---------- Uhland	Loamy Bottomland----------	7,500	6,500	4,000
We---------- Weswood	Loamy Bottomland----------	8,000	6,500	5,000
Wn---------- Wilson	Claypan Prairie Pe 44-64------	6,000	4,500	3,000
Wv:				
Wilson----------	Claypan Prairie Pe 44-64------	6,000	4,500	3,000
Davilla----------	Claypan Prairie Pe 44-64------	6,000	5,000	3,000
Ya---------- Yahola	Loamy Bottomland----------	7,000	4,900	3,500

Table 8.--Selected Plants Suitable for Gardening and Landscaping

Soil name and map symbols	Flowers and ground cover	Vines	Shrubs	Trees	Vegetables and fruits
Altoga - AgD2 Lewisville - LeB Seawillow - SmC Sunev - SzC	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston, ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, acuba Barbados-cherry, bottlebrush, bougainvillea, bridal-wreath, crepemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan plum, redbud, red cedar.	Bean, beet, blackberry broccoli, brussel sprout, cabbage, cantaloupe, cauliflower, cucumber, carrot, lettuce, okra, onion, parsley, pea, pepper, Irish potato, pumpkin, radish, spinach, squash, sweet corn, strawberry, tomato, turnip.
Bastsil - Ba Bigbrown - BbC Chazos - ChB Edge - EdC2, EdC3 Gause - GuB Minerva - MnC Minwells - MwC Rader - RaB Riesel - RgC Silawa - SwB, SwC Travis - TrB,TrC2,TsC	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Acuba, azalea, barberry, butterfly-bush, camellia, crepemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer, juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.
Bosque - Be Branyon - BrA, BrB Burleson - Bu Ferris - FeE2 Frio - Fr Gowen - Gw Heiden - HeC Houston Black - HoB Oakalla - Oa Ships - Sp Tinn - Tc, Tn Weswood - We	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copper-leaf, cornflower, dahlia, daylily, dianthus, dwarf juniper dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold narcissus, ophiopogon, periwinkle, petunia, potentilla, shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, acuba, bridal-wreath, crepemyrtle, duranta, fatsia, gold-flower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	American elm, cedar elm, Chinese pistache crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.	Bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, okra, onion, parlsey, pea, pepper, Irish potato, radish, spinach, squash, strawberry, sweet corn, tomato, turnip.

Table 8.--Selected Plants Suitable for Gardening and Landscaping--Continued

Soil name and map symbols	Flowers and ground cover	Vines	Shrubs	Trees	Vegetables and fruits
Crockett - CrB Normangee - NoB Payne - Pc Wilson-Davilla - Wv	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha,quince, Texas sage, yucca.	American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache Chinese tallow-tree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.
Gaddy - Ga Sandow - Sa Uhland - Uh Yahola - Ya	Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, junipers, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, acuba, althea, azalea, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellias, duranta, goldflower, guava, Indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage.	American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak.	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.
Jedd - JeE	Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, shasta daisy, vinca.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, quince, Texas sage.	American elm, cedar elm, Chinese pistache Chinese tallow-tree, cottonwood, halepensis, mulberry, post oak, tulip-poplar.	Bean, blackberry, cabbage, cantaloupe, cucumber, lettuce, pea, pepper, spinach, squash, strawberry, sweet corn, tomato.

Table 8.--Selected Plants Suitable for Gardening and Landscaping--Continued

Soil name and map symbols	Flowers and ground cover	Vines	Shrubs	Trees	Vegetables and fruits
Lufkin-Gause - Lu Satin - SgB Wilson - Wn	Agapanthus, ajuga, amaryllis, aspidistra, aster, caladium, canna, cornflower, daylily, dwarf bamboo, euonymus, hollyhock, honeysuckle, lantana, liviope, moneywart, ophiopogon, plumbago, potentilla, silvia, shasta daisy, vinca, zinnia.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	American holly, bottlebrush, bridalwreath, deutzia, forsythia, goldflower, hydrangea, jasmine, ligustrum, oleander, pfitzer, juniper, pomegranate, pyracantha, quince.	American elm, Arizona ash, baldcypress, bur oak, cedar elm, cedrus, Chinese tallow-tree, deodar cedar, hackberry, halepensis live oak, magnolia, mulberry, peach, pecan, plum, redbud, red cedar, sweetgum, tulip-poplar, water oak, weeping willow.	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.
Desan - DeC Padina - PaC Silstid - SyB	Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hyacinth, jessamine, junipers, marigold, ornamental pepper, pansies, periwinkle, petunia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, acuba, azalea, barberry, boxwood, camellias, cottoneaster, crepemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, Indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses.	Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow.	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.

Table 9.--Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AgD2—Altoga	Slight	Slight	Severe: slope.	Slight	Severe: too clayey.
Ba—Bastsil	Slight	Slight	Slight	Slight	Slight.
BbC—Bigbrown	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
BcC:					
Bigbrown	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Slickspots	---	---	---	---	---
Be—Bosque	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
BrA—Branyon	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
BrB—Branyon	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
Bu—Burleson	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
ChB—Chazos	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
CrB—Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Severe: erodes easily.	Moderate: droughty.
CrC2—Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Severe: erodes easily.	Moderate: droughty.
DeC—Desan	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Dp—Dumps	---	---	---	---	---
EdC2—Edge	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Severe: erodes easily.	Slight.

Table 9.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
EdC3:					
Edge	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Severe: erodes easily.	Slight.
Gullied land	---	---	---	---	---
FeE2:					
Ferris	Moderate: percs slowly, slope.	Moderate: slope, too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: too clayey.
Heiden	Moderate: percs slowly.	Moderate: too clayey.	Severe: slope.	Moderate: slope, too clayey.	Severe: too clayey.
Fr:					
Frio	Severe: flooding.	Moderate: too clayey.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
Ga:					
Gaddy	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
GuB:					
Gause	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Gw:					
Gowen	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
HeC:					
Heiden	Moderate: percs slowly.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
HoB:					
Houston Black	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
JeE:					
Jedd	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
LeB:					
Lewisville	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
Lu:					
Lufkin	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, small stones.	Slight	Moderate: droughty.
Gause	Slight	Slight	Slight	Slight	Slight.
MnC:					
Minerva	Slight	Slight	Moderate: slope.	Slight	Slight.
MwC:					
Minwells	Slight	Slight	Moderate: slope.	Slight	Slight.
NoB:					
Normangee	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight	Slight.

Table 9.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Oa Oakalla	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
PaC Padina	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Pc Payne	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
Pg Pits	---	---	---	---	---
RaB Rader	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: percs slowly, slope, wetness.	Slight	Moderate: droughty.
RgC Riesel	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
Sa Sandow	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
SgB Satin	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
SmC Seawillow	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
Sp Ships	Severe: flooding, percs slowly, too clayey.	Severe: percs slowly, too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: too clayey.
SwB Silawa	Slight	Slight	Moderate: slope.	Slight	Slight.
SwC Silawa	Slight	Slight	Moderate: slope.	Slight	Slight.
SyB Silstid	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
SzC Sunev	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Tc Tinn	Severe: flooding, percs slowly, too clayey.	Severe: percs slowly, too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: too clayey.
Tn Tinn	Severe: flooding, percs slowly, too clayey.	Severe: percs slowly, too clayey.	Severe: flooding, percs slowly, too clayey.	Severe: too clayey.	Severe: flooding, too clayey.

Table 9.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TrB---------- Travis	Slight---------	Slight---------	Moderate: slope, small stones.	Slight---------	Moderate: droughty.
TrC2---------- Travis	Slight---------	Slight---------	Moderate: slope, small stones.	Slight---------	Moderate: droughty.
TsC---------- Travis	Moderate: small stones, too clayey.	Moderate: small stones, too clayey.	Severe: small stones.	Moderate: too clayey.	Severe: too clayey.
Uh---------- Uhland	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
We---------- Weswood	Severe: flooding.	Slight---------	Slight---------	Slight---------	Moderate: flooding.
Wn---------- Wilson	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, small stones.	Slight---------	Slight.
Wv:					
Wilson----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, small stones.	Slight---------	Slight.
Davilla----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight---------	Slight.
Ya---------- Yahola	Severe: flooding.	Slight---------	Moderate: flooding.	Slight---------	Moderate: flooding.

Table 10.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AgD2--Altoga	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Ba--Bastsil	Good	Fair	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
BbC--Bigbrown	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
BcC:												
Bigbrown	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Slickspots	---	---	---	---	---	---	---	---	---	---	---	---
Be--Bosque	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
BrA--Branyon	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
BrB--Branyon	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Bu--Burleson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
ChB--Chazos	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
CrB--Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
CrC2--Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
DeC--Desan	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Dp--Dumps	---	---	---	---	---	---	---	---	---	---	---	---
EdC2--Edge	Fair	Fair	Good	Good	---	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
EdC3:												
Edge	Fair	Fair	Good	Good	---	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Gullied land	---	---	---	---	---	---	---	---	---	---	---	---
FeE2:												
Ferris	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Heiden	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life	Range-land wild-life
Fr---------- Frio	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
Ga---------- Gaddy	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
GuB---------- Gause	Fair	Good	Good	Good	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Gw---------- Gowen	Very poor.	Poor	Fair	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Fair.
HeC---------- Heiden	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
HoB---------- Houston Black	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
JeE---------- Jedd	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
LeB---------- Lewisville	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Lu:												
Lufkin----------	Fair	Good	Fair	Good	Good	---	Fair	Fair	Fair	Good	Fair	---
Gause----------	Good	Good	Good	Good	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
MnC---------- Minerva	Fair	Good	Good	Fair	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
MwC---------- Minwells	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
NoB---------- Normangee	Fair	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Oa---------- Oakalla	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
PaC---------- Padina	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Pc---------- Payne	Fair	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Pg---------- Pits	---	---	---	---	---	---	---	---	---	---	---	---
RaB---------- Rader	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
RgC---------- Riesel	Poor	Poor	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
Sa---------- Sandow	Very poor.	Poor	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Fair	Good.

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life	Range-land wild-life
SgB---Satin	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Fair.
SmC---Seawillow	Fair	Good	Fair	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Fair.
Sp---Ships	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
SwB---Silawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
SwC---Silawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
SyB---Silstid	Poor	Poor	Fair	Poor	Poor	Good	Poor	Very poor.	Poor	Poor	Very poor.	Fair.
SzC---Sunev	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Tc---Tinn	Fair	Fair	Fair	Good	---	---	Poor	Fair	Fair	Good	Poor	---
Tn---Tinn	Poor	Fair	Fair	Good	---	---	Poor	Fair	Fair	Fair	Poor	---
TrB---Travis	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
TrC2---Travis	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
TsC---Travis	Poor	Fair	Fair	---	---	Fair	Very poor.	Poor	Fair	Very poor.	Very poor.	Fair.
Uh---Uhland	Poor	Fair	Fair	Good	---	Good	Fair	Fair	Fair	---	Fair	Fair.
We---Weswood	Poor	Fair	Fair	Good	---	Good	Fair	Fair poor.	Fair	---	Fair poor.	Fair.
Wn---Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Wv:												
Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Davilla	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Ya---Yahola	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

Table 11.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AgD2--- Altoga	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: too clayey.
Ba--- Bastsil	Slight---	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
BbC--- Bigbrown	Slight---	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BcC:						
Bigbrown---	Slight---	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Slickspots---	---	---	---	---	---	---
Be--- Bosque	Moderate: flooding, too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
BrA--- Branyon	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
BrB--- Branyon	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Bu--- Burleson	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
ChB--- Chazos	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
CrB--- Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: droughty.
CrC2--- Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: droughty.
DeC--- Desan	Severe: cutbanks cave.	Slight---	Slight---	Slight---	Slight---	Moderate: droughty.
Dp--- Dumps	---	---	---	---	---	---
EdC2--- Edge	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.

Table 11.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EdC3:						
Edge	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Gullied land	---	---	---	---	---	----
FeE2:						
Ferris	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Fr	Moderate: flooding, too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Severe: too clayey.
Frio						
Ga	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Gaddy						
GuB	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
Gause						
Gw	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.
Gowen						
HeC	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Heiden						
HoB	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Houston Black						
JeE	Moderate: slope, too clayey, depth to rock.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope, depth to rock.	Severe: slope.	Severe: low strength.	Severe: small stones.
Jedd						
LeB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Lewisville						
Lu:						
Lufkin	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: droughty.
Gause	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
MnC	Slight---	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
Minerva						
MwC	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Minwells						

Table 11.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
NoB Normangee	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Oa Oakalla	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
PaC Padina	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Pc Payne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Pg Pits	---	---	---	---	---	---
RaB Rader	Severe: wetness.	Moderate: wetness.	Severe: shrink-swell, wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
RgC Riesel	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell,	Severe: small stones, droughty.
Sa Sandow	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
SgB Satin	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Moderate: small stones, droughty.
SmC Seawillow	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.
Sp Ships	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
SwB Silawa	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
SwC Silawa	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
SyB Silstid	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
SzC Sunev	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
Tc Tinn	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, low strength, shrink-swell.	Severe: too clayey.
Tn Tinn	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, low strength, shrink-swell.	Severe: flooding, too clayey.

Table 11.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TrB Travis	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: droughty.
TrC2 Travis	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Moderate: droughty.
TsC Travis	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Severe: too clayey.
Uh Uhland	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.
We Weswood	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
Wn Wilson	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight
Wv: Wilson	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Davilla	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Ya Yahola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

Table 12.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AgD2--Altoga	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: excess lime, too clayey.
Ba--Bastsil	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BbC--Bigbrown	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
BcC:					
Bigbrown	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Slickspots	---	---	---	---	---
Be--Bosque	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: thin layer, too clayey.
BrA--Branyon	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
BrB--Branyon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Bu--Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
ChB--Chazos	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
CrB--Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack. too clayey
CrC2--Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
DeC--Desan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Dp--Dumps	---	---	---	---	---
EdC2--Edge	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EdC3:					
Edge	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Gullied land	---	---	---	---	---
FeE2:					
Ferris	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: hard to pack, too clayey.
Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Fr Frio	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: hard to pack, too clayey.
Ga Gaddy	Severe: flooding, poor filter.	Severe: flooding, seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
GuB Gause	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Gw Gowen	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HeC Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
HoB Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
JeE Jedd	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: hard to pack, too clayey, depth to rock.
LeB Lewisville	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Lu:					
Lufkin	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Gause	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
MnC Minerva	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MwC Minwells	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Poor: thin layer.
NoB Normangee	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Oa Oakalla	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
PaC Padina	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pc Payne	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Pg Pits	---	---	---	---	---
RaB Rader	Severe: percs slowly, wetness.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: hard to pack, too clayey.
RgC Riesel	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Slight	Poor: small stones, too clayey.
Sa Sandow	Severe: flooding, percs slowly, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey, too sandy.
SgB Satin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: small stones, too clayey.
SmC Seawillow	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: small stones, too clayey.
Sp Ships	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: hard to pack, too clayey.
SwB Silawa	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer, too clayey.
SwC Silawa	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer, too clayey.
SyB Silstid	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
SzC Sunev	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: small stones, too clayey.

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tc Tinn	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: hard to pack, too clayey.
Tn Tinn	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: hard to pack, too clayey.
TrB Travis	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
TrC2 Travis	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
TsC Travis	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Uh Uhland	Severe: flooding, percs slowly, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Fair: wetness.
We Weswood	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Wn Wilson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Wv: Wilson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
Davilla	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Poor: hard to pack.
Ya Yahola	Severe: flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.

Table 13.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AgD2—Altoga	Poor: low strength.	Improbable: excess fines.	Improbable*: excess fines.	Poor: excess lime, too clayey.
Ba—Bastsil	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Good.
BbC—Bigbrown	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
BcC:				
Bigbrown	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
Slickspots	---	---	---	---
Be—Bosque	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
BrA—Branyon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
BrB—Branyon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
Bu—Burleson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
ChB—Chazos	Poor: low strength.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
CrB—Crockett	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CrC2—Crockett	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DeC—Desan	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Dp—Dumps	---	---	---	---
EdC2—Edge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

Table 13.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
EdC3:				
Edge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gullied land	---	---	---	---
FeE2:				
Ferris	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Fr	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Frio				
Ga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Gaddy				
GuB	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
Gause				
Gw	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Gowen				
HeC	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Heiden				
HoB	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Houston Black				
JeE	Poor: low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Jedd				
LeB	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
Lewisville				
Lu:				
Lufkin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gause	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MnC	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Minerva				
MwC	Good	Probable	Probable	Poor: too clayey.
Minwells				

See footnote at end of table.

Table 13.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
NoB---Normangee	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Oa---Oakalla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
PaC---Padina	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Pc---Payne	Poor: low strength.	Improbable: excess fines.	Improbable*: excess fines.	Poor: thin layer.
Pg---Pits	---	---	---	---
RaB---Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
RgC---Riesel	Good	Probable	Probable	Poor: area reclaim, small stones, too clayey.
Sa---Sandow	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, too sandy.
SgB---Satin	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
SmC---Seawillow	Poor: low strength.	Improbable: excess fines.	Improbable*: excess fines.	Poor: small stones.
Sp---Ships	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SwB---Silawa	Good	Probable	Probable	Fair: area reclaim, small stones, too clayey.
SwC---Silawa	Good	Probable	Probable	Fair: area reclaim, small stones, too clayey.
SyB---Silstid	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: small stones, too sandy.
SzC---Sunev	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, too clayey.

See footnote at end of table.

Table 13.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Tc Tinn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Tn Tinn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TrB Travis	Good	Improbable: excess fines.	Improbable*: excess fines.	Poor: area reclaim, small stones, too clayey.
TrC2 Travis	Good	Improbable: excess fines.	Improbable*: excess fines.	Poor: area reclaim, small stones, too clayey.
TsC Travis	Good	Improbable: excess fines.	Improbable*: excess fines.	Poor: area reclaim, small stones, too clayey.
Uh Uhland	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
We Weswood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Wn Wilson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
Wv: Wilson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable*: excess fines.	Poor: too clayey.
Davilla	Poor: low strength.	Improbable: excess fines.	Improbable*: excess fines.	Fair: small stones, too clayey.
Ya Yahola	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

*Beds of sand and gravel are below a depth of 10 to 15 feet in some places.

Table 14.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AgD2---------- Altoga	Moderate: seepage.	Slight---------	Deep to water	Slope, excess lime.	Favorable------	Excess lime.
Ba---------- Bastsil	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
BbC---------- Bigbrown	Moderate: slope.	Moderate: piping.	Deep to water	Slope, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
BcC:						
Bigbrown---------	Moderate: slope.	Moderate: piping.	Deep to water	Slope, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Slickspots-------	---	---	---	---	---	---
Be---------- Bosque	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
BrA, BrB---------- Branyon	Slight*--------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
Bu---------- Burleson	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
ChB---------- Chazos	Slight---------	Moderate: hard to pack.	Deep to water	Fast intake, droughty.	Soil blowing, percs slowly.	Percs slowly, droughty.
CrB---------- Crockett	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly, droughty.	Erodes easily, percs slowly.	Erodes easily, droughty.
CrC2---------- Crockett	Moderate: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, droughty.	Erodes easily, percs slowly.	Erodes easily, droughty.
DeC---------- Desan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Soil blowing, too sandy.	Droughty.
Dp---------- Dumps	---	---	---	---	---	---
EdC2---------- Edge	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, soil blowing, percs slowly.	Erodes easily, soil blowing.	Erodes easily, percs slowly.
EdC3:						
Edge----------	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, soil blowing, percs slowly.	Erodes easily, soil blowing.	Erodes easily, percs slowly.
Gullied land-----	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Water Management--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
FeE2:						
Ferris	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Heiden	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
Fr Frio	Slight*	Moderate: hard to pack.	Deep to water	Slow intake, flooding.	Favorable	Favorable.
Ga Gaddy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, flooding.	Too sandy, soil blowing.	Droughty.
GuB Gause	Slight*	Moderate: hard to pack.	Deep to water	Droughty, fast intake, soil blowing.	Percs slowly, soil blowing.	Droughty, percs slowly.
Gw Gowen	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
HeC Heiden	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
HoB Houston Black	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
JeE Jedd	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty. depth to rock.	Slope, depth to rock.	Depth to rock, slope, droughty.
LeB Lewisville	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Slow intake	Erodes easily	Erodes easily.
Lu:						
Lufkin	Slight*	Severe: hard to pack.	Deep to water	Soil blowing. percs slowly, droughty.	Erodes easily, percs slowly, soil blowing.	Droughty, erodes easily, percs slowly.
Gause	Slight*	Moderate: hard to pack.	Deep to water	Soil blowing	Percs slowly, soil blowing.	Percs slowly.
MnC Minerva	Moderate: seepage.	Moderate: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
MwC Minwells	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Soil blowing, percs slowly, slope.	Soil blowing	Percs slowly.
NoB Normangee	Slight	Severe: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Oa Oakalla	Moderate: seepage.	Moderate: hard to pack, piping.	Deep to water	Flooding	Favorable	Favorable.

See footnote at end of table.

Table 14.--Water Management--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PaC---------- Padina	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, slope, droughty.	Too sandy, soil blowing.	Droughty.
Pc---------- Payne	Slight*--------	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Pg---------- Pits	---	---	---	---	---	---
RaB---------- Rader	Severe: seepage.	Moderate: hard to pack, wetness.	Percs slowly---	Wetness, fast intake, droughty.	Wetness, soil blowing, erodes easily.	Percs slowly, erodes easily, droughty.
RgC---------- Riesel	Severe: seepage.	Moderate: thin layer.	Deep to water	Droughty, percs slowly, slope.	Percs slowly---	Droughty, percs slowly.
Sa---------- Sandow	Slight---------	Severe: piping.	Deep to water	Flooding-------	Too sandy------	Favorable.
SgB---------- Satin	Slight---------	Slight---------	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty, percs slowly.
SmC---------- Seawillow	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
Sp---------- Ships	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
SwB---------- Silawa	Severe: seepage.	Severe: thin layer.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
SwC---------- Silawa	Severe: seepage.	Severe: thin layer.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing---	Favorable.
SyB---------- Silstid	Moderate: seepage.	Severe: seepage, piping.	Deep to water	Slope, fast intake.	Soil blowing---	Droughty.
SwC---------- Sunev	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
Tc,Tn---------- Tinn	Slight---------	Severe: hard to pack.	Deep to water	Flooding, slow intake, percs slowly.	Percs slowly---	Percs slowly.
TrB---------- Travis	Slight*--------	Moderate: hard to pack.	Deep to water	Droughty, fast intake.	Soil blowing---	Droughty.
TrC2---------- Travis	Slight*--------	Moderate: hard to pack.	Deep to water	Droughty, fast intake, slope.	Soil blowing---	Droughty.
TsC---------- Travis	Moderate*: slope.	Moderate: hard to pack.	Deep to water	Slope, slow intake.	Favorable------	Favorable.

See footnote at end of table.

Table 14.--Water Management--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Uh---------- Uhland	Moderate: seepage.	Severe: piping.	Flooding-------	Wetness, erodes easily, soil blowing.	Wetness, erodes easily, soil blowing.	Erodes easily.
We---------- Weswood	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily--	Erodes easily.
Wh---------- Wilson	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Wv:						
Wilson----------	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Davilla----------	Slight---------	Moderate: hard to pack.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Ya---------- Yahola	Severe: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.

* Beds of sand and gravel are at a depth of 10 to 15 feet in some places.

Table 15.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
AgD2---------- Altoga	0-7	Silty clay	CH, CL	A-7-6	0	0	95-100	95-100	90-100	70-99	45-60	22-36
	7-62	Silty clay, silty clay loam	CH, CL	A-6, A-7-6	0	0	95-100	95-100	90-100	70-99	36-55	18-33
	62-80	Silty clay, silty clay loam, loam	CH, CL	A-6, A-7-6	0	0	95-100	95-100	90-100	58-99	32-55	15-33
Ba---------- Bastsil	0-16	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	95-100	95-100	75-100	36-70	0-25	NP-7
	16-80	Loam, clay loam, sandy clay loam	CL, SC	A-6, A-7-6	0	0	95-100	90-100	75-100	40-70	26-42	11-26
BbC---------- Bigbrown	0-2	Clay loam	CL	A-6, A-7	0	0-1	95-100	95-100	80-100	65-95	30-45	12-25
	2-80	Stratified very fine sandy loam to silty clay loam	CL, SC	A-4, A-6, A-7-6	0	0-1	85-100	85-100	60-100	36-95	25-50	7-27
BcC:												
Bigbrown--------	0-2	Clay loam	CL	A-6, A-7	0	0-1	95-100	95-100	80-100	65-95	30-45	12-25
	2-80	Stratified very fine sandy loam to silty clay loam	CL, SC	A-6, A-4, A-7-6	0	0-1	85-100	85-100	60-100	36-95	25-50	7-27
Slickspots------	---	---	---	---	---	---	---	---	---	---	---	---
Be---------- Bosque	0-21	Clay loam	CL, CL-ML	A-4, A-6, A-7-6	0	0	100	96-100	90-100	56-85	23-45	7-25
	21-52	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-7-6, A-6	0	0	100	95-100	80-90	50-85	23-45	7-25
	52-80	Loam, clay loam, clay	CL, CL-ML	A-6, A-4, A-7-6	0	0	98-100	95-100	85-100	65-94	23-49	7-29
BrA---------- Branyon	0-6	Clay	CH	A-7-6	0	0	95-100	85-100	80-100	75-100	54-80	35-55
	6-58	Clay, silty clay	CH	A-7-6	0	0	95-100	85-100	80-100	75-100	54-80	35-55
	58-80	Clay, silty clay	CH	A-7	0	0	90-100	85-100	80-100	75-100	54-80	38-60
BrB---------- Branyon	0-6	Clay	CH	A-7-6	0	0	95-100	85-100	80-100	75-100	54-80	35-55
	6-50	Clay, silty clay	CH	A-7-6	0	0	95-100	85-100	80-100	75-100	54-80	35-55
	50-80	Clay, silty clay	CH	A-7	0	0	90-100	85-100	80-100	75-100	54-80	38-60
Bu---------- Burleson	0-6	Clay	CH	A-7-6	0	0-2	90-100	90-100	90-99	67-97	56-75	33-49
	6-38	Clay, silty clay	CH	A-7-6	0	0-1	90-100	90-100	90-99	80-99	51-75	34-54
	38-80	Clay, silty clay, clay loam	CH	A-7-6	0	0-2	90-100	80-100	75-99	67-98	51-75	34-54

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
ChB---------- Chazos	0-17	Loamy fine sand	SC-SM, SM	A-2-4, A-4	0	0	80-100	75-100	60-98	20-50	0-25	NP-4
	17-26	Sandy clay, clay, clay loam	CH, CL	A-7-6	0	0	90-100	75-100	70-100	55-85	43-58	21-35
	26-36	Clay loam, sandy clay loam, sandy clay	CH, CL, SC	A-7-6	0	0	90-100	75-100	65-95	35-75	43-58	21-35
	36-80	Clay loam, silty clay loam, clay, sandy clay	CH, CL, SC	A-6, A-7-6, A-7	0	0	90-100	75-100	65-100	40-75	35-45	14-22
CrB---------- Crockett	0-7	Fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0-2	98-100	94-100	89-100	40-96	15-35	3-15
	7-13	Clay, clay loam, sandy clay	CH, CL	A-6, A-7	0	0	89-100	75-100	75-100	60-98	35-59	23-42
	13-42	Clay loam, sandy clay loam, clay	CH, CL	A-6, A-7	0	0-5	90-100	85-100	75-100	50-90	30-60	15-40
	42-80	Stratified loam to clay	CH, CL	A-7	0	0-5	90-100	90-100	90-100	70-99	45-71	27-52
CrC2---------- Crockett	0-4	Fine sandy loam	CL, SM, ML, SC	A-4, A-6	0	0-2	98-100	94-100	89-100	40-96	15-35	3-15
	4-13	Clay, clay loam, sandy clay	CH, CL	A-6, A-7	0	0	89-100	75-100	75-100	60-98	35-59	23-42
	13-46	Clay, clay loam, sandy clay	CH, CL	A-6, A-7	0	0	89-100	75-100	75-100	65-98	35-59	23-42
	46-80	Stratified loam to clay	CH, CL	A-7	0	0-5	90-100	90-100	90-100	70-99	45-71	27-52
DeC---------- Desan	0-8	Loamy fine sand	SC-SM, SP-SM, SM	A-2-4, A-3	0	0	98-100	95-100	85-100	8-28	16-25	NP-5
	8-50	Loamy fine sand, fine sand	SM, SC-SM, SP-SM	A-2-4, A-3	0	0	98-100	95-100	85-100	8-28	16-25	NP-5
	50-80	Sandy clay loam, fine sandy loam	SC	A-4, A-2, A-6	0	0	98-100	95-100	90-100	25-50	20-36	8-20
Dp---------- Dumps	---	---	---	---	---	---	---	---	---	---	---	---
EdC2---------- Edge	0-11	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-4	0	0	98-100	96-100	80-100	45-75	15-30	NP-7
	11-29	Sandy clay, clay	CH, CL	A-7-6	0	0	98-100	97-100	90-100	70-98	48-65	29-42
	29-43	Clay loam, sandy clay	CL	A-6, A-7-6	0-5	0	98-100	96-100	90-100	65-96	30-49	14-30
	43-48	Fine sandy loam, sandy clay loam, clay loam	CL-ML, SC, CL, SC-SM	A-4, A-6, A-7-6	0-10	0	95-100	90-100	72-100	48-78	18-45	4-25
	48-80	Stratified fine sandy loam to clay	CH, CL, SC	A-2-6, A-6, A-2-7	0	0	95-100	90-100	72-100	29-80	25-51	11-34

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
EdC3:												
Edge	0-3	Fine sandy loam	CL-ML, ML, SM, SC-SM	A-4	0	0	98-100	96-100	80-100	45-75	15-30	NP-7
	3-23	Sandy clay, clay	CH, CL	A-7-6	0	0	98-100	97-100	90-100	70-98	48-65	29-42
	23-40	Clay loam, sandy clay	CL	A-6, A-7-6	0-5	0	98-100	96-100	90-100	65-96	30-49	14-30
	40-80	Stratified fine sandy loam to clay	CH, CL, SC	A-2-6, A-2-7, A-6	0	0	95-100	90-100	72-100	29-80	25-51	11-34
Gullied land	0-80	---	---	---	---	---	---	---	---	---	---	---
FeE2:												
Ferris	0-10	Clay	CH	A-7-6	0	0	92-100	92-100	75-100	75-100	51-76	35-55
	10-40	Clay, silty clay	CH	A-7-6	0	0	92-100	92-100	75-100	72-100	51-78	35-56
	40-80	Clay, silty clay	CH	A-7-6	0	0	92-100	92-100	85-100	75-100	61-100	42-75
Heiden	0-18	Clay	CH	A-7-6	0	0	95-100	90-100	80-100	75-99	51-80	32-55
	18-42	Clay, silty clay	CH, CL	A-7-6	0	0	95-100	90-100	75-100	70-90	49-80	32-55
	42-80	Clay	CH, CL	A-7-6	0	0	92-100	92-100	85-100	70-90	49-80	32-55
Fr	0-6	Silty clay	CH, CL	A-6, A-7	0	0-2	90-100	85-100	85-100	69-100	36-59	17-34
Frio	6-50	Silty clay, silty clay loam, clay loam	CH, CL	A-6, A-7	0	0-2	90-100	85-100	85-100	69-100	36-59	17-34
	50-80	Silty clay, silty clay loam, clay loam	CH, CL	A-6, A-7	0	0-5	90-100	90-100	85-100	68-100	36-59	17-34
Ga	0-7	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	95-100	70-100	36-60	15-26	NP-7
Gaddy	7-80	Stratified fine sand to clay loam	CL, SP-SM, ML, SM	A-2, A-3, A-6, A-4	0	0	100	98-100	80-100	5-90	0-40	NP-18
GuB	0-14	Loamy fine sand	SC-SM, SM	A-2-4	0	0	100	95-100	80-100	15-30	16-22	NP-5
Gause	14-48	Sandy clay, clay loam, clay	CH, CL, SC	A-7-6	0	0	100	95-100	90-100	40-70	41-55	18-28
	48-80	Sandy clay, clay loam, sandy clay loam	CL, SC	A-2-6, A-6, A-7-6	0	0	100	95-100	85-100	30-70	30-49	11-25
Gw	0-37	Clay loam	CL	A-6, A-7-6	0	0	100	96-100	85-100	60-85	30-49	15-30
Gowen	37-80	Clay loam, loam, sandy clay loam	CL	A-6, A-7-6	0	0	100	96-100	80-100	55-85	25-45	11-28
HeC	0-10	Clay	CH	A-7-6	0	0	95-100	90-100	80-100	75-99	51-80	32-55
Heiden	10-21	Clay, silty clay	CH	A-7-6	0	0	95-100	90-100	80-100	75-99	51-80	32-55
	21-44	Clay, silty clay	CH, CL	A-7-6	0	0	95-100	90-100	75-100	70-90	49-80	32-55
	44-80	Clay	CH, CL	A-7-6	0	0	92-100	92-100	85-100	70-90	49-80	32-55

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
HoB---------- Houston Black	0-6	Clay	CH	A-7-6	0	0	97-100	96-100	94-100	88-98	58-90	34-60
	6-67	Clay, silty clay	CH	A-7-6	0	0	98-100	98-100	92-100	88-97	58-98	37-72
	67-80	Clay, silty clay	CH	A-7-6	0	0	94-100	93-100	87-100	84-99	51-99	32-78
JeE---------- Jedd	0-11	Very gravelly sandy loam	GP-GM, GM, SM, SP-SM	A-1-b, A-1-a, A-2-4	0	0-4	35-60	15-50	15-42	6-29	16-30	NP-7
	11-25	Clay, sandy clay, sandy clay loam	CH, ML, CL, MH	A-6, A-7-5, A-7-6	0	0-4	90-100	90-100	70-100	51-87	35-61	15-29
	25-80	Weathered bedrock			---	---	---	---	---	---	---	---
LeB---------- Lewisville	0-14	Silty clay	CH, CL	A-7	0	0	95-100	95-100	82-99	77-95	41-61	20-37
	14-26	Silty clay, clay loam, silty clay loam	CH, CL	A-7	0	0	95-100	95-100	73-99	72-95	40-60	24-36
	26-80	Silty clay, clay loam, silty clay loam	CH, CL	A-6, A-7	0	0	75-100	72-99	69-98	62-95	30-55	12-34
Lu:												
Lufkin----------	0-6	Loam	CL, ML, SM, SC	A-4	0	0-5	90-100	80-100	80-100	40-85	15-30	NP-10
	6-55	Clay, clay loam, silty clay loam	CH, CL	A-7-6	0	0	90-100	90-100	90-100	65-95	45-67	30-45
	55-80	Loam, clay loam, sandy clay loam	CL, CH, SC	A-7	0	0	85-100	85-100	80-100	48-90	40-86	25-55
Gause----------	0-16	Fine sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	100	95-100	80-100	20-50	16-25	3-8
	16-50	Sandy clay, clay loam, clay	CH, SC, CL	A-7-6	0	0	100	95-100	90-100	40-70	41-55	18-28
	50-80	Sandy clay, clay loam, sandy clay loam	CL, SC	A-2-6, A-6, A-7-6	0	0	100	95-100	85-100	30-70	30-49	11-25
MnC---------- Minerva	0-14	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	95-100	95-99	60-85	20-40	16-25	NP-6
	14-80	Sandy clay loam, loam, fine sandy loam	CL, SC	A-6	0	0	95-100	95-100	85-99	40-60	28-40	11-20
MwC---------- Minwells	0-10	Fine sandy loam	CL-ML, SC, CL, SC-SM	A-4, A-2, A-6	0	0	96-100	90-100	80-98	30-60	0-30	NP-15
	10-50	Clay, clay loam, sandy clay	CL	A-6, A-7-6	0	0	95-100	90-100	85-98	50-80	32-50	15-32
	50-80	Clay loam, sandy clay loam, gravelly sandy clay loam	CL, SC	A-4, A-6, A-7-6	0	0	85-100	80-100	65-98	45-80	23-45	8-26

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
NoB---------- Normangee	0-6	Clay loam	CL	A-6, A-7	0	0	98-100	96-100	90-100	65-95	30-48	11-27
	6-40	Clay, clay loam	CH, CL	A-7	0	0	98-100	98-100	90-100	65-96	44-80	22-58
	40-80		CH, CL	A-7	0	0	95-100	90-100	90-100	65-90	41-60	20-35
Oa---------- Oakalla	0-6	Silty clay loam	CH, CL	A-6, A-7-6	0-1	0-2	90-100	90-100	85-100	60-97	25-54	14-33
	6-38	Loam, clay loam, silty clay loam	CH, CL	A-6, A-7-6	0-1	0-2	85-100	80-100	70-100	60-99	28-58	13-38
	38-80	Loam, clay loam, silty clay loam	CH, CL	A-4, A-6, A-7-6	0-1	0-2	85-100	80-100	75-100	60-96	25-55	8-35
PaC---------- Padina	0-8	Fine sand	SM, SC-SM, SP-SM	A-2-4, A-3	0	0	100	95-100	65-80	8-28	16-25	NP-5
	8-66	Fine sand, loamy fine sand	SC-SM, SM, SP-SM	A-2-4, A-3	0	0	100	95-100	85-100	8-28	16-25	NP-5
	66-80	Sandy clay loam, fine sandy loam	CL, SC	A-2, A-4, A-7, A-6	0	0	90-100	90-100	90-100	25-65	22-42	8-22
Pc---------- Payne	0-7	Loam	CL	A-4, A-6	0	0	95-100	95-100	90-100	60-80	25-36	8-16
	7-34	Clay, clay loam	CH, CL	A-7-6	0	0	95-100	95-100	85-100	70-90	45-60	25-36
	34-80	Clay, clay loam	CH, CL	A-6, A-7-6	0	0-5	85-100	80-100	70-90	55-90	35-55	20-36
Pg---------- Pits	---	---	---	---	---	---	---	---	---	---	---	---
RaB---------- Rader	0-5	Loamy fine sand	SC-SM, SM	A-2-4	0	0	98-100	95-100	90-100	14-29	16-20	1-5
	5-18	Fine sandy loam, very fine sandy loam, loam	ML, CL-ML, SC, SM	A-2, A-4	0	0	98-100	95-100	90-100	34-75	18-28	3-10
	18-26	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	95-100	95-100	90-100	36-75	26-40	11-22
	26-52	Clay loam, sandy clay, clay	CH, CL	A-6, A-7	0	0	95-100	95-100	90-100	51-90	36-60	18-38
	52-80	Sandy clay loam, sandy clay, clay	CH, CL, SC	A-6, A-7	0	0	95-100	95-100	90-100	36-75	25-52	11-36
RgC---------- Riesel	0-11	Gravelly fine sandy loam	GP-GM, GM, SC, SM	A-2-4, A-1, A-2-6	0	0-5	25-88	15-85	12-70	5-30	16-33	3-17
	11-27	Very gravelly clay, very gravelly clay loam	GC, SC	A-2-7, A-7	0	0-5	25-70	25-50	18-50	15-45	41-60	23-40
	27-60	Clay, extremely gravelly clay, very gravelly clay	CL, CH, GC, SC	A-2-7, A-7	0	0-5	25-92	20-85	14-80	8-75	41-81	20-54
	60-80	Gravelly fine sand, very gravelly loamy sand	GP-GM	A-1	0	5-10	10-40	10-30	10-15	6-10	0-14	NP

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
Sa	0-8	Clay loam	CL	A-6, A-7-6	0	0	100	100	90-100	65-90	25-45	11-28
Sandow	8-80	Stratified loamy sand to clay loam	CL, CL-ML, SC	A-4, A-7-6, A-6	0	0	100	100	65-100	30-75	25-47	7-28
SgB	0-9	Gravelly clay loam	CL, CH, GC, SC	A-7-6	0	0-3	65-95	60-90	50-80	42-70	45-64	23-38
Satin	9-60	Very gravelly clay, gravelly clay	GC, SC, GP-GC, GW-GC	A-2-7	0	0-5	15-70	12-50	11-35	10-35	56-72	33-46
	60-80	Clay, silty clay	CH, CL	A-6, A-7-6	0	0	90-100	85-100	75-100	60-100	35-55	20-40
SmC	0-8	Loam	CL-ML, CL, SC, SC-SM	A-6, A-4, A-7-6	0	0-15	85-100	75-100	75-100	49-83	20-45	5-25
Seawillow	8-50	Loam, clay loam, silty clay loam	CL	A-6, A-7-6	0	0-15	85-100	65-100	60-100	51-82	30-45	14-26
	50-80	Loam, clay loam, silty clay loam	CL	A-6, A-4, A-7-6	0	0-15	85-100	75-100	75-100	51-80	25-45	8-25
Sp	0-6	Clay	CH	A-7-6	0	0	100	100	95-100	95-100	55-75	35-50
Ships	6-80	Clay	CH	A-7-6	0	0	100	100	95-100	95-100	55-75	35-50
SwB	0-14	Loamy fine sand	SC-SM, SM	A-2-4	0	0	95-100	95-100	70-100	15-35	16-22	NP-4
Silawa	14-50	Sandy clay loam, fine sandy loam, clay loam	CL, SC	A-4, A-6	0	0	85-100	85-100	80-100	35-65	25-40	8-18
	50-80	Fine sandy loam, gravelly fine sandy loam, sandy clay loam	CL-ML, CL, SC, SC-SM	A-2-4, A-4, A-6	0	0-2	70-100	70-100	38-100	18-60	21-34	4-14
SwC	0-11	Loamy fine sand	SC-SM, SM	A-2-4	0	0	95-100	95-100	70-100	15-35	16-22	NP-4
Silawa	11-42	Sandy clay loam, fine sandy loam, clay loam	CL, SC	A-4, A-6	0	0	85-100	85-100	80-100	35-65	25-40	8-18
	42-80	Loamy fine sand, gravelly loamy fine sand, fine sandy loam	GM, SP-SM, SC-SM, SM	A-2-4, A-1-b, A-4	0	0-2	51-100	51-100	38-100	12-40	16-26	NP-7
SyB	0-8	Loamy fine sand	SM, SP-SM	A-2-4, A-3	0	0-1	90-100	85-100	80-100	9-25	16-25	NP-3
Silstid	8-32	Fine sand, loamy fine sand	SM, SP-SM	A-2, A-3	0	0-1	90-100	85-100	80-100	9-25	16-25	NP-3
	32-80	Sandy clay loam, loam, fine sandy loam	CL, SC-SM, CL-ML, SC	A-2-4, A-6, A-2-6, A-4	0	0-1	90-100	85-100	75-100	30-55	20-43	4-26

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
SzC	0-18	Loam	CL, SC	A-4, A-6	0	0	90-100	80-100	70-100	45-70	25-35	8-16
Sunev	18-30	Loam, clay loam, silty clay loam	CL	A-4, A-6	0	0	85-100	80-100	70-100	51-85	28-40	8-20
	30-80	Loam, clay loam, silty clay loam	CL	A-4, A-6, A-7-6	0	0	80-100	70-100	65-100	51-70	25-42	8-22
Tc	0-17	Clay	CH, CL	A-7	0	0	95-100	95-100	85-100	80-100	45-75	25-54
Tinn	17-80	Clay, silty clay	CH	A-7	0	0	95-100	90-100	80-100	80-100	55-75	35-54
Tn	0-24	Clay	CH, CL	A-7	0	0	95-100	95-100	85-100	80-100	45-75	25-54
Tinn	24-52	Clay, silty clay	CH	A-7	0	0	95-100	90-100	80-100	80-100	55-75	35-54
	52-80	Clay, silty clay	CH	A-7	0	0	95-100	90-100	80-100	80-100	55-75	35-54
TrB	0-17	Loamy fine sand	SC-SM, SM, SP-SM	A-2-4	0	0-2	90-100	83-100	80-90	10-35	15-25	NP-5
Travis	17-50	Sandy clay, clay, gravelly clay	CH, CL, SC	A-6, A-7-6	0	0-2	90-100	69-100	60-90	36-53	38-54	18-30
	50-80	Gravelly sandy clay loam, gravelly sandy clay, gravelly fine sandy loam	GC, SC	A-2-4, A-2-6, A-6	0-1	0-10	60-90	15-90	15-75	15-45	27-45	9-24
TrC2	0-5	Loamy fine sand	SC-SM, SM, SP-SM	A-2-4	0	0-2	90-100	83-100	80-90	10-35	15-25	NP-5
Travis	5-34	Sandy clay, clay, gravelly clay	CH, CL, SC	A-6, A-7-6	0	0-2	90-100	69-100	60-90	36-53	38-54	18-30
	34-80	Sandy clay loam, gravelly sandy clay, gravelly fine sandy loam	GC, SC	A-2-4, A-2-6, A-6	0-1	0-10	95-100	90-100	75-100	51-90	30-60	15-40
TsC	0-3	Gravelly sandy loam, sandy clay	GM, SM, SC	A-1, A-2	0	0-2	55-75	40-75	40-65	20-35	<15	NP-5
Travis	3-50	Sandy clay, clay, gravelly clay	CH, CL, SC	A-6, A-7	0	0-2	90-100	69-100	60-95	36-53	38-54	18-30
	50-80	Gravelly sandy clay loam, gravelly sandy clay, gravelly fine sandy loam	GC, SC	A-2-4, A-2-6, A-6	0-1	0-10	60-90	15-90	15-75	15-45	27-45	9-24

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
Uh	0-6	Loam	ML, CL, SC, SM	A-4, A-6	0	0	97-100	97-100	80-100	36-70	22-35	3-13
Uhland	6-44	Loamy fine sand, loam, very fine sandy loam	CL, SM, ML, SC	A-4, A-6	0	0	90-100	83-100	80-90	10-35	15-25	NP-5
	44-80	Loam, clay loam	CL	A-4, A-6, A-7	0	0	97-100	95-100	80-100	50-90	28-43	9-21
We	0-6	Silty clay loam	CL	A-4, A-6	0	0	100	98-100	95-100	75-98	20-40	9-22
Weswood	6-41	Very fine sandy loam, silty clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0	100	98-100	95-100	70-98	20-40	5-22
	41-80	Silty clay loam, silty clay	CH, CL	A-7-6	0	0	100	98-100	95-100	75-100	40-60	22-40
Wn	0-9	Loam	CL	A-6	0	0	95-100	85-100	80-100	60-96	26-38	11-20
Wilson	9-58	Silty clay, clay, clay loam	CH, CL	A-7-6	0	0	90-100	80-100	80-100	65-96	43-56	26-37
	58-80	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7-6	0	0	95-100	90-100	85-100	70-96	38-65	24-48
Wv:												
Wilson	0-4	Loam	CL	A-6	0	0	95-100	85-100	80-100	60-96	26-38	11-20
	4-36	Silty clay, clay, clay loam	CH, CL	A-7-6	0	0	90-100	80-100	80-100	65-96	43-56	26-37
	36-80	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7-6	0	0	95-100	90-100	85-100	70-96	38-65	24-48
Davilla	0-10	Loam	CL, CL-ML	A-4, A-6	0	0-2	95-100	95-100	85-100	51-85	20-33	4-15
	10-24	Sandy clay loam, clay loam	CH, CL	A-6, A-7	0	0	95-100	90-100	75-100	51-90	30-60	15-40
	24-50	Sandy clay loam, clay loam	CH, CL	A-6, A-7	0	0	95-100	90-100	75-100	51-90	30-60	15-40
	50-80	Sandy clay loam, clay loam, loam	CH, CL	A-6, A-7	0	0-5	95-100	85-100	65-100	51-90	30-60	15-40
Ya	0-12	Loam	CL-ML, CL, ML	A-4	0	0	100	100	94-100	51-85	14-29	NP-10
Yahola	12-80	Fine sandy loam, loam, very fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-10

Table 16.--Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated.)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	*Pct*	*G/cc*	*In/hr*	*In/in*	*pH*					*Pct*
AgD2	0-7	40-50	1.10-1.40	0.6-2.0	0.15-0.18	7.9-8.4	High	0.32	5	4	0.5-2
Altoga	7-62	30-50	1.20-1.50	0.6-2.0	0.15-0.18	7.9-8.4	Moderate	0.32			
	62-80	25-50	1.20-1.50	0.6-2.0	0.15-0.18	7.9-8.4	Moderate	0.32			
Ba	0-16	7-20	1.50-1.65	2.0-6.0	0.11-0.15	5.1-7.3	Low	0.24	5	3	0.5-2
Bastsil	16-80	18-35	1.50-1.65	0.6-2.0	0.12-0.16	5.6-7.8	Moderate	0.32			
BbC	0-2	27-40	1.20-1.55	0.2-0.6	0.15-0.20	5.6-8.4	Moderate	0.37	5	6	<1
Bigbrown	2-80	18-35	1.25-1.60	0.06-0.2	0.10-0.18	5.6-8.4	Moderate	0.43			
BcC:											
Bigbrown	0-2	27-40	1.20-1.55	0.2-0.6	0.15-0.20	5.6-8.4	Moderate	0.37	5	6	<1
	2-80	18-35	1.25-1.60	0.06-0.2	0.10-0.18	5.6-8.4	Moderate	0.43			
Slickspots	---	---	---	---	---	---	---	--	-	--	--
Be	0-21	27-35	1.20-1.40	0.6-2.0	0.15-0.20	7.9-8.4	Low	0.28	5	4L	1-4
Bosque	21-52	20-35	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	Low	0.28			
	52-80	20-45	1.20-1.40	0.6-2.0	0.11-0.18	7.9-8.4	Low	0.28			
BrA	0-6	40-60	1.15-1.45	<0.06	0.12-0.18	7.4-8.4	Very high	0.32	5	4	2-4
Branyon	6-58	40-60	1.20-1.45	<0.06	0.12-0.18	7.4-8.4	Very high	0.32			
	58-80	40-60	1.20-1.35	<0.06	0.12-0.18	7.9-8.4	Very high	0.32			
BrB	0-6	40-60	1.15-1.45	0.01-0.06	0.12-0.18	7.4-8.4	Very high	0.32	5	4	2-4
Branyon	6-50	40-60	1.20-1.45	0.01-0.06	0.12-0.18	7.4-8.4	Very high	0.32			
	50-80	30-60	1.20-1.35	0.01-0.06	0.12-0.18	7.9-8.4	Very high	0.32			
Bu	0-6	40-60	1.35-1.50	0.01-0.06	0.12-0.18	5.6-7.8	Very high	0.32	5	4	1-3
Burleson	6-38	40-60	1.40-1.55	0.01-0.06	0.12-0.18	5.6-8.4	Very high	0.32			
	38-80	35-60	1.40-1.55	0.01-0.06	0.12-0.18	7.4-8.4	Very high	0.32			
ChB	0-17	2-12	1.40-1.60	2.0-6.0	0.06-0.10	5.6-7.3	Low	0.20	5	2	0.5-1
Chazos	17-26	35-50	1.35-1.50	0.06-0.2	0.10-0.18	5.6-6.5	Moderate	0.32			
	26-36	20-40	1.35-1.55	0.06-0.2	0.10-0.18	5.6-7.3	Moderate	0.32			
	36-80	27-45	1.40-1.60	0.06-0.2	0.10-0.18	6.1-8.4	Moderate	0.32			
CrB	0-7	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.8	Low	0.43	5	5	0.5-2
Crockett	7-13	40-55	1.35-1.60	0.01-0.06	0.18-0.14	5.6-7.3	High	0.32			
	13-42	20-50	1.50-1.70	0.01-0.06	0.11-0.15	6.1-8.4	Moderate	0.32			
	42-80	30-60	1.50-1.70	0.01-0.06	0.11-0.15	6.1-8.4	High	0.32			
CrC2	0-4	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.8	Low	0.43	5	5	0.5-2
Crockett	4-13	40-55	1.35-1.60	0.01-0.06	0.08-0.14	5.6-7.3	High	0.32			
	13-46	35-55	1.40-1.65	0.01-0.06	0.08-0.14	6.1-8.4	High	0.32			
	46-80	30-60	1.50-1.70	0.01-0.06	0.11-0.15	6.1-8.4	High	0.32			
DeC	0-8	2-12	1.30-1.60	6.0-20	0.05-0.08	5.1-7.3	Low	0.20	5	2	<1
Desan	8-50	2-12	1.30-1.60	6.0-20	0.05-0.08	5.1-7.3	Low	0.17			
	50-80	12-25	1.35-1.65	0.6-2.0	0.12-0.16	5.1-6.5	Low	0.24			
Dp	---	---	---	---	---	---	---	--	-	--	--
Dump											

Table 16.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	*Pct*	*G/cc*	*In/hr*	*In/in*	*pH*					*Pct*
EdC2----------	0-11	5-12	1.25-1.55	0.6-2.0	0.14-0.18	4.5-7.3	Low----------	0.43	5	3	0.5-1
Edge	11-29	40-55	1.36-1.55	0.01-0.06	0.11-0.19	4.5-6.5	High----------	0.32			
	29-43	35-45	1.45-1.65	0.06-0.2	0.10-0.16	4.5-6.5	Moderate-----	0.32			
	43-48	10-40	1.40-1.69	0.2-0.6	0.10-0.16	4.5-7.8	Moderate-----	0.37			
	48-80	10-45	1.50-1.75	0.06-0.2	0.11-0.18	5.1-8.4	Moderate-----	0.37			
EdC3:											
Edge----------	0-3	5-12	1.25-1.55	0.6-2.0	0.14-0.18	4.5-7.3	Low----------	0.43	5	3	0.5-1
	3-23	40-55	1.36-1.55	0.01-0.06	0.11-0.19	4.5-6.5	High----------	0.32			
	23-40	35-45	1.45-1.65	0.06-0.2	0.10-0.16	4.5-6.5	Moderate-----	0.32			
	40-80	10-45	1.50-1.75	0.06-0.2	0.11-0.18	5.1-8.4	Moderate-----	0.37			
Gullied land----	---	---	---	---	---	---	---	--	-	--	--
FeE2:											
Ferris----------	0-10	40-65	1.40-1.50	0.01-0.06	0.15-0.18	7.9-8.4	Very high----	0.32	4	4	0.5-2
	10-40	40-65	1.40-1.50	0.01-0.06	0.12-0.18	7.9-8.4	Very high----	0.32			
	40-80	40-75	1.45-1.65	0.01-0.06	0.11-0.15	7.9-8.4	High----------	0.32			
Heiden----------	0-18	40-60	1.30-1.50	<0.06	0.12-0.18	7.9-8.4	Very high----	0.32	5	4	1-4
	18-42	40-60	1.40-1.60	<0.06	0.12-0.18	7.9-8.4	Very high----	0.32			
	42-80	40-60	1.45-1.65	<0.06	0.11-0.15	7.9-8.4	Very high----	0.32			
Fr----------	0-6	30-50	1.25-1.45	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32	5	4	1-4
Frio	6-50	30-50	1.25-1.45	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
	50-80	35-50	1.30-1.55	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
Ga----------	0-7	10-18	1.30-1.60	2.0-6.0	0.11-0.15	7.4-8.4	Low----------	0.20	5	3	<0.5
Gaddy	7-80	5-35	1.50-1.70	6.0-20	0.06-0.10	7.9-8.4	Low----------	0.17			
GuB----------	0-14	5-15	1.40-1.60	6.0-20	0.06-0.10	5.6-7.3	Low----------	0.17	5	2	<1
Gause	14-48	35-50	1.40-1.65	0.06-0.2	0.12-0.18	4.5-6.0	Moderate-----	0.32			
	48-80	20-40	1.40-1.65	0.2-0.6	0.12-0.18	4.5-6.0	Moderate-----	0.32			
Gw----------	0-37	27-30	1.35-1.50	0.6-2.0	0.15-0.20	6.6-8.4	Moderate-----	0.28	5	6	1-4
Gowen	37-80	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.6-8.4	Moderate-----	0.28			
HeC----------	0-10	40-60	1.30-1.50	<0.06	0.12-0.18	7.9-8.4	Very high----	0.32	5	4	1-4
Heiden	10-21	40-60	1.35-1.55	<0.06	0.12-0.18	7.9-8.4	Very high----	0.32			
	21-44	40-60	1.40-1.60	<0.06	0.12-0.18	7.9-8.4	Very high----	0.32			
	44-80	40-60	1.45-1.65	<0.06	0.11-0.15	7.9-8.4	Very high----	0.32			
HoB----------	0-6	50-60	1.20-1.40	<0.06	0.15-0.20	7.4-8.4	Very high----	0.32	5	4	1-5
Houston Black	6-67	50-60	1.25-1.50	<0.06	0.12-0.18	7.4-8.4	Very high----	0.32			
	67-80	45-65	1.30-1.55	<0.06	0.10-0.16	7.4-8.4	Very high----	0.32			
JeE----------	0-11	5-18	1.20-1.40	0.6-2.0	0.04-0.10	5.6-7.3	Low----------	0.10	3	8	0.5-2
Jedd	11-25	35-55	1.35-1.55	0.2-0.6	0.13-0.17	4.5-6.0	Moderate-----	0.32			
	25-80	---	---	0.01-0.06	---	---	----------	----			
LeB----------	0-14	28-45	1.20-1.40	0.6-2.0	0.16-0.20	7.9-8.4	High----------	0.32	5	4L	1-3
Lewisville	14-26	30-45	1.20-1.45	0.6-2.0	0.14-0.18	7.9-8.4	High----------	0.37			
	26-80	30-50	1.30-1.50	0.6-2.0	0.14-0.18	7.9-8.4	High----------	0.37			
Lu:											
Lufkin----------	0-6	15-18	1.35-1.55	0.6-2.0	0.11-0.18	5.1-6.5	Low----------	0.43	5	3	0.5-2
	6-55	35-50	1.40-1.60	0.01-0.06	0.09-0.14	4.5-7.8	Very high----	0.32			
	55-80	20-40	1.40-1.68	0.01-0.06	0.09-0.14	5.6-8.4	High----------	0.37			
Gause----------	0-16	10-20	1.40-1.60	2.0-6.0	0.11-0.15	5.6-7.3	Low----------	0.24	5	3	<1
	16-50	35-50	1.40-1.65	0.06-0.2	0.12-0.18	4.5-6.0	Moderate-----	0.32			
	50-80	20-40	1.40-1.65	0.2-0.6	0.12-0.18	4.5-6.0	Moderate-----	0.32			

Table 16.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	*Pct*	*G/cc*	*In/hr*	*In/in*	*pH*					*Pct*
MnC	0-14	5-12	1.30-1.60	6.0-20	0.07-0.11	5.6-7.3	Low	0.20	5	2	0.5-1
Minerva	14-80	18-33	1.35-1.60	0.6-2.0	0.12-0.19	4.5-6.0	Moderate	0.32			
MwC	0-10	10-20	1.40-1.55	2.0-6.0	0.10-0.15	6.1-7.8	Low	0.24	5	3	<1
Minwells	10-50	35-45	1.35-1.60	0.06-0.2	0.11-0.16	5.6-7.8	Moderate	0.32			
	50-80	20-35	1.35-1.60	0.2-0.6	0.10-0.16	6.6-8.4	Moderate	0.32			
NoB	0-6	25-35	1.50-1.60	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	0.37	4	6	0.5-2
Normangee	6-40	35-55	1.55-1.65	<0.06	0.12-0.18	5.6-8.4	High	0.32			
	40-80	35-55	1.60-1.70	<0.06	0.12-0.18	6.1-8.4	High	0.32			
Oa	0-6	25-43	1.30-1.45	0.6-2.0	0.14-0.19	7.9-8.4	Moderate	0.32	5	4L	1-7
Oakalla	6-38	20-40	1.30-1.45	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	0.32			
	38-80	20-40	1.35-1.50	0.6-2.0	0.12-0.16	7.9-8.4	Moderate	0.32			
PaC	0-8	2-10	1.20-1.50	6.0-20	0.05-0.08	5.6-7.3	Low	0.17	5	1	0.5-1
Padina	8-66	2-10	1.20-1.50	6.0-20	0.05-0.08	5.6-7.3	Low	0.17			
	66-80	18-30	1.40-1.60	0.6-2.0	0.14-0.18	5.1-6.5	Low	0.24			
Pc	0-7	20-30	1.40-1.60	0.2-0.6	0.15-0.20	6.1-7.3	Moderate	0.37	5	6	1-3
Payne	7-34	35-55	1.40-1.55	<0.06	0.12-0.18	6.1-7.8	Moderate	0.32			
	34-80	35-55	1.45-1.60	<0.06	0.12-0.18	7.4-8.4	Moderate	0.32			
Pg	---	---	---	---	---	---	---	--	-	--	--
Pits											
RaB	0-5	2-12	1.40-1.60	6.0-20	0.08-0.14	4.5-6.5	Low	0.24	5	2	0.5-1
Rader	5-18	4-15	1.35-1.55	2.0-6.0	0.10-0.18	4.5-6.5	Low	0.37			
	18-26	18-30	1.40-1.60	0.2-0.6	0.10-0.18	4.5-6.0	Moderate	0.32			
	26-52	35-50	1.45-1.65	0.01-0.06	0.10-0.18	4.5-6.5	High	0.32			
	52-80	24-45	1.45-1.65	0.06-0.2	0.10-0.18	5.1-8.4	Moderate	0.32			
RgC	0-11	5-15	1.40-1.60	2.0-6.0	0.04-0.10	6.1-7.3	Low	0.10	4	8	0.5-2
Riesel	11-27	35-55	1.35-1.50	0.06-0.2	0.05-0.12	5.6-7.3	Moderate	0.17			
	27-60	35-55	1.40-1.55	0.06-0.2	0.05-0.16	5.6-7.3	Moderate	0.17			
	60-80	3-12	1.45-1.65	6.0-20	0.03-0.05	6.6-8.4	Low	0.10			
Sa	0-8	27-35	1.25-1.40	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	0.32	5	6	1-4
Sandow	8-80	10-35	1.30-1.60	0.2-0.6	0.12-0.17	5.6-7.8	Moderate	0.32			
SgB	0-9	30-40	1.35-1.55	0.06-0.2	0.12-0.18	6.6-7.8	High	0.37	5	4	1-3
Satin	9-60	40-55	1.25-1.50	0.06-0.2	0.05-0.12	6.6-8.4	High	0.28			
	60-80	40-55	1.25-1.55	0.06-0.2	0.12-0.18	7.9-8.4	High	0.32			
SmC	0-8	20-27	1.35-1.50	0.6-2.0	0.12-0.18	7.9-8.4	Low	0.28	5	4L	<1
Seawillow	8-50	22-40	1.35-1.55	0.6-2.0	0.12-0.16	7.9-8.4	Moderate	0.28			
	50-80	22-40	1.35-1.60	0.6-2.0	0.12-0.14	7.9-8.4	Low	0.32			
Sp	0-6	60-80	1.20-1.40	<0.06	0.14-0.18	7.9-8.4	Very high	0.32	5	4	0.5-3
Ships	6-80	60-80	1.20-1.40	<0.06	0.10-0.18	7.9-8.4	Very high	0.32			
SwB	0-14	5-15	1.20-1.45	6.0-20	0.07-0.11	5.1-6.5	Low	0.20	5-4	2	0.5-2
Silawa	14-50	18-35	1.35-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.32			
	50-80	12-30	1.40-1.65	2.0-6.0	0.08-0.15	4.5-6.0	Low	0.32			
SwC	0-11	5-15	1.20-1.45	6.0-20	0.07-0.11	5.1-6.5	Low	0.20	5-4	2	0.5-2
Silawa	11-42	18-35	1.35-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.32			
	42-80	2-15	1.40-1.70	6.0-20	0.05-0.11	4.5-6.5	Low	0.20			
SyB	0-8	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17	5	2	0.5-1
Silstid	8-32	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	32-80	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24			

Table 16.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	*Pct*	*G/cc*	*In/hr*	*In/in*	*pH*					*Pct*
SzC	0-18	15-28	1.30-1.50	0.6-2.0	0.10-0.16	7.9-8.4	Low	0.28	5	3	1-3
Sunev	18-30	20-40	1.40-1.60	0.6-2.0	0.11-0.16	7.9-8.4	Low	0.28			
	30-80	20-40	1.40-1.60	0.6-2.0	0.11-0.16	7.9-8.4	Low	0.28			
Tc	0-17	40-60	1.40-1.50	0.06-0.2	0.15-0.20	7.4-8.4	Very high	0.32	5	4	1-4
Tinn	17-80	40-60	1.40-1.50	0.01-0.06	0.15-0.18	7.4-8.4	Very high	0.32			
Tn	0-24	40-60	1.40-1.50	0.06-0.2	0.15-0.20	7.4-8.4	Very high	0.32	5	4	1-4
Tinn	24-52	40-60	1.40-1.50	0.01-0.06	0.13-0.18	7.4-8.4	Very high	0.32			
	52-80	40-60	1.40-1.50	0.01-0.06	0.13-0.18	7.4-8.4	Very high	0.32			
TrB, TrC2	0-17	5-13	1.50-1.70	2.0-6.0	0.08-0.12	5.6-7.3	Low	0.20	5	2	0.5-1
Travis	17-50	35-50	1.35-1.60	0.2-0.6	0.10-0.16	5.1-6.0	Moderate	0.32			
	50-80	17-38	1.35-1.65	0.2-0.6	0.04-0.16	5.6-6.5	Low	0.15			
TsC	0-3	2-15	1.45-1.65	2.0-0.6	0.05-0.10	5.6-7.3	Low	0.15	5	8	0.5-1
Travis	3-50	35-50	1.45-1.65	0.2-0.6	0.10-0.16	5.1-8.0	Moderate	0.32			
	50-80	15-38	1.45-1.70	0.2-0.6	0.04-0.16	4.5-6.0	Low	0.15			
Uh	0-6	10-20	1.25-1.40	0.6-2.0	0.10-0.16	6.1-7.8	Low	0.37	5	3	1-4
Uhland	6-44	10-18	1.25-1.55	0.6-2.0	0.10-0.16	6.1-7.8	Low	0.37			
	44-80	18-35	1.25-1.60	0.2-0.6	0.12-0.18	6.1-7.8	Moderate	0.32			
We	0-6	27-35	1.20-1.35	0.6-2.0	0.12-0.20	7.4-8.4	Low	0.43	5	6	1-4
Weswood	6-41	10-35	1.30-1.55	0.6-2.0	0.12-0.20	7.4-8.4	Low	0.43			
	41-80	27-45	1.30-1.55	0.2-0.6	0.13-0.18	7.4-8.4	Moderate	0.32			
Wn	0-9	18-27	1.35-1.45	0.2-0.6	0.10-0.17	5.6-7.3	Low	0.43	5	5	0.5-2
Wilson	9-58	35-50	1.50-1.60	0.01-0.06	0.10-0.16	5.6-7.4	High	0.37			
	58-80	35-60	1.50-1.70	0.01-0.06	0.10-0.16	6.6-8.4	High	0.37			
Wv:											
Wilson	0-4	18-27	1.35-1.45	0.2-0.6	0.10-0.17	5.6-7.3	Low	0.43	5	5	0.5-2
	4-36	35-50	1.50-1.60	0.01-0.06	0.10-0.16	5.6-7.8	High	0.37			
	36-80	35-60	1.50-1.60	0.01-0.06	0.10-0.16	6.6-8.4	High	0.37			
Davilla	0-10	10-20	1.50-1.60	0.6-2.0	0.14-0.20	6.1-7.3	Low	0.43	5	5	0.5-2
	10-24	27-35	1.55-1.65	<0.06	0.12-0.20	6.1-7.8	Moderate	0.32			
	24-50	27-35	1.60-1.70	<0.06	0.12-0.20	6.6-8.4	Moderate	0.32			
	50-80	20-35	1.60-1.70	<0.06	0.12-0.20	7.4-8.4	Moderate	0.32			
Ya	0-12	10-18	1.30-1.55	2.0-6.0	0.13-0.20	7.4-8.4	Low	0.32	5	4	0.5-1
Yahola	12-80	5-18	1.30-1.70	2.0-6.0	0.13-0.20	7.9-8.4	Low	0.32			

Table 17.--Soil and Water Features

("Flooding," "water table," and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			*In*			
AgD2---------- Altoga	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Ba---------- Bastsil	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
BbC---------- Bigbrown	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
BcC:											
Bigbrown---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Slickspots-------	---	---	---	---	---	---	---	---	---	---	---
Be---------- Bosque	B	Occasional	Brief-----	Oct-May	>6.0	---	---	>60	---	High-----	Low.
BrA, BrB---------- Branyon	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Bu---------- Burleson	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
ChB---------- Chazos	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
CrB, CrC2--------- Crockett	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
DeC---------- Desan	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Dp---------- Dumps	---	---	---	---	---	---	---	---	---	---	---
EdC2---------- Edge	D	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
EdC3:											
Edge----------	D	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Gullied land-----	---	---	---	---	---	---	---	---	---	---	---
FeE2:											
Ferris----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Heiden----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Fr---------- Frio	B	Occasional	Brief-----	Oct-May	>6.0	---	---	>60	---	High-----	Low.
Ga---------- Gaddy	A	Frequent----	Very brief	Mar-Oct	>8.0	---	---	>80	---	Low------	Low.
GuB---------- Gause	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.

Table 17.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			*In*			
Gw---------- Gowen	B	Frequent----	Brief-----	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
HeC---------- Heiden	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
HoB---------- Houston Black	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
JeE---------- Jedd	C	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
LeB---------- Lewisville	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Lu:											
Lufkin----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Gause----------	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
MnC---------- Minerva	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
MwC---------- Minwells	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
NoB---------- Normangee	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Oa---------- Oakalla	B	Occasional	Very brief to brief.	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
PaC---------- Padina	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Pc---------- Payne	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Pg---------- Pits	---	---	---	---	---	---	---	---	---	---	---
RaB---------- Rader	D	None--------	---	---	2.0-4.0	Perched	Dec-May	>60	---	High-----	Moderate.
RgC---------- Riesel	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Sa---------- Sandow	B	Frequent----	Brief-----	Dec-May	3.5-6.0	Perched	Dec-Apr	>60	---	High-----	Low.
SgB---------- Satin	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
SmC---------- Seawillow	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Sp---------- Ships	D	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Low.
SwB, SwC---------- Silawa	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.

Table 17.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			*In*			
SyB---------- Silstid	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
SzC---------- Sunev	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Tc---------- Tinn	D	Occasional	Brief-----	Feb-May	>6.0	---	---	>60	---	High-----	Low.
Tn---------- Tinn	D	Frequent----	Brief-----	Feb-May	>6.0	---	---	>60	---	High-----	Low.
TrB, TrC2, TsC---- Travis	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Uh---------- Uhland	B	Frequent----	Brief-----	Feb-Jun	2.0-3.5	Apparent	Mar-May	>60	---	High-----	Low.
We---------- Weswood	B	Occasional	Brief-----	Mar-Sep	>6.0	---	---	>60	---	High-----	Low.
Wn---------- Wilson	D	None--------	---	---	>6.0	---	---	>60	---	High-----	High.
Wv:											
Wilson----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	High.
Davilla----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Ya---------- Yahola	B	Occasional	Brief-----	Apr-Oct	>8.0	---	---	>80	---	Low------	Low.

Table 18.--Engineering Index Test Data

(Dashes indicate data were not available. Np means nonplastic. Analysis by the Texas Department of Transportation, Austin, Texas).

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		*g/cc*	*Pct*	*Pct*	
Altoga[1]														
(84TX-331-1)														
Ap ----- 0-7	A-7-6(22)	CL	---	---	---	100	97	90	41	24	2.65	12	14.1	2.01
Bk1 ----- 7-16	A-6(21)	CL	---	---	---	100	97	87	39	25	2.58	15	11.8	1.90
Bk2 ----- 16-36	A-6(17)	CL	---	---	---	100	98	84	39	21	2.69	17	10.5	1.84
Bk3 ----- 36-62	A-6(15)	CL	---	---	---	100	97	81	36	20	2.65	17	9.3	1.85
BCk ----- 62-72	A-6(10)	CL	---	---	---	100	97	76	33	15	2.65	19	7.3	1.81
Bastsil[1]														
(84TX-331-2)														
A ----- 6-16	A-2-4(0)	SM-SC	---	---	100	99	81	27	20	5	2.67	17	2.0	1.82
Bt1 ----- 16-41	A-6(3)	SC	---	100	99	98	81	41	38	19	2.65	17	10.6	1.88
Bt2 ----- 41-62	A-6(5)	SC	---	100	99	96	79	45	36	19	2.64	16	9.8	1.85
Bigbrown[1]														
(82TX-331-1)														
C ----- 6-34	A-7(26)	CL	---	---	---	100	99	92	48	26	2.67	23	11.2	1.68
C ----- 34-49	A-7(26)	CL	---	---	---	100	99	90	49	27	2.73	20	12.8	1.75
Crockett[1]														
(84TX-331-6)														
Ap ----- 0-7	A-4(1)	SC	---	---	---	100	99	43	31	8	2.60	25	3.4	1.59
Bt1 ----- 7-13	A-7-6(14)	CL	---	---	---	---	100	63	49	25	2.65	19	13.1	1.77
Bt2 ----- 13-22	A-7-6(17)	CL	---	---	---	---	100	64	50	29	2.66	19	13.9	1.81
Bt3 ----- 22-33	A-7-6(19)	CH	---	---	---	---	100	64	53	34	2.61	18	14.5	1.77
BC ----- 33-42	A-7-6(12)	CL	---	---	---	---	100	55	48	27	2.64	18	13.2	1.73
C ----- 42-60	A-7-6(23)	CH	---	---	---	---	100	74	55	31	2.61	20	14.0	1.75
Edge[2]														
(82TX-331-12)														
A ----- 0-6	A-4(0)	SM	---	100	99	97	96	46	23	2	2.67	21	1.6	1.67
Bt1 ----- 6-11	A-7(33)	CH	---	---	---	---	100	91	59	32	2.70	18	17.0	1.83
Bt2 ----- 11-24	A-7(30)	CH	---	---	---	---	100	93	52	29	2.69	17	15.2	1.84
Bt3 ----- 24-34	A-7(28)	CL	---	---	---	---	100	94	49	27	2.68	16	14.7	1.35
BC ----- 34-55	A-6(12)	CL	---	---	---	---	100	75	37	18	2.65	20	8.8	1.69
C1 ----- 55-80	A-2(0)	SC	---	---	---	---	100	29	37	15	2.65	28	4.4	1.54
C2 ----- 80-100	A-7(12)	CL	---	---	---	100	99	64	43	22	2.65	26	7.4	1.56
Frio[1]														
(84TX-331-3)														
A1 ----- 6-26	A-7-6(34)	CH	---	---	---	---	100	99	53	30	2.63	19	14.9	1.83
A2 ----- 26-50	A-7-6(34)	CH	---	---	---	---		100	52	30	2.67	15	15.8	1.86
Jedd[1]														
(82TX-331-8)														
A ----- 0-5	A-1(0)	SM,SM-SC	83	68	53	42	36	15	27	4	2.66	23	2.8	1.62
E ----- 5-11	A-1(0)	SC,SM-SC	90	83	68	54	48	13	20	3	2.69	18	1.6	1.76
Bt1 ----- 11-21	A-7(13)	CL	---	---	---	---	100	60	47	26	2.75	21	11.9	1.74
Bt2 ----- 21-25	A-2(1)	SC	---	---	---	---	100	34	33	14	2.67	22	5.6	1.68
Cr ----- 25-60	A-2(0)	SC,SM-SC	---	---	---	100	99	19	25	7	2.69	23	1.3	1.66

See footnotes at end of table.

Table 18.--Engineering Index Test Data--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		*g/cc*	*Pct*	*Pct*	
Minerva[1]														
(82TX-331-3)														
A ----- 0-4	A-2(0)	SM	---	---	---	100	98	13	25	4	2.69	20	0.0	1.64
E ----- 4-14	A-2(0)	SM	---	---	---	100	98	23	18	2	2.64	18	0.0	1.73
Bt1 ----- 14-28	A-6(6)	SC	---	---	---	100	98	50	34	19	2.65	16	9.3	1.84
Bt2 ----- 28-48	A-6(7)	CL	---	---	100	99	98	52	37	21	2.69	17	10.1	1.84
Bt3 ----- 48-78	A-6(4)	SC	100	99	98	97	93	44	34	19	2.67	20	6.8	1.73
BCt ----- 78-88	A-7(13)	CL	---	---	---	100	99	64	43	24	2.68	19	11.2	1.76
C ----- 88-94	A-2(1)	SC	---	---	---	---	100	35	35	16	2.68	22	6.8	1.69
Minwells[1]														
(82TX-331-1)														
A1 ----- 0-5	A-2(0)	SM	---	---	100	99	93	34	20	3	2.61	17	1.8	1.79
A2 ----- 5-10	A-2(0)	SM	---	---	100	99	93	33	16	2	2.62	15	1.1	1.87
Bt1 ----- 10-22	A-7(10)	CL	---	---	100	99	93	53	45	26	2.63	17	13.1	1.85
Bt2 ----- 22-38	A-7(9)	CL	---	100	99	98	92	53	42	23	2.67	15	12.8	1.85
Bt3 ----- 38-50	A-7(8)	SC,CL	100	99	97	95	90	50	42	23	2.68	17	11.8	1.82
BCk1----- 50-66	A-7(10)	CL	---	---	100	99	96	54	44	26	2.66	19	11.8	1.81
BCk2----- 66-73	A-6(8)	CL	---	---	---	100	98	69	30	16	2.70	17	6.8	1.85
Oakalla[1]														
(82TX-331-14)														
Ap ----- 0-6	A-7(22)	CL	---	---	---	100	99	92	44	22	2.65	18	12.3	1.83
Ak1 ----- 6-22	A-7(24)	CL	---	---	---	---	100	92	45	24	2.66	19	11.9	1.81
Ak2 ----- 22-38	A-7(22)	CL	---	---	---	100	99	91	43	23	2.68	17	12.2	1.86
Bk ----- 38-60	A-7(23)	CL	---	---	---	100	99	92	44	24	2.68	17	12.8	1.89
Padina[1]														
(84TX-331-7)														
E ----- 8-66	A-2-4(0)	SM	---	---	---	---	100	19	23	2	2.60	19	0.0	1.69
Bt2 ----- 74-86	A-7-6(12)	CL	---	---	---	---	100	65	42	22	2.64	18	11.1	1.78
Rader[1]														
(82TX-331-2)														
A ----- 0-5	A-2(0)	SM-SC	---	---	---	100	99	14	24	4	2.65	21	1.0	1.69
E ----- 5-18	A-2(0)	SM	---	---	---	100	99	20	20	2	2.62	17	0.0	1.76
Bt/E----- 18-26	A-6(0)	SC	---	---	100	99	98	36	27	11	2.62	19	5.0	1.76
Bt1 ----- 26-52	A-6(2)	SC	---	---	---	---	100	45	29	13	2.66	17	7.2	1.79
Bt2 ----- 52-71	A-6(6)	SC	---	---	100	99	98	45	39	24	2.63	17	10.1	1.78
Bt3 ----- 71-80	A-6(5)	SC	---	---	---	100	99	43	38	21	2.63	18	9.8	1.78
Riesel[1]														
(85TX-331-3)														
A1 ----- 0-8	A-2-6(0)	SC	100	94	88	79	57	29	33	17	2.62	16	8.6	1.84
Bt1 ----- 11-20	A-2-7(0)	SC	88	83	70	48	27	20	60	40	2.65	14	19.4	1.95
Bt2 ----- 20-27	A-7-6(35)	CH	97	96	92	85	78	66	81	54	2.74	13	24.4	1.93
Bt3 ----- 27-37	A-2-7(0)	SC	93	87	72	58	38	21	58	38	2.68	15	18.3	1.92
Bt4 ----- 37-60	A-2-7(0)	SC	84	69	51	32	14	8	53	34	2.68	14	17.0	1.93
Sandow[3]														
(85TX-331-2)														
A ----- 0-8	A-7-6(15)	CL	---	---	---	---	100	73	41	23	2.59	16	11.8	1.81
Bw ----- 8-30	A-7-6(22)	CL	---	---	---	---	100	86	43	26	2.63	15	13.2	1.89
Cg1 ----- 30-53	A-6(8)	CL	---	---	---	---	100	69	34	15	2.65	19	7.3	1.73
Cg2 ----- 53-60	A-4(4)	CL	---	---	---	---	100	77	29	7	2.68	23	3.4	1.61

See footnotes at end of table.

Table 18.--Engineering Index Test Data--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200				Limit	Linear	Ratio
									Pct		*g/cc*	*Pct*	*Pct*	
Satin[1]														
(82TX-331-4)														
A ----- 0-9	A-7(5)	SC	77	73	67	62	54	44	45	21	2.59	21	10.4	1.66
Bt1 ----- 9-20	A-2(0)	GM-GC	67	50	35	23	19	17	76	40	2.66	18	21.0	1.80
Bt2 ----- 20-42	A-2(0)	GW-GM	24	18	15	12	11	10	113	76	2.72	22	27.4	1.77
Bt3 ----- 42-60	A-2(0)	GW-GM	45	35	26	17	12	11	112	80	2.70	16	29.5	1.94
Seawillow[4]														
(82TX-331-10)														
Ap ----- 0-6	A-2(18)	SC	---	---	---	---	100	83	41	22	2.66	16	11.7	1.83
Bk1 ----- 6-20	A-2(18)	SC	---	---	---	---	100	82	41	23	2.68	18	11.3	1.84
Bk2 ----- 20-42	A-7(18)	CL	---	---	---	100	99	80	41	23	2.67	16	12.2	1.90
BCk ----- 42-70	A-6(16)	CL	---	---	---	100	99	78	38	23	2.69	15	11.7	1.93
C ----- 70-96	A-6(8)	CL	---	100	98	91	79	54	38	22	2.66	15	11.4	1.92
Silstid[1]														
(82TX-331-6)														
A ----- 0-8	A-2(0)	SC	---	---	---	100	98	18	19	2	2.66	15	0.0	1.87
E ----- 8-32	A-2(0)	SC	---	---	---	100	98	18	17	1	2.65	15	0.0	1.84
Bt1 ----- 32-40	A-2(2)	SC	---	---	100	99	98	40	31	15	2.65	17	7.0	1.79
Bt2 ----- 40-53	A-7(7)	SC	---	---	---	100	99	46	43	25	2.68	18	11.5	1.78
Bt3 ----- 53-60	A-2(2)	SC	---	---	100	99	95	35	38	20	2.68	19	9.2	1.76
Bt4 ----- 60-72	A-2(1)	SC	---	---	---	---	100	33	34	16	2.67	20	7.3	1.73
Bt5 ----- 72-80	A-7(7)	SC	---	---	---	100	98	48	42	24	2.71	18	11.3	1.81
Sunev[5]														
(82TX-331-5)														
A ----- 0-10	A-6(5)	CL	---	---	---	100	98	55	31	15	2.67	16	7.8	1.84
Bk1 ----- 10-20	A-6(8)	CL	---	100	99	96	93	61	36	18	2.66	18	9.1	1.84
Bk2 ----- 20-28	A-6(14)	CL	---	---	100	98	95	79	36	19	2.70	14	11.0	1.79
BCk ----- 28-46	A-6(13)	CL	---	---	---	100	99	75	36	19	2.69	16	10.1	1.91
Ck ----- 46-60	A-6(14)	CL	---	100	99	99	98	77	35	20	2.73	16	9.8	1.94
Travis[1]														
(85TX-331-1)														
Ap ----- 0-9	A-2-4(0)	SM	---	---	100	99	87	30	15	1	2.64	16	0.0	1.72
Bt1 ----- 17-33	A-7-6(10)	CL	---	100	98	95	84	53	43	27	2.73	15	13.3	1.90
Bt2 ----- 33-50	A-7-6(7)	SC	---	100	97	92	78	41	45	29	2.63	16	13.5	1.86
Bt3 ----- 50-72	A-2-6(0)	SC	---	100	97	97	69	26	35	22	2.63	17	8.9	1.81
Uhland[1]														
(84TX-331-1)														
A ----- 0-6	A-6(7)	CL	---	---	---	---	100	70	32	12	2.62	23	4.5	1.65
2C1 ----- 6-20	A-6(10)	CL	---	---	---	---	100	78	33	15	2.59	19	7.2	1.78
2C2 ----- 20-44	A-4(0)	SM-SC	---	---	---	---	100	44	24	4	2.62	21	1.6	1.72
2Ab ----- 44-64	A-6(10)	CL	---	---	---	---	100	68	36	18	2.62	18	8.8	1.81
Wilson[1]														
(84TX-331-1)														
Ap ----- 0-9	A-6(9)	CL	---	---	---	---	100	63	35	18	2.65	15	10.1	1.70
Btg ----- 9-32	A-7-6(17)	CL	---	---	---	---	100	70	44	27	2.63	13	14.5	1.97
Btkg----- 32-47	A-7-6(21)	CL	---	---	100	99	94	71	48	32	2.66	24	15.3	1.94
Btk ----- 47-58	A-7-6(19)	CL	---	---	100	97	91	70	46	30	2.62	15	14.2	1.92
BCk ----- 58-66	A-7-6(22)	CH	---	100	99	96	89	70	51	34	2.68	15	16.9	1.96

See footnotes at end of table.

Table 18.--Engineering Index Test Data--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--						Liquid limit	Plasticity index	Specific gravity	Shrinkage: Limit	Shrinkage: Linear	Shrinkage: Ratio
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200						
									Pct		*g/cc*	*Pct*	*Pct*	
Yahola[1] (82TX-331-9)														
Ap ----- 0-12	A-4(8)	CL-ML	---	---	---	---	100	86	31	10	2.64	21	5.0	1.69
C1 ----- 12-28	A-4(5)	CL,ML-CL	---	---	---	---	100	75	28	9	2.67	21	3.7	1.72
C2 ----- 28-48	A-4(0)	SM-SC	---	---	---	---	100	38	24	5	2.68	21	2.0	1.67
C3 ----- 48-80	A-4(0)	SM-SC,SC	---	---	---	---	100	50	24	4	2.66	23	1.2	1.67

[1]The location of the pedon sample is the same as that of the pedon given as typical for the series in the section "Soil Series and Their Morphology."
[2]Location of pedon sample: 10 miles south of Cameron on U.S. Highway 190, 1.0 mile northeast on unpaved road, 100 feet east of road.
[3]Location of pedon sample: from the junction of U.S. Highway 77 and U.S. Highway 79, in Rockdale; 5.9 miles south of U.S. Highway 77; 200 feet east in pasture.
[4]Location of pedon sample: 200 feet east of Farm Road 486 in a field at the south edge of Thorndale.
[5]Location of pedon sample: 1,000 feet northwest on a gravel road from the intersection of Farm Road 487 and Farm Road 437 in Davilla, 200 feet east of road in pasture.

Table 19.--Classification of the Soils

Soil name	Family or higher taxonomic class
Altoga	Fine-silty, carbonatic, thermic Udic Ustochrepts
Bastsil	Fine-loamy, siliceous, thermic Udic Paleustalfs
Bigbrown	Fine-silty, mixed, nonacid, thermic Typic Ustorthents
Bosque	Fine-loamy, mixed, superactive, thermic Cumulic Haplustolls
Branyon	Fine, smectitic, thermic Udic Haplusterts
Burleson	Fine, thermic Udic Haplusterts
Chazos	Fine, smectitic, thermic Udic Paleustalfs
Crockett	Fine, smectitic, thermic Udertic Paleustalfs
Davilla	Fine-loamy, siliceous, thermic Udic Haplustalfs
Desan	Loamy, siliceous, thermic Grossarenic Paleustalfs
Edge	Fine, mixed, active, thermic Udic Paleustalfs
Ferris	Fine, smectitic, thermic Chromic Udic Haplusterts
Frio	Fine, smectitic, thermic Cumulic Haplustolls
Gaddy	Sandy, mixed, thermic Udic Ustifluvents
Gause	Fine, mixed, thermic Ultic Paleustalfs
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Heiden	Fine, smectitic, thermic Udic Haplusterts
Houston Black	Fine, smectitic, thermic Udic Haplusterts
Jedd	Fine, mixed, semiactive, thermic Ultic Paleustalfs
Lewisville	Fine-silty, mixed, thermic Udic Calciustolls
Lufkin	Fine, smectitic, thermic Oxyaquic Vertic Paleustalfs
Minerva	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Minwells	Fine, mixed, thermic Udic Paleustalfs
Normangee	Fine, smectitic, thermic Udertic Haplustalfs
Oakalla	Fine-loamy, carbonatic, thermic Cumulic Haplustolls
Padina	Loamy, siliceous, active, thermic Grossarenic Paleustalfs
Payne	Fine, smectitic, thermic Udic Paleustalfs
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Riesel	Clayey-skeletal, mixed, thermic Udic Paleustalfs
Sandow	Fine-loamy, siliceous, thermic Udifluventic Ustochrepts
Satin	Clayey-skeletal, smectitic, thermic Udic Argiustolls
Seawillow	Fine-loamy, carbonatic, thermic Udic Ustochrepts
Ships	Very-fine, mixed, active, thermic Chromic Hapluderts
Silawa	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Silstid	Loamy, siliceous, semiactive, thermic Arenic Paleustalfs
Sunev	Fine-loamy, carbonatic, thermic Udic Calciustolls
Tinn	Fine, smectitic, thermic Typic Hapluderts
Travis	Fine, mixed, thermic Ultic Paleustalfs
Uhland	Coarse-loamy, siliceous, superactive, thermic Aquic Ustochrepts
Weswood	Fine-silty, mixed, superactive, thermic Udifluventic Ustochrepts
Wilson	Fine, smectitic, thermic Oxyaquic Vertic Haplustalfs
Yahola	Coarse-loamy, mixed, superactive, calcareous, thermic Udic Ustifluvents

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