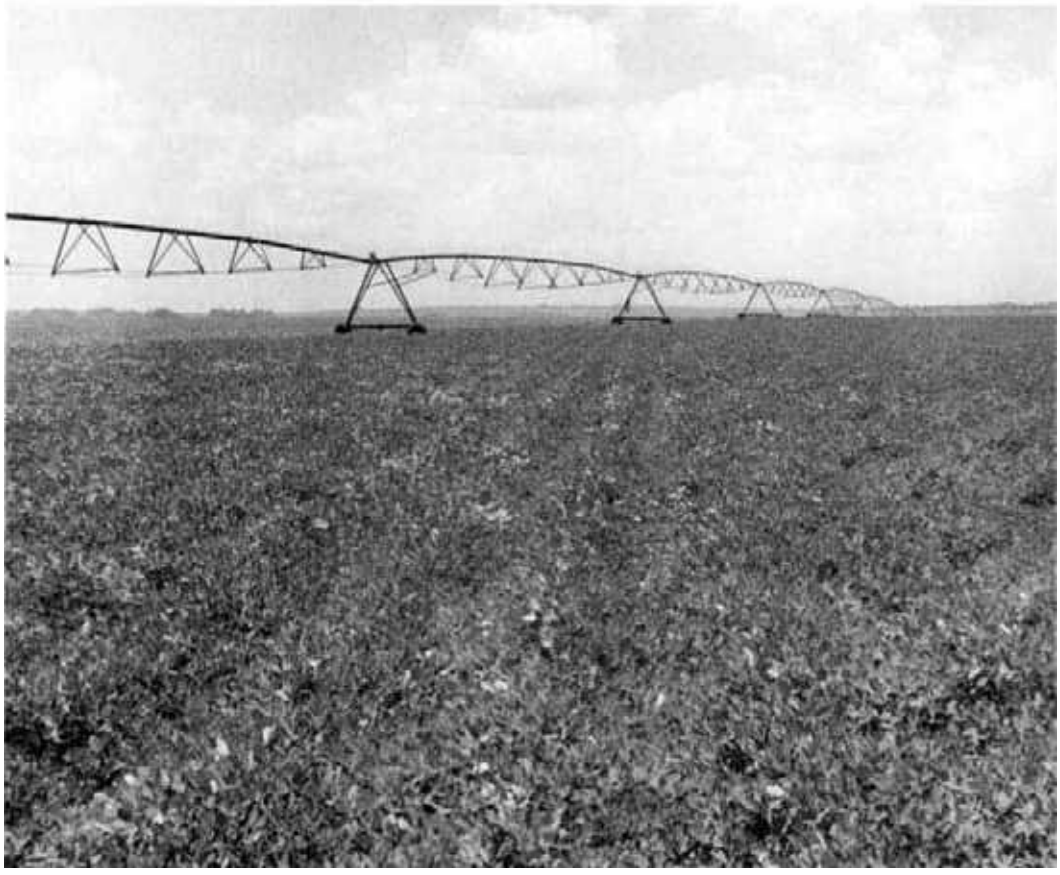
United States Department of Agriculture

Soil Conservation Service

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

Soil Survey of Frio County, Texas



ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy, date October 1992. It has been formatted for electronic delivery. Additional and updated information may be available from the Web Soil Survey. In Web Soil Survey, identify an Area of Interest (AOI) and navigate through the AOI Properties panel to learn what soil data is available.

How To Use This Soil Survey

General Soil Map

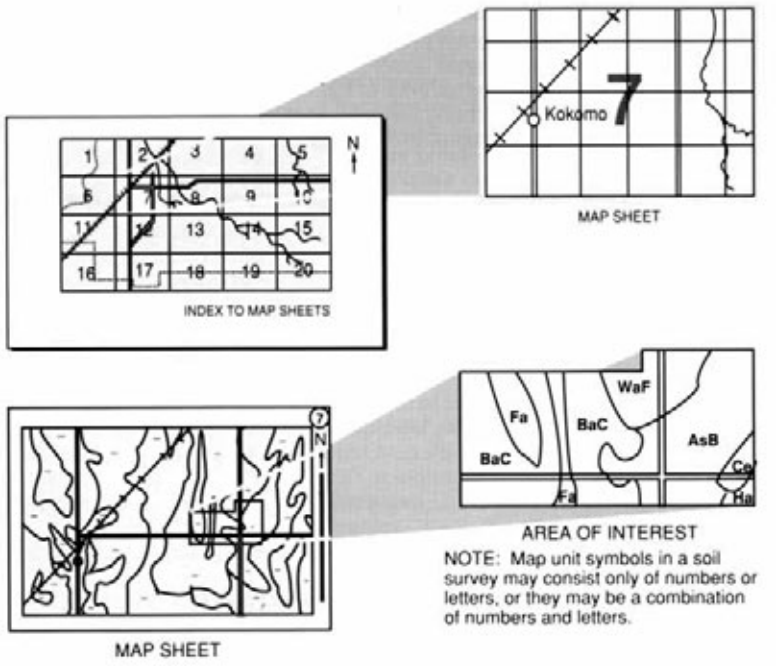
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

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

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



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

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

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

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This soil survey was made cooperatively by the Soil Conservation Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. It is part of the technical assistance furnished to the Frio Soil and Water Conservation District.

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

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

Cover: Peanuts grown under a center-pivot irrigation system in an area of Duval loamy fine sand, 0 to 5 percent slopes.

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Issued October 1992

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Summary of Tables

Foreword

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

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

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow 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 Soil Conservation Service or the Cooperative Extension Service.

Harry W. Oneth
State Conservationist
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Soil Survey of
Frio County, Texas

By Wayne J. Gabriel, John M. Galbraith, and John A. Groves Ill, Soil Conservation Service

Major fieldwork by John A. Groves III, John M. Galbraith, Wayne J. Gabriel, Micheal L. Golden, and Jack W. Stevens, Soil Conservation Service

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

FRIO COUNTY is in the southern part of Texas (fig. 1). It borders Medina County in the north, Atascosa County in the east, La Salle County in the south, and Zavala County in the west. Frio County is rectangular. It is about 31 miles from north to south and 37 miles from east to west. It has an area of 725,004 acres, or about 1,133 square miles.

Frio County is in the Northern Rio Grande Plain Major Land Resource Area. The land surface is nearly level to rolling and generally slopes to the southeast. Elevations range from 400 to 850 feet above sea level.

The major drainage systems in Frio County are the Frio River, which flows from the northwestern part of the county to the south-central part, and San Miguel Creek, which flows south through the eastern part of the county. Seco and Hondo Creeks, which are tributaries of the Frio River, drain the north-central part of the county. The Leona River, another tributary of the Frio River, drains the west-central part.

The major land uses in Frio County are rangeland and cropland. In 1986, about 502,970 acres was used as rangeland, 177,810 acres as cropland, 26,380 acres as pasture and hayland, 13,910 acres as urban or built-up land, 1,890 acres for farm ponds, 1,620 acres for orchards, 384 acres for caliche and gravel pits, 30 acres for confined livestock feeding enterprises, and 10 acres for other purposes.

General Nature of the County

This section gives general information about Frio County. It describes history, climate, economic enterprises, natural resources, and transportation facilities.

History

Indian tribes had inhabited this survey area for thousands of years prior to exploration by the French and Spanish in the late 1600's. In the period following the early explorations, most of the area was a vast open range used by settlers who owned or controlled large tracts. Large numbers of longhorn cattle and horses were raised in the area and were driven overland each year to distant markets.

After the advent of barbed wire in the 1870's, large blocks of rangeland were fenced and improved breeds of beef cattle were gradually introduced. At one time sheep ranching was locally important, but low prices caused this industry to decline. Since 1883, little of the rangeland in the county has been used for sheep ranching.

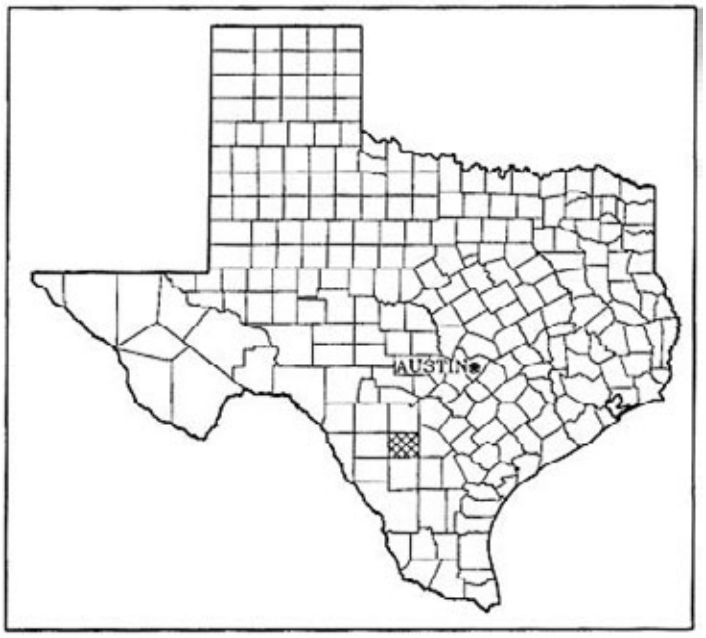

Figure 1.—Location of Frio County in Texas.

By 1860, several small settlements, mainly ranch headquarters and trading centers, were located along the streams and rivers in the county. In 1871, the Texas Legislature approved a bill organizing Frio County. At this time Frio, or Frio City, a small community located at the Presidio Road Crossing of the Frio River, was named as the county seat. In 1880, the International Great Northern Railroad extended its line from San Antonio to Laredo, bypassing Frio City. Pearsall, a new town established near the railroad, became the county seat in 1883. Frio City became known as Frio Town and was eventually deserted. Today, Pearsall is the center of industry and trade for Frio County.

Farming began in 1860 along the Leona River. Only three farmers were reported in the county census at this time. After the construction of the railroad in 1883, however, many farmers moved into the county. By 1890, cotton was a major crop in the county, although some corn was grown. Prior to the drilling of the first artesian wells in 1905 and 1908, only dryland crops were grown. Since then, most farmers have drilled wells into the underlying aquifer and are able to pump water for irrigation. During the 1930's, farmers began to replace cotton with peanuts.

In 1980, the population of Frio County was 13,785. Pearsall, the county seat, had a population of about 7,400. Dilley, the second largest town, had a population of about 2,600. Other communities in the county include Moore, Bigfoot, Schattel, and Derby.

The Frio Soil and Water Conservation District was formed on November 29, 1945. The district was originally part of the Atascosa Soil and Water Conservation District.

This soil survey updates the survey of Frio County published in 1929 (3). It provides additional information and has larger maps, which show the soils in greater detail.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Frio County has hot summers and fairly warm winters. Cold temperatures and snowfall are rare. Rainfall is usually heaviest in late spring and early fall. Rain in the fall is often associated with a dissipating tropical storm. The total annual precipitation is usually adequate for range vegetation. Because of a high rate of evapotranspiration, however, it commonly is not adequate for cotton, small grain, and sorghum. Irrigation is needed if these crops are grown.

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

In winter, the average temperature is 54 degrees F and the average daily minimum temperature is 42 degrees. The lowest temperature on record, which occurred at Pearsall on February 12, 1962, is 10 degrees. In summer, the average temperature is 84 degrees and the average daily maximum temperature is 96 degrees. The highest recorded temperature, which occurred on August 13, 1962, is 109 degrees.

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

The total annual precipitation is nearly 25 inches. Of this, more than 16 inches, or about 65 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall was 6.76 inches at Pearsall on October 7, 1981. Thunderstorms occur on about 36 days each year.

The average seasonal snowfall is less than 1 inch. The greatest snow depth at any one time during the period of record was 3 inches. On the average, less than 1 day each year has at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 11 miles per hour, in spring.

Economic Enterprises

Agriculture, agribusiness, and oil and gas production are the principal industries in Frio County. Other major industries include electric power generation and retail trade. Also, hunting and fishing leases are an important source of income.

The two largest sources of agricultural revenue in the county are the sale of cattle and the sale of peanuts. Other important agricultural products include feed grain, cotton, watermelons, and vegetables.

Agribusinesses in the county include peanut processing, cotton ginning, vegetable processing, fertilizer and agricultural chemical sales, livestock sales and shipping, and farm machinery and irrigation equipment sales.

Natural Resources

The most important natural resources in Frio County are soil, water, wildlife, petroleum, and natural gas. Also, large deposits of gravel, caliche, clay, and sand are used for the construction of roads and buildings.

Most of the soils in Frio County are very deep to moderately deep. They can produce large amounts of forage and a wide variety of crops if properly managed. The shallow and very shallow soils are used primarily as rangeland.

The largest supply of good quality water in the county is in the Carrizo Sand Aquifer. Carrizo Sand crops out in the northern part of the county. Wells in this aquifer supply water for domestic use, livestock, and irrigation.

Wildlife in the county provide opportunities for recreation and income. Whitetail deer, javelina, quail, dove, and turkey are the major game species. Farm ponds and the Frio and Leona Rivers provide habitat for game fish.

Transportation Facilities

Interstate Highway 35 crosses the middle of Frio County, passing through Moore, Pearsall, and Dilley. U.S. Highway 81 parallels Interstate 35. U.S. Highway 57 connects Moore with Eagle Pass. Texas Highway 85 connects Dilley with Carrizo Springs. Texas Highway 173 passes through the northeast corner of the county. Farm Roads 117, 140, 462, 472, 1581, 1582, and 2779 and many county roads provide ready access to agricultural markets.

The Missouri-Pacific Railroad is the only railroad in the county. It connects Laredo with San Antonio and parallels U.S. Highway 81 in Frio County. Air service, which is limited to small aircraft, is provided mainly by the McKinley Airport at Pearsall and by the Dilley Airport.

How This Survey Was Made

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

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

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

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

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation

of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Survey Procedures

Before fieldwork for this soil survey began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs. Soil scientists studied USGS topographic maps and photographs, relating land and image features.

The soil scientists made traverses by truck on the existing network of roads and trails. Where there were no roads or trails, traverses were made on foot. Soil examinations along the traverses were made about 50 to 1,000 yards apart, depending on the landscape and soil pattern (6). The soil was examined with the aid of a hand auger, spade, or power probe to a depth of 5 to 7 feet or to bedrock within a depth of 7 feet. Many typical pedons were observed and studied in pits that were dug with a backhoe or by hand. Observations of landforms, geology, vegetation, roadcuts, excavations, and animal burrows were made continuously without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretations.

The soil scientists transected many of the map units to determine the composition of the units and record the kind of vegetation. They chose at least three delineations of each transected map unit to be representative of the unit. At least 10 observations 50 to 300 feet apart were made for most transects.

Samples for most of the engineering index test data in table 19 and most of the chemical and physical analyses in tables 17 and 18 were taken from the sites of The typical pedons of the major soils in the county. The analyses in table 19 were made by the Texas State Department of Highways and Public Transportation, Austin, Texas. The analyses in tables 17 and 18 were made by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska, and by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

After completion of the soil mapping, map unit delineations were transferred by hand to high-altitude aerial photographs at a scale of 1:24,000. Surface drainage and cultural features were transferred from 7½-minute USGS topographic maps and were recorded from visual observations in the field.

Data on soil interpretations were assembled from a variety of sources, such as the results of research, farm records, field experience, laboratory data, and consultation with state and local specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from the results of consultation with local farmers and field or plot experiments. After the soils in the county were described, delineated, named, analyzed, and interpreted, the information was organized so that it can be used by farmers, ranch managers, engineers, planners, developers, builders, home buyers, and others.

Map Unit Composition

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

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

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

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern. The percentages shown for each of the minor soils are for the map unit as a whole. They do not apply to each delineation of the unit.

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

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

Texture terms in this section refer to the surface layer unless otherwise indicated. Texture terms for the subsoil are for the upper part of the subsoil.

Soil Descriptions

Very Deep and Deep, Loamy Soils on Uplands

The total area of these soils is 395,450 acres, or about 54.6 percent of the county. The major soils are those in the Campbellton, Duval, Elmendorf, Webb, and Zavco series. They are on nearly level and gently undulating plains. They are well drained and are moderately permeable to very slowly permeable.

These soils generally have a high potential for most agricultural uses. Most areas are used as rangeland. A large acreage is used for corn, cowpeas, forage sorghum, grain sorghum, oats, peanuts, wheat, potatoes, or watermelons. Some areas are used as pasture or hayland.

1. Duval-Webb

Nearly level and gently undulating, moderately permeable or moderately slowly permeable soils that have a loamy surface layer and a loamy or clayey subsoil

The total area of this unit is 293,420 acres, or about 40.5 percent of the county. The unit is about 46 percent Duval soils, 17 percent Webb soils, and 37 percent minor soils (fig. 2).

The landscape consists of broad, smooth plains dissected by narrow flood plains along creeks and small drainageways. Duval and Webb soils generally are on the plains.

Duval soils are deep, well drained, and moderately permeable. Typically, the surface layer is yellowish red very fine sandy loam about 16 inches thick. The subsoil, which is between depths of 16 and 52 inches, is yellowish red and red sandy clay loam. White, weakly cemented sandstone is between depths of 52 and 72 inches.

Webb soils are very deep, well drained, and moderately slowly permeable. Typically, the surface layer is dark brown very fine sandy loam about 10 inches thick. The upper part of the subsoil, which is between depths of 10 and 19 inches, is reddish brown sandy clay. The lower part, which is between depths of 19 and 72 inches, is reddish brown, yellowish red, and strong brown sandy clay loam. White, weakly cemented sandstone is between depths of 72 and 80 inches.

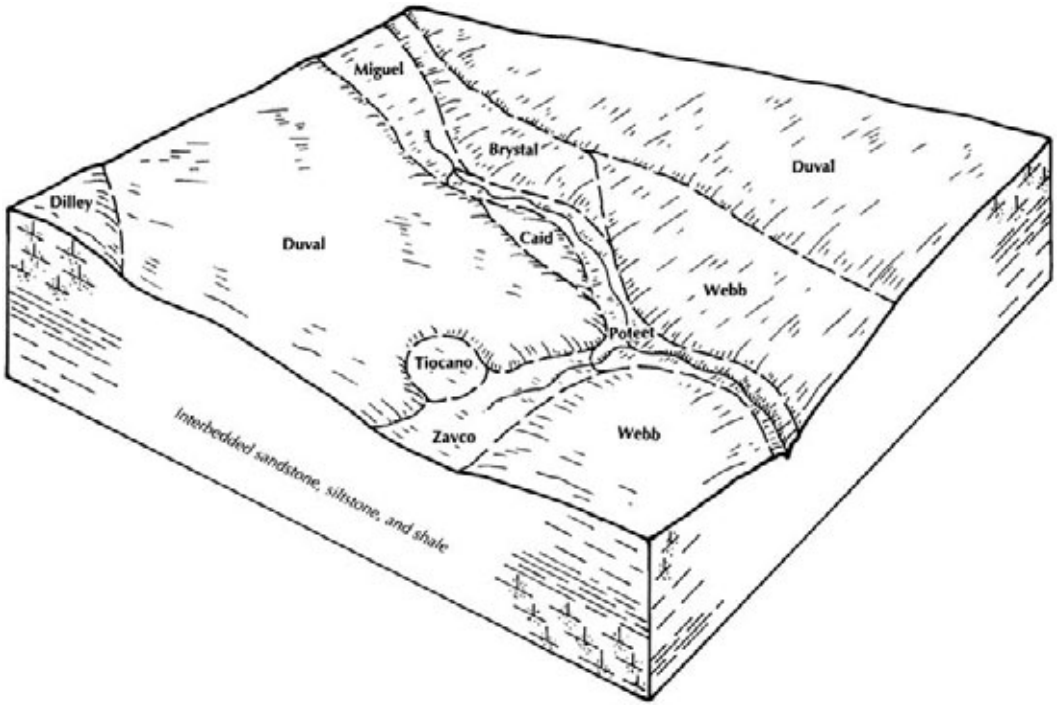

Figure 2.—Typical pattern of soils in the Duval-Webb general soil map unit.

The minor soils and their extent in this unit are as follows: about 3 percent Amphion soils, 7 percent Brystal soils, 2 percent Caid soils, 1 percent Dilley soils, 1 percent Divot soils, 1 percent Hindes soils, 1 percent Lacoste soils, 2 percent Miguel soils, 5 percent Poteet soils, 6 percent Zavco soils, and 8 percent Tiocano and other soils. Amphion, Brystal, Caid, Miguel, and Zavco soils are in landscape positions similar to or slightly lower than those of the Duval and Webb soils. Dilley, Hindes, and Lacoste soils are on hills and ridges. Divot soils are on flood plains along creeks. Poteet soils are in upland drainageways.

The major soils are well suited to most agricultural uses. Water erosion and wind erosion are the main hazards.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are inhabited by dove and turkey.

The major soils are moderately suited or well suited to most urban and recreational uses.

2. Zavco-Elmendorf-Campbellton

Nearly level and gently undulating, moderately slowly permeable or very slowly permeable soils that have a loamy surface layer and a clayey subsoil

The total area of this unit is 78,870 acres, or about 10.9 percent of the county. The unit is about 20 percent Zavco soils, 13 percent Elmendorf soils, 10 percent Campbellton soils, and 57 percent minor soils (fig. 3).

The landscape consists of smooth plains, hills, and ridges dissected by narrow flood plains along creeks and small drainageways. Zavco, Elmendorf, and Campbellton soils generally are on the plains and the foot slopes of hills and ridges.

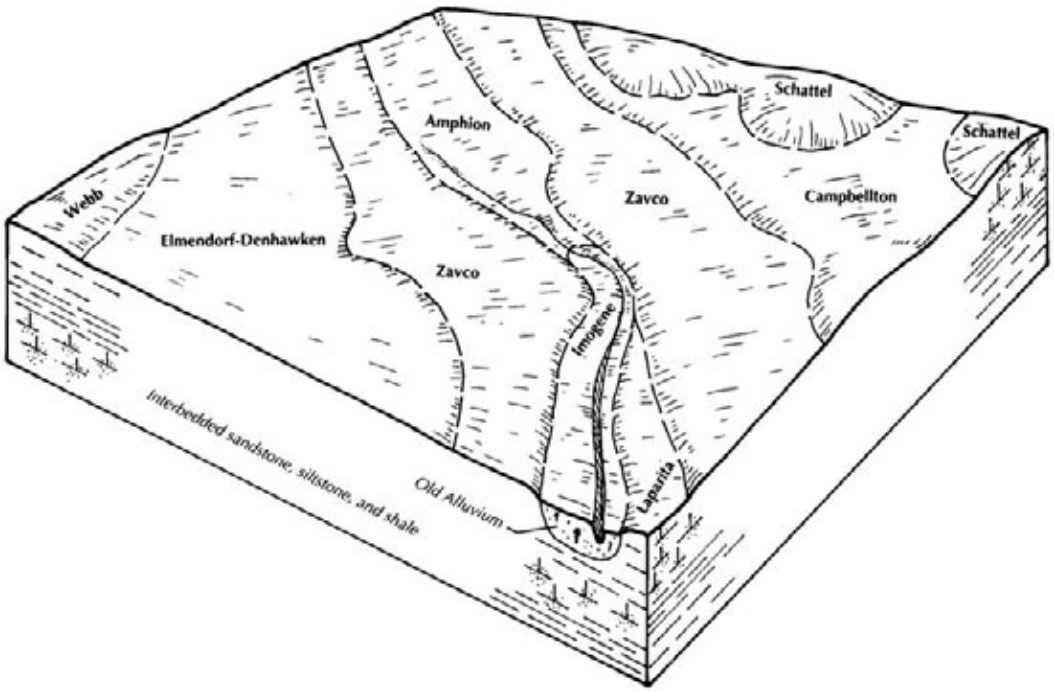

Figure 3.—Typical pattern of soils in the Zavco-Elmendorf-Campbellton general soil map unit.

Zavco soils are very deep, well drained, and moderately slowly permeable. Typically, the surface layer is dark brown sandy clay loam about 16 inches thick. The subsoil, which is between depths of 16 and 58 inches, is yellowish red and reddish yellow sandy clay. The substratum, which is between depths of 58 and 72 inches, is light brown clay loam.

Elmendorf soils are very deep, well drained, and very slowly permeable. Typically, the surface layer is very dark gray clay loam about 8 inches thick. The upper part of the subsoil, which is between depths of 8 and 42 inches, is black, very dark gray, and dark grayish brown clay. The lower part, which is between depths of 42 and 63 inches, is yellowish brown and light brown clay.

Campbellton soils are very deep, well drained, and moderately slowly permeable. Typically, the surface layer is dark grayish brown clay loam about 12 inches thick. The upper part of the subsoil, which is between depths of 12 and 18 inches, is brown clay. The lower part, which is between depths of 18 and 48 inches, is yellowish brown and very pale brown clay. The substratum, which is between depths of 48 and 60 inches, is light gray clay intermingled with soft shale fragments.

The minor soils and their extent in this unit are as follows: about 10 percent Amphion soils, 2 percent Brystal soils, 2 percent Caid soils, 7 percent Denhawken soils, 2 percent Duval soils, 1 percent Hindes soils, 8 percent Imogene soils, 4 percent Laparita soils, 2 percent Miguel soils, 3 percent Monteola soils, 1 percent Poteet soils, 9 percent Schattel soils, 4 percent Webb soils, and 2 percent other soils. Brystal, Denhawken, Duval, Miguel, Monteola, and Webb soils are in landscape positions similar to or slightly higher than those of the Zavco, Elmendorf, and Campbellton soils. Amphion, Caid, Imogene, Laparita, and Poteet soils are on flood plains and stream terraces along creeks and drainageways and on smooth plains adjacent to the creeks and small drainageways. Hindes and Schattel soils are on hills and ridges. Schattel soils are on plains.

The Zavco and Elmendorf soils are well suited to most agricultural uses, and the Campbellton soils are moderately suited. Water erosion and wind erosion are the main hazards.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are inhabited by dove and turkey.

The major soils are poorly suited or moderately suited to most urban uses and are moderately suited or well suited to most recreational uses.

3. Webb-Zavco

Nearly level and gently undulating, moderately slowly permeable soils that have a loamy surface layer and a clayey subsoil

The total area of this unit is 23,160 acres, or about 3.2 percent of the county. The unit is about 35 percent Webb soils, 26 percent Zavco soils, and 39 percent minor soils.

The landscape consists of broad, smooth plains dissected by narrow flood plains along creeks and small drainageways. Webb and Zavco soils are on the plains.

Webb soils are very deep and well drained. Typically, the surface layer is dark brown very fine sandy loam about 10 inches thick. The upper part of the subsoil, which is between depths of 10 and 19 inches, is reddish brown sandy clay. The lower part, which is between depths of 19 and 72 inches, is reddish brown, yellowish red, and strong brown sandy clay loam. White, weakly cemented sandstone is between depths of 72 and 80 inches.

Zavco soils are very deep and well drained. Typically, the surface layer is dark brown sandy clay loam about 16 inches thick. The subsoil, which is between depths of 16 and 58 inches, is yellowish red and reddish yellow sandy clay. The substratum, which is between depths of 58 and 72 inches, is light brown clay loam.

The minor soils and their extent in this unit are as follows: about 4 percent Amphion soils, 5 percent Brystal soils, 1 percent Comitas soils, 1 percent Denhawken soils, 4 percent Duval soils, 2 percent Elmendorf soils, 1 percent Hindes soils, 5 percent Imogene soils, 1 percent Laparita soils, 10 percent Miguel soils, 4 percent Poteet soils, and 1 percent Tiocano soils. Brystal, Comitas, Denhawken, Duval, Elmendorf, and Miguel soils are in landscape positions similar to those of the Webb and Zavco soils. Hindes soils are on hills and ridges. Imogene and Poteet soils are on flood plains along creeks and small drainageways. Amphion and Laparita soils are on smooth plains adjacent to the creeks and small drainageways. Tiocano soils are in playas.

The major soils are well suited to most agricultural uses. Water erosion and wind erosion are the main hazards.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are inhabited by dove and turkey.

The major soils are moderately suited to most urban uses and are moderately suited or well suited to most recreational uses.

Deep, Moderately Deep, Shallow, and Very Shallow, Loamy and Sandy Soils on Uplands

The total area of these soils is 109,630 acres, or about 15.2 percent of the county. The major soils are those in the Dilley, Duval, Goldfinch, Hindes, Olmos, and Yologo series. They are on nearly level to rolling plains, ridges, and hills. They are well drained and are moderately permeable or moderately slowly permeable.

These soils generally have a low potential for most agricultural uses. A high content of gravel and the shallowness to bedrock or to cemented caliche limit the use of most of the soils to rangeland or wildlife habitat. A few areas of Duval and Dilley soils are used as cropland or pasture.

4. Hindes-Yologo-Olmos

Gently undulating to rolling, moderately slowly permeable or moderately permeable soils that have a very gravelly and loamy surface layer and an extremely gravelly and clayey or a loamy subsoil over cemented caliche

The total area of this unit is 91,760 acres, or about 12.7 percent of the county. The unit is about 33 percent Hindes soils, 28 percent Yologo soils, 10 percent Olmos soils, and 29 percent minor soils (fig. 4).

The landscape consists of hills and ridges dissected by plains in narrow valleys. Hindes, Yologo, and Olmos soils generally are on the hills and ridges.

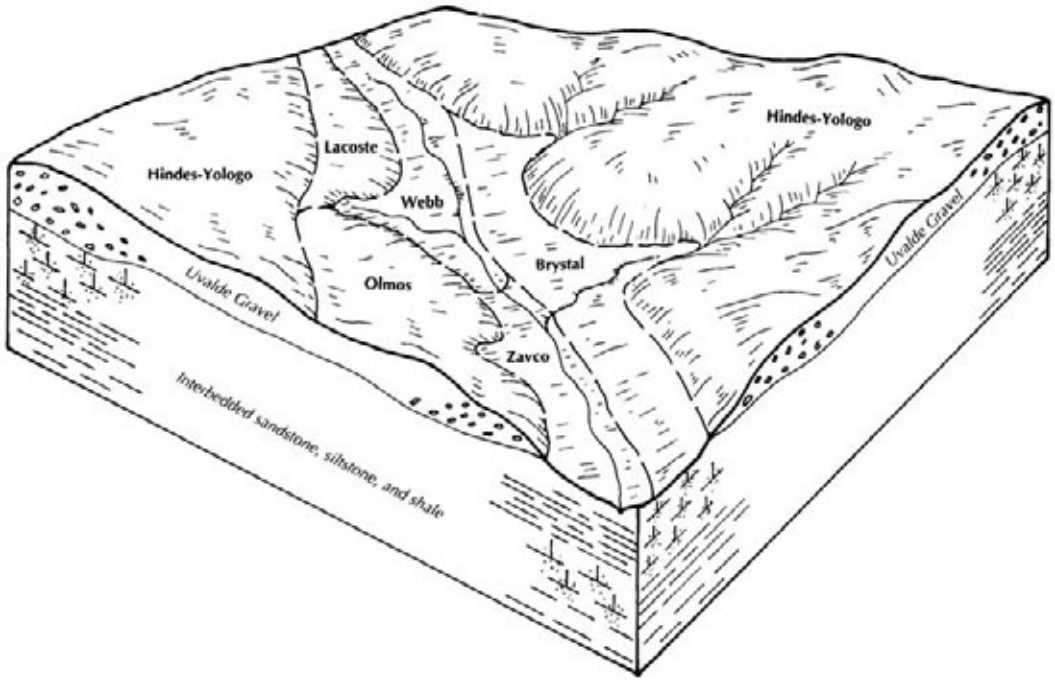

Figure 4.—Typical pattern of soils in the Hindes-Yologo-Olmos general soil map unit.

Hindes soils are gently undulating to rolling, moderately deep over cemented caliche, well drained, and moderately slowly permeable. Typically, the surface layer is dark grayish brown very gravelly loam about 9 inches thick. The subsoil, which is between depths of 9 and 32 inches, is reddish brown extremely gravelly clay loam and clay. The underlying material, which is between depths of 32 and 60 inches, is pink, weakly cemented caliche.

Yologo soils are gently undulating and undulating, very shallow or shallow over cemented caliche, well drained, and moderately permeable. Typically, the surface layer is brown very gravelly loam about 6 inches thick. The subsoil, which is between depths of 6 and 14 inches, is reddish brown extremely gravelly clay loam. The underlying material, which is between depths of 14 and 60 inches, is pink and white, strongly cemented and weakly cemented caliche.

Olmos soils are gently undulating and undulating, very shallow or shallow over cemented caliche, well drained, and moderately permeable. Typically, the surface layer is dark grayish brown very gravelly loam about 14 inches thick. The underlying material, which is between depths of 14 and 60 inches, is white, strongly cemented and weakly cemented caliche.

The minor soils and their extent in this unit are as follows: about 1 percent Amphion soils, 4 percent Brystal soils, 1 percent Caid soils, 2 percent Devine soils, 2 percent Duval soils, 7 percent Lacoste soils, 1 percent Schattel soils, 1 percent Uvalde soils, 1 percent Valco soils, 3 percent Webb soils, 3 percent Zavco soils, and 3 percent other soils. Amphion, Brystal, Duval, Webb, and Zavco soils generally are on plains in narrow valleys. Caid, Uvalde, and Valco soils are on plains on stream terraces. Devine, Lacoste, and Schattel soils are in landscape positions similar to those of the Hindes, Yologo, and Olmos soils.

The major soils are poorly suited to most agricultural uses. They are not suited to cropland. A very low available water capacity, a high content of gravel, and the shallowness to cemented caliche are the main limitations, and water erosion is the main hazard.

Rangeland productivity is low. If properly managed, areas that support native vegetation produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail, are good sites for dove, and are inhabited by turkey and deer.

The major soils are poorly suited or moderately suited to most urban uses and are poorly suited to most recreational uses. They are a potential source of caliche and gravel for construction.

5. Duval-Goldfinch-Dilley

Nearly level to rolling, moderately permeable soils that have a sandy, very gravelly and loamy, or loamy surface layer and a loamy or extremely gravelly and loamy subsoil

The total area of this unit is 17,870 acres, or about 2.5 percent of the county. The unit is about 35 percent Duval soils, 34 percent Goldfinch soils, 28 percent Dilley soils, and 3 percent minor soils (fig. 5).

The landscape consists of hills and ridges dissected by plains in narrow valleys. Duval soils are on the plains. Goldfinch and Dilley soils are on the hills and ridges.

Duval soils are nearly level to gently undulating, deep, and well drained. Typically, the surface layer is yellowish red loamy fine sand about 18 inches thick. The subsoil, which is between depths of 18 and 44 inches, is yellowish red and red sandy clay loam. Reddish yellow, weakly cemented sandstone is between depths of 44 and 62 inches.

Goldfinch soils are gently undulating to rolling, shallow, and well drained. Typically, the surface layer is reddish brown very gravelly sandy loam about 8 inches thick. The subsoil, which is between depths of 8 and 16 inches, is reddish brown extremely gravelly sandy clay loam. Strong brown, fractured, weakly cemented sandstone is between depths of 16 and 48 inches.

Dilley soils are gently undulating, shallow, and well drained. Typically, the surface layer is reddish brown fine sandy loam about 6 inches thick. The subsoil, which is between depths of 6 and 12 inches, is yellowish red fine sandy loam. Yellowish brown, fractured, strongly cemented sandstone is between depths of 12 and 60 inches.

The minor soils and their extent in this unit are as follows: about 2 percent Comitas soils and 1 percent Poteet and Webb soils. Comitas and Webb soils are in landscape positions similar to those of the Duval soils. Poteet soils are in small drainageways.

The Duval soils are moderately suited to most agricultural uses, and the Goldfinch and Dilley soils are poorly suited. The Duval soils are used mainly as cropland, pasture, rangeland, or wildlife habitat. The Goldfinch and Dilley soils are used mainly as rangeland or wildlife habitat. The main management concerns in areas of the Duval soils are the hazards of water erosion and wind erosion and a low available water capacity. The main management concerns in areas of the Goldfinch and Dilley soils are a very low available water capacity, the shallowness to bedrock, the slope, and the hazards of water erosion and wind erosion. A high content of gravel in the Goldfinch soils is an additional concern.

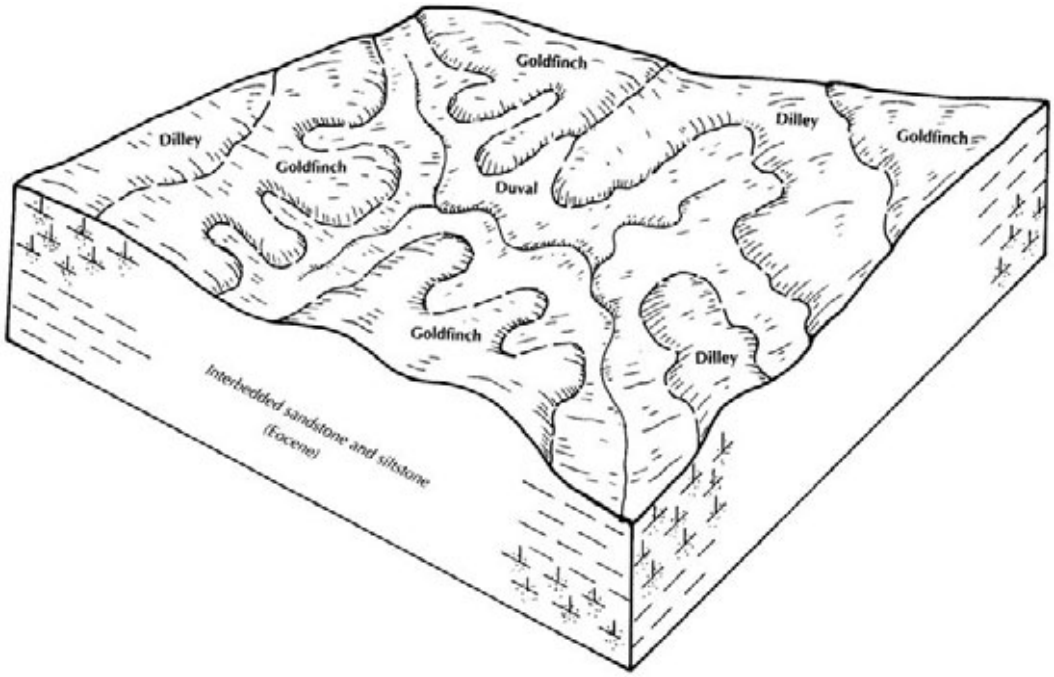

Figure 5.—Typical pattern of soils in the Duval-Goldfinch-Dilley general soil map unit.

Rangeland productivity is medium or low. If properly managed, areas that support native vegetation produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail and dove and are inhabited by turkey and deer.

The Duval soils are well suited to most urban uses and moderately suited to most recreational uses. The Goldfinch and Dilley soils are poorly suited to most urban and recreational uses.

Very Deep and Deep, Sandy and Loamy Soils on Uplands

The total area of these soils is 101,860 acres, or about 14 percent of the county. The major soils are those in the Antosa, Bobillo, Duval, Falfurrias, Miguel, Poth, Ruiz, and Wilco series. They are on nearly level and gently undulating plains. They are moderately well drained to somewhat excessively drained and are rapidly permeable to very slowly permeable.

These soils generally have a medium potential for most agricultural uses. Most areas are used for corn, cowpeas, forage sorghum, grain sorghum, oats, peanuts, wheat, or watermelons. Water erosion and wind erosion are the main hazards. Some areas are used as rangeland, wildlife habitat, or pasture.

6. Duval

Nearly level and gently undulating, moderately permeable soils that have a sandy surface layer and a loamy subsoil

The total area of this unit is 53,590 acres, or about 7.4 percent of the county. The unit is about 83 percent Duval soils and 17 percent minor soils.

The landscape consists of broad, smooth plains dissected by small drainageways. A few hills and ridges are in scattered areas. Duval soils generally are on the plains.

Duval soils are deep and well drained. Typically, the surface layer is yellowish red loamy fine sand about 18 inches thick. The subsoil, which is between depths of 18 and 44 inches, is yellowish red and red sandy clay loam. Reddish yellow, weakly cemented sandstone is between depths of 44 and 62 inches.

The minor soils and their extent in this unit are as follows: about 6 percent Comitas soils, 5 percent Dilley soils, 2 percent Goldfinch soils, 1 percent Poteet soils, 2 percent Poth soils, and 1 percent other soils. Comitas and Poth soils are in landscape positions similar to those of the Duval soils. Poteet soils are in small drainageways. Dilley and Goldfinch soils are on hills and ridges.

The Duval soils are moderately suited to most agricultural uses. They are used mainly as cropland or pasture. Water erosion and wind erosion are the main hazards, and a low available water capacity is the main limitation.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are inhabited by turkey. The population of deer generally is lower in the more extensive areas, which support a limited variety of browse plants.

The Duval soils are well suited to most urban uses and moderately suited to most recreational uses.

7. Poth-Miguel-Wilco

Nearly level and gently undulating, slowly permeable or very slowly permeable soils that have a sandy or loamy surface layer and a clayey subsoil

The total area of this unit is 41,030 acres, or about 5.6 percent of the county. The unit is about 43 percent Poth soils, 19 percent Miguel soils, 14 percent Wilco soils, and 24 percent minor soils (fig. 6).

The landscape consists of broad, smooth plains dissected by small drainageways. A few hills and ridges are in scattered areas. Poth, Miguel, and Wilco soils are on the plains.

Poth soils are very deep, well drained, and slowly permeable. Typically, the surface layer is brown loamy fine sand about 21 inches thick. The subsurface layer, which is between depths of 21 and 30 inches, is light brown loamy fine sand. The upper part of the subsoil, which is between depths of 30 and 58 inches, is dark yellowish brown, mottled clay and yellowish brown, mottled sandy clay. The lower part, which is between depths of 58 and 64 inches, is strong brown, mottled sandy clay loam.

Miguel soils are very deep, well drained, and very slowly permeable. Typically, the surface layer is grayish brown very fine sandy loam about 15 inches thick. The upper part of the subsoil, which is between depths of 15 and 36 inches, is brown, mottled sandy clay. The lower part, which is between depths of 36 and 60 inches, is reddish yellow, mottled sandy clay loam. The substratum, which is between depths of 60 and 66 inches, is brownish yellow sandy clay loam.

Wilco soils are very deep, well drained, and slowly permeable. Typically, the surface layer is brown and pale brown loamy fine sand about 16 inches thick. The upper part of the subsoil, which is between depths of 16 and 42 inches, is light yellowish brown, mottled sandy clay. The lower part, which is between depths of 42 and 56 inches, is strong brown, mottled sandy clay loam. The substratum, which is between depths of 56 and 72 inches, is reddish yellow fine sandy loam.

The minor soils and their extent in this unit are as follows: about 2 percent Amphion soils, 1 percent Antosa soils, 1 percent Brystal soils, 2 percent Comitas soils, 3 percent Dilley soils, 7 percent Duval soils, 4 percent Poteet soils, 3 percent Webb soils, and 1 percent other soils. Antosa, Brystal, Comitas, Duval, and Webb soils are in landscape positions similar to those of the Poth, Miguel, and Wilco soils. Amphion and Poteet soils are on stream terraces and in narrow drainageways in valleys. Dilley soils are on hills and ridges.

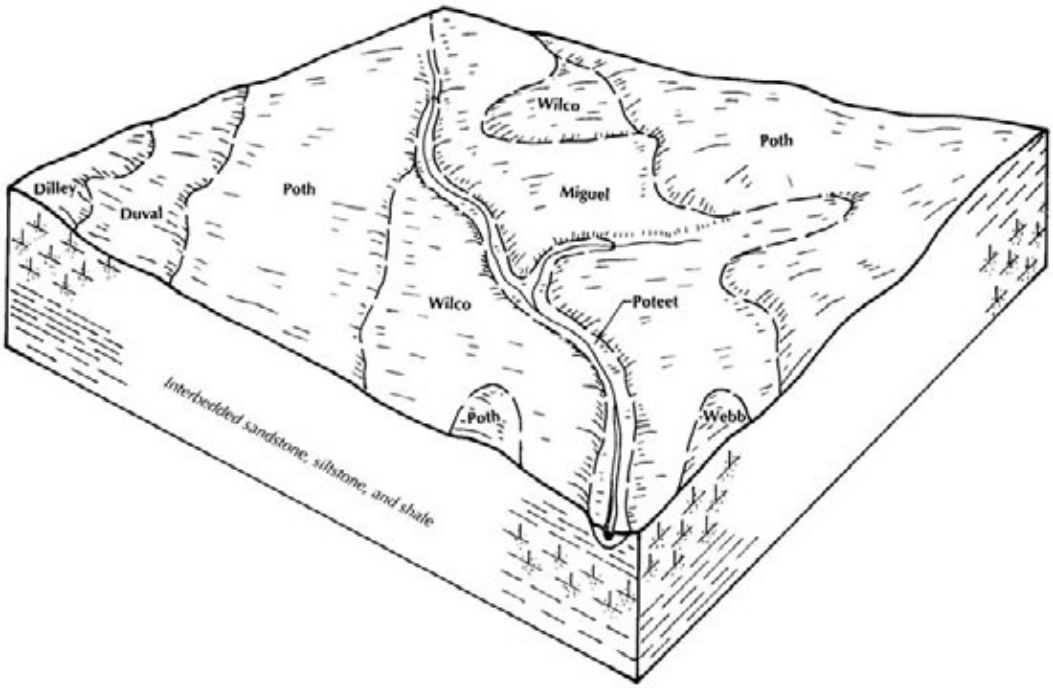

Figure 6.—Typical pattern of soils in the Poth-Miguel-Wilco general soil map unit

The major soils are moderately suited to most agricultural uses. They are used mainly as cropland or pasture. Water erosion and wind erosion are the main hazards, and a moderate available water capacity in the Poth and Wilco soils is the main limitation.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a variety of forage for livestock and wildlife. These areas are preferred sites for quail and dove and are inhabited by turkey and deer.

The major soils are moderately suited to most urban uses and are moderately suited or well suited to most recreational uses.

8. Ruiz-Bobillo-Falfurrias

Nearly level and gently undulating, rapidly permeable or moderately permeable soils that have a sandy surface layer and a sandy or loamy subsoil

The total area of this unit is 3,930 acres, or about 0.5 percent of the county. The unit is about 38 percent Ruiz soils, 20 percent Bobillo soils, 16 percent Falfurrias soils, and 26 percent minor soils.

The landscape consists of broad, smooth plains.

Ruiz soils are very deep, somewhat excessively drained, and rapidly permeable. Typically, the surface layer is pale brown and brown loamy sand about 48 inches thick. The subsurface layer, which is between depths of 48 and 80 inches, is pink loamy sand that has thin horizontal bands of reddish yellow material.

Bobillo soils are very deep, well drained, and moderately permeable. Typically, the surface layer is yellowish brown and pink loamy sand about 56 inches thick. The subsurface layer, which is between depths of 56 and 68 inches, is white loamy sand. The upper part of the subsoil, which is between depths of 68 and 81 inches, is pale brown, mottled sandy clay loam. The lower part, which is between depths of 81 and 88 inches, is white, mottled sandy loam.

Falfurrias soils are very deep, somewhat excessively drained, and rapidly permeable. Typically, the surface layer is pale brown sand about 30 inches thick. The upper part of the underlying material, which is between depths of 30 and 72 inches, is reddish yellow sand. The lower part, which is between depths of 72 and 80 inches, is pink sand.

The minor soils and their extent in this unit are as follows: about 2 percent Antosa soils, 3 percent Comitas soils, 4 percent Duval soils, 1 percent Hindes soils, 2 percent Miguel soils, 9 percent Poth soils, 1 percent Ramadero soils, and 4 percent Wilco soils. Hindes soils are on hills and ridges, and Ramadero soils are in small drainageways. All of the other minor soils are in landscape positions similar to those of the Ruiz, Bobillo, and Falfurrias soils.

The major soils are poorly suited to most agricultural uses. They are used almost exclusively as rangeland or wildlife habitat. Wind erosion is the main hazard, and a low available water capacity is the main limitation.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are inhabited by turkey. The population of deer generally is lower in the more extensive areas, which support a limited variety of browse plants.

The major soils are poorly suited to most urban and recreational uses. They are a potential source of sand for construction.

9. Antosa-Bobillo

Nearly level and gently undulating, moderately slowly permeable or moderately permeable soils that have a sandy surface layer and a loamy subsoil

The total area of this unit is 3,310 acres, or about 0.5 percent of the county. The unit is about 47 percent Antosa soils, 37 percent Bobillo soils, and 16 percent minor soils.

The landscape consists of broad, smooth plains dissected by narrow flood plains along creeks and small drainageways. Antosa and Bobillo soils are on the plains.

Antosa soils are very deep, moderately well drained, and moderately slowly permeable. Typically, the surface layer is light brownish gray loamy sand about 17 inches thick. The subsurface layer, which is between depths of 17 and 26 inches, is light gray loamy sand. The upper part of the subsoil, which is between depths of 26 and 40 inches, is light gray, mottled sandy clay loam. The lower part, which is between depths of 40 and 72 inches, is pale yellow, mottled sandy clay loam.

Bobillo soils are very deep, well drained, and moderately permeable. Typically, the surface layer is pale brown sand about 12 inches thick. The subsurface layer, which is between depths of 12 and 52 inches, is very pale brown sand. The upper part of the subsoil, which is between depths of 52 and 68 inches, is very pale brown and light gray, mottled sandy clay loam. The lower part, which is between depths of 68 and 74 inches, is white, mottled sandy clay loam.

The minor soils and their extent in this unit are as follows: about 2 percent Comitas soils, 6 percent Poteet soils, 6 percent Poth soils, and 2 percent Sinton soils. Comitas and Poth soils are in landscape positions similar to those of the Antosa and Bobillo soils. Poteet and Sinton soils are in small drainageways and on narrow flood plains and are lower on the landscape than the Antosa and Bobillo soils.

The major soils are poorly suited to most agricultural uses. They are used mainly as rangeland or wildlife habitat. Wind erosion is the main hazard, and a low or moderate available water capacity is the main limitation.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are inhabited by turkey. The population of deer generally is lower in the more extensive areas, which support a limited variety of browse plants.

The Antosa soils are moderately suited to most urban and recreational uses, and the Bobillo soils are poorly suited. Both soils are a potential source of sand for construction.

Very Deep, Loamy and Clayey Soils on Stream Terraces

The total area of these soils is 78,880 acres, or about 10.9 percent of the county. The major soils are those in the Caid, Montell, and Uvalde series. They are on nearly level and gently undulating plains on stream terraces above present-day flood plains. They are well drained and moderately well drained and are moderately permeable or very slowly permeable.

These soils generally have a high potential for most agricultural uses. Most areas are used as rangeland or wildlife habitat. A large acreage is used for corn, cotton, grain sorghum, oats, wheat, or vegetables. Some areas are used as pasture.

10. Uvalde-Caid-Montell

Nearly level and gently undulating, moderately permeable or very slowly permeable soils that have a loamy or clayey surface layer and a clayey or loamy subsoil

The total area of this unit is 78,880 acres, or about 10.9 percent of the county. The unit is about 37 percent Uvalde soils, 25 percent Caid soils, 12 percent Montell soils, and 26 percent minor soils (fig. 7).

The landscape consists of broad, smooth plains on stream terraces along rivers and large creeks. The plains are dissected by narrow flood plains along creeks and sloughs. Uvalde, Caid, and Montell soils generally are on the plains.

Uvalde soils are very deep, well drained, and moderately permeable. Typically, the surface layer is dark grayish brown and dark brown clay loam about 18 inches thick. The upper part of the subsoil, which is between depths of 18 and 37 inches, is dark yellowish brown clay. The lower part, which is between depths of37 and 62 inches, is pink and light brown clay.

Caid soils are very deep, well drained, and moderately permeable. Typically, the surface layer is dark grayish brown sandy clay loam about 17 inches thick. The upper part of the subsoil, which is between depths of 17 and 38 inches, is dark brown sandy clay loam and strong brown clay loam. The lower part, which is between depths of 38 and 72 inches, is reddish yellow clay loam.

Montell soils are very deep, moderately well drained, and very slowly permeable. Typically, the surface layer is dark gray and gray clay about 27 inches thick. The upper part of the subsoil, which is between depths of 27 and 42 inches, is grayish brown clay. The lower part, which is between depths of 42 and 74 inches, is pale brown and very pale brown clay.

The minor soils and their extent in this unit are as follows: about 1 percent Amphion soils, 2 percent Bigfoot soils, 3 percent Bookout soils, 8 percent Divot soils, 1 percent Hindes soils, 1 percent Olmos soils, 1 percent Ramadero soils, 4 percent Valco soils, 1 percent Zavco soils, and 4 percent other soils. Amphion and Bookout soils are in landscape positions similar to those of the Uvalde, Caid, and Montell soils. Bigfoot and Divot soils are on narrow flood plains along creeks and sloughs. Ramadero soils are in narrow drainageways. Valco soils are slightly higher on the stream terraces than the Uvalde, Caid, and Montell soils. Hindes and Olmos soils are on hills and ridges at the higher elevations near the perimeter of the unit. Zavco soils are on plains at the higher elevations.

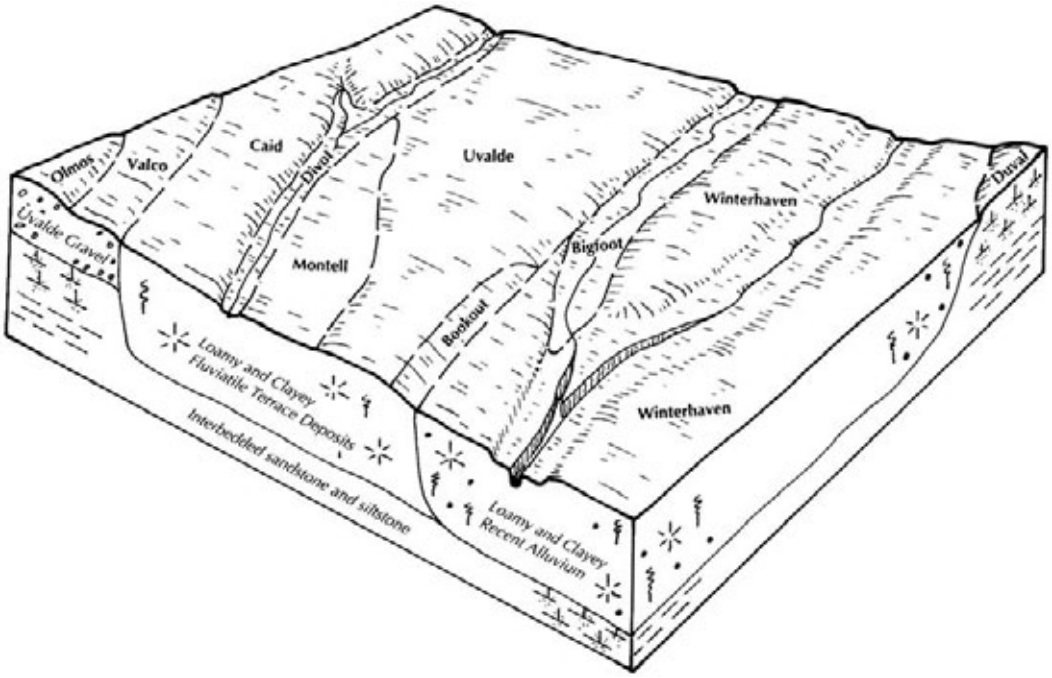

Figure 7.—Typical pattern of soils in the Uvalde-Caid-Montell and Winterhaven-Bigfoot general soil map units.

The major soils are well suited to most agricultural uses. They are used mainly as rangeland, wildlife habitat, or cropland. Some areas are used as pasture. Water erosion and wind erosion are the main hazards.

Rangeland productivity is medium. If properly managed, areas that support native vegetation produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are inhabited by dove and turkey.

The Uvalde and Caid soils are moderately suited to most urban uses, and the Montell soils are poorly suited. All three soils are moderately suited to most recreational uses.

Very Deep, Loamy and Clayey Soils on Flood Plains

The total area of these soils is 39,184 acres, or about 5.3 percent of the county. The major soils are those in the Bigfoot, Divot, and Winterhaven series. They are on nearly level flood plains along rivers and large creeks. They are occasionally flooded or frequently flooded. They are well drained and are moderately permeable or moderately slowly permeable.

These soils generally have a medium potential for most agricultural uses. Most areas are used as rangeland or wildlife habitat. Some areas are used for grain sorghum, forage sorghum, oats, or wheat or for pecan orchards. Some are used as pasture.

11. Winterhaven-Bigfoot

Nearly level, moderately permeable or moderately slowly permeable soils that have a loamy or clayey surface layer and a loamy or clayey subsoil

The total area of this unit is 19,650 acres, or about 2.7 percent of the county. The unit is about 82 percent Winterhaven soils, 12 percent Bigfoot soils, and 6 percent minor soils (fig. 7).

The landscape consists of broad flood plains along rivers and large creeks. It is dissected by numerous sloughs and stream channels. Stream terraces and upland plains, hills, and ridges are near the boundary of the unit. Winterhaven and Bigfoot soils are on the flood plains.

Winterhaven soils are very deep, well drained, and moderately permeable. Typically, the surface layer is grayish brown silty clay loam about 11 inches thick. The subsoil, which is between depths of 11 and 32 inches, is pale brown silty clay loam. The substratum, which is between depths of 32 and 62 inches, is light yellowish brown silty clay loam.

Bigfoot soils are very deep, well drained, and moderately slowly permeable. Typically, the surface layer is dark grayish brown silty clay about 9 inches thick. The upper part of the subsoil, which is between depths of 9 and 33 inches, is grayish brown silty clay. The lower part, which is between depths of 33 and 63 inches, is pale brown silty clay.

The minor soils and their extent in this unit are as follows: about 1 percent Duval soils, 1 percent Lacoste soils, 1 percent Olmos soils, 1 percent Uvalde soils, and 2 percent other soils. Uvalde soils are on stream terraces. Duval soils are on upland plains. Lacoste and Olmos soils are on hills and ridges.

The major soils are moderately suited to most agricultural uses. They are used mainly as rangeland or wildlife habitat. Frequently flooded areas are not suited to cropland. A few occasionally flooded areas are used as cropland or pasture. Flooding is the main hazard.

Rangeland productivity is high. If properly managed, areas that support native vegetation provide a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove.

The major soils are severely limited as sites for most urban uses because of the flooding. They are poorly suited or moderately suited to most recreational uses.

12. Bigfoot-Divot

Nearly level, moderately slowly permeable soils that have a clayey or loamy surface layer and a clayey subsoil

The total area of this unit is 19,534 acres, or about 2.6 percent of the county. The unit is about 78 percent Bigfoot soils, 11 percent Divot soils, and 11 percent minor soils.

The landscape consists of broad flood plains along rivers and large creeks. It is dissected by numerous sloughs and stream channels. Stream terraces, hills, and ridges are near the boundary of the unit. Bigfoot and Divot soils are on the flood plains.

Bigfoot soils are very deep and well drained. Typically, the surface layer is dark grayish brown silty clay about 9 inches thick. The upper part of the subsoil, which is between depths of 9 and 33 inches, is grayish brown silty clay. The lower part, which is between depths of 33 and 63 inches, is pale brown silty clay.

Divot soils are very deep and well drained. Typically, the surface layer is dark grayish brown and dark brown silty clay loam about 34 inches thick. The upper part of the subsoil, which is between depths of 34 and 50 inches, is brown silty clay loam. The lower part, which is between depths of 50 and 72 inches, is light yellowish brown silty clay loam.

The minor soils and their extent in this unit are as follows: about 1 percent Bookout soils, 2 percent Caid soils, 1 percent Hindes soils, 1 percent Olmos soils, 4 percent Uvalde soils, 1 percent Winterhaven soils, and 1 percent other soils. Winterhaven soils are in landscape positions similar to those of the Bigfoot and Divot soils. Bookout, Caid, and Uvalde soils are on stream terraces. Hindes and Olmos soils are on hills and ridges.

The major soils are moderately suited to most agricultural uses. They are used mainly as rangeland or wildlife habitat. Frequently flooded areas are not suited to cropland. A few occasionally flooded areas are used as cropland or pasture. Flooding is the main hazard.

Rangeland productivity is high. If properly managed, areas that support native vegetation provide a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove.

The major soils are severely limited as sites for most urban uses because of the flooding. They are poorly suited or moderately suited to most recreational uses.

Detailed Soil Map Units

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses. Texture terms in the first paragraph of each description refer to the surface layer.

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Duval very fine sandy loam, 1 to 3 percent slopes, is a phase of the Duval series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Elmendorf-Denhawken complex, 0 to 1 percent slopes, is an example.

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

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

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

AmA—Amphion sandy clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on broad, smooth plains. The shape of the slopes is linear or concave. Individual areas are irregular in shape and range from 8 to 400 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches; very dark grayish brown, mildly alkaline sandy clay loam

8 to 20 inches; very dark gray, neutral sandy clay loam

Subsoil:
20 to 29 inches; dark grayish brown, moderately alkaline clay loam
29 to 36 inches; brown, moderately alkaline clay loam that has brownish yellow mottles
36 to 60 inches; brownish yellow, moderately alkaline clay loam that has pale brown and strong brown mottles
60 to 63 inches or more; yellow, moderately alkaline clay loam that has strong brown mottles

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Amphion and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Amphion soil but have a light colored surface layer or a red subsoil. Also included are small areas of Amphion soils that have slopes of 1 to 3 percent or are occasionally flooded.

The contrasting soils in this map unit include small areas of Brystal, Caid, Campbellton, Denhawken, Divot, Elmendorf, Duval, Hindes, Imogene, Laparita, Miguel, Poteet, Ramadero, Schattel, Tiocano, Uvalde, Webb, Yologo, and Zavco soils. Divot, Imogene, Poteet, Ramadero, Tiocano, and Uvalde soils are lower on the landscape than the Amphion soil. Hindes and Yologo soils are on hills and ridges. The other soils are in landscape positions similar to or higher than those of the Amphion soil.

The Amphion soil is used as rangeland (fig. 8), wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is well suited to cropland. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cabbage, and potatoes. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Clay Loam.

Figure 8.—An area of Amphion sandy clay loam, 0 to 1 percent slopes, used as rangeland. The dominant brush is mesquite.

AmB—Amphion sandy clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains. The shape of the slopes is convex or linear. Individual areas are irregular in shape and range from 8 to 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark grayish brown, neutral sandy clay loam

Subsoil:
10 to 16 inches; very dark grayish brown, neutral clay
16 to 24 inches; dark brown, mildly alkaline clay 24 to 42 inches; yellowish brown, mildly alkaline clay
42 to 62 inches or more; light yellowish brown, moderately alkaline clay that has brownish yellow mottles

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Amphion and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are

similar to the Amphion soil but have a light colored surface layer or a red subsoil. Also included are small areas of Amphion soils that have slopes of 0 to 1 percent or are occasionally flooded.

The contrasting soils in this map unit include small areas of Brystal, Caid, Campbellton, Denhawken, Divot, Duval, Elmendorf, Hindes, Imogene, Laparita, Miguel, Poteet, Schattel, Tiocano, Webb, Yologo, and Zavco soils. Divot, Imogene, Poteet, and Tiocano soils are lower on the landscape than the Amphion soil. Hindes and Yologo soils are on hills and ridges. The other soils are in landscape positions similar to or higher than those of the Amphion soil.

The Amphion soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is well suited to cropland. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cabbage, and potatoes. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIe, nonirrigated and irrigated. The range site is Clay Loam.

An—Amphion sandy clay loam, occasionally flooded. This very deep, nearly level, loamy soil is on stream terraces along creeks. The shape of the slopes is concave or linear. The slopes are mainly less than 1 percent but range from 0 to 2 percent. Individual areas are elongated and range from 8 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches; dark grayish brown, neutral sandy clay loam

Subsoil:

8 to 22 inches; dark gray, neutral clay
22 to 35 inches; dark grayish brown, mildly alkaline clay
35 to 42 inches; grayish brown, moderately alkaline clay loam
42 to 72 inches or more; brown, mildly alkaline clay loam that has strong brown and yellowish brown mottles

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow

Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years, usually lasts less than 2 days, and is of low velocity
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Amphion and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Amphion soil but have a red subsoil. Also included are small areas of Amphion soils that are not flooded and have slopes of 0 to 3 percent.

The contrasting soils in this map unit include small areas of Brystal, Caid, Campbellton, Divot, Imogene, Poteet, Tiocano, Webb, and Zavco soils. Divot, Imogene, Poteet, and Tiocano soils are in landscape positions similar to or lower than those of the Amphion soil. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Amphion soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove.

This soil is moderately suited to cropland. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cabbage, and potatoes. Flooding is the main hazard. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned.

The land capability classification is IIIw, nonirrigated and irrigated. The range site is Ramadero.

ATC—Antosa-Bobillo complex, gently undulating. These are very deep, sandy soils on broad, smooth plains. The shape of the slopes is linear or convex. The slopes are 0 to 3 percent. Individual areas are irregular in shape and range from 20 to 1,800 acres in size.

The Antosa and Bobillo soils occur as areas so intricately mixed that they could not be mapped separately.

The typical sequence, depth, and composition of the layers of Antosa soil are as follows—

Surface layer:
0 to 17 inches; light brownish gray, slightly acid loamy sand

Subsurface layer:
17 to 26 inches; light gray, slightly acid loamy sand

Subsoil:
26 to 40 inches; light gray, slightly acid sandy clay loam, mottled in shades of brown, yellow, and gray
40 to 72 inches or more; pale yellow, neutral sandy clay loam that is mottled in shades of brown and yellow

Important properties of the Antosa soil—

Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Very slow
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

The typical sequence, depth, and composition of the layers of Bobillo soil are as follows—

Surface
0 to 12 inches; pale brown, neutral sand

Subsurface layer:
12 to 52 inches; very pale brown, neutral sand

Subsoil:
52 to 56 inches; very pale brown, slightly acid sandy clay loam that is mottled in shades of yellow and brown
56 to 68 inches; light gray, slightly acid sandy clay loam that is mottled in shades of red and brown
68 to 74 inches or more; white, slightly acid sandy clay loam that is mottled in shades of red, yellow, and gray

Important properties of the Bobillo soil—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Low
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Very slow
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

Based on three transects, the best estimate is that Antosa and similar soils make up 48 percent of this map unit, Bobillo and similar soils make up 36 percent, and contrasting soils make up 16 percent. There is an 80 percent probability that the true composition of the entire map unit is 40 to 55 percent Antosa soil, 30 to 45 percent Bobillo soil, and 0 to 30 percent contrasting soils.

The contrasting soils in this map unit include small areas of Comitas, Falfurrias, Poth, and Wilco soils. These soils are in landscape positions similar to those of the Antosa and Bobillo soils.

The Antosa and Bobillo soils are used mainly as rangeland or wildlife habitat. Some areas are used as cropland or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and

are used by turkey. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

These soils are poorly suited to cropland. The sandy surface layer limits the number of suitable crops. The major crops are oats, wheat, peanuts, and watermelons. The main limitation is the low available water capacity, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth. A permanent plant cover may be needed to control wind erosion.

The Antosa soil is well suited to pasture, and the Bobillo soil is moderately suited. The sandy surface layer limits the number of suitable pasture grasses. The main pasture grass is coastal bermudagrass.

The Antosa soil is moderately suited to most urban uses, and the Bobillo soil is poorly suited. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soils. The sandy surface layer is rapidly permeable. As a result, the surface layer and subsurface layer of the soils do not adequately filter the effluent in the absorption fields. Seepage of pollutants from other sanitary facilities is likely unless special liners are used. Because of the sandy surface layer, droughtiness affects lawns and landscaping.

The Antosa soil is moderately suited to most recreational uses, and the Bobillo soil is poorly suited. The sandy surface layer and the limited available water capacity restrict plant growth. Surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IVe, nonirrigated and irrigated. The range site is Sandy.

Bb—Bigfoot silty clay, occasionally flooded. This very deep, nearly level, clayey soil is on broad flood plains along the Frio River and Hondo Creek. The shape of the slopes is linear or concave. Because of braided channels and sloughs, the surface appears undulating. The slopes range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to 700 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches; dark grayish brown, mildly alkaline silty clay

Subsoil:
9 to 33 inches; grayish brown, moderately alkaline silty clay
33 to 63 inches or more; pale brown, moderately alkaline silty clay

Important soil properties—

Drainage: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years and usually lasts less than 2 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Bigfoot and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Bigfoot soil but have a light colored surface layer. Also included are small

areas of Bigfoot soils that are flooded more often than 50 times in 100 years or that have slopes of 2 to 3 percent.

The contrasting soils in this map unit include small areas of Bookout, Caid, Divot, Uvalde, and Winterhaven soils. Divot and Winterhaven soils are in landscape positions similar to those of the Bigfoot soil. The other soils are in the higher positions. Also included are soils that are similar to Winterhaven soils but have a dark surface layer.

The Bigfoot soil is used mainly as rangeland or wildlife habitat. Some areas are used as cropland.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby Frio River and Hondo Creek provide water for wildlife.

This soil is well suited to cropland. The chief crops are forage sorghum, grain sorghum, wheat, and oats. The alkalinity of the surface layer limits the number of suitable crops. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned. Because of the clayey surface layer, special surfacing material may be needed during wet periods in areas that are subject to foot traffic.

The land capability classification is IIw, nonirrigated and irrigated. The range site is Clayey Bottomland.

Bf—Bigfoot silty clay, frequently flooded. This very deep, nearly level, clayey soil is on broad flood plains along the Frio River and Hondo Creek. The shape of the slopes is linear or concave. Because of braided channels and sloughs, the surface appears undulating. The slopes range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; dark grayish brown, mildly alkaline silty clay

Subsoil:
8 to 23 inches; grayish brown, mildly alkaline silty clay
23 to 36 inches; brown, moderately alkaline silty clay
36 to 63 inches or more; pale brown, moderately alkaline silty clay

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow

Flooding: Frequent; occurs more often than 50 times in 100 years and usually lasts less than 7 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Bigfoot and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Bigfoot soil but have a light colored surface layer. Also included are small areas of Bigfoot soils that are flooded less often than 50 times in 100 years or that have slopes of 2 to 3 percent.

The contrasting soils in this map unit include small areas of Bookout, Caid, Divot, Uvalde, and Winterhaven soils. Divot and Winterhaven soils are in landscape positions similar to those of the Bigfoot soil. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels as much as 100 feet wide and soils that are similar to Winterhaven soils but have a dark surface layer.

The Bigfoot soil is used mainly as rangeland or wildlife habitat.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby Frio River and Hondo Creek provide water for wildlife.

This soil is not suited to cropland. The flooding and the resultant scouring of bare areas are the main hazards.

This soil is poorly suited to dryland pasture and is not suited to irrigated pasture. Floodwater can destroy irrigation systems. The removal of native trees and brush near stream channels can result in severe scouring and streambank erosion during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas or playgrounds unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when other recreational areas are planned. Because of the clayey surface layer, special surfacing material may be needed during wet periods in areas that are subject to foot traffic.

The land capability classification is Vw, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Clayey Bottomland.

BoB—Bookout clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on smooth plains on the scarps of stream terraces along the Frio River. The shape of the slopes is convex. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; pale brown, mildly alkaline clay loam 8 to 16 inches; pale brown, moderately alkaline clay loam

Subsoil:
16 to 32 inches; light yellowish brown, mildly alkaline clay
32 to 44 inches; very pale brown, moderately alkaline clay

44 to 62 inches or more; very pale brown, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Bookout and similar soils make up 85 percent or more of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Bookout soil but have more than 15 percent sand coarser than very fine sand in the subsoil. Also included are small areas of Bookout soils that have slopes of 0 to 1 percent or 3 to 5 percent.

The contrasting soils in this map unit include small areas of Bigfoot, Caid, Divot, Lacoste, Olmos, Uvalde, Valco, and Winterhaven soils. Caid and Uvalde soils are in landscape positions similar to those of the Bookout soil. Bigfoot, Divot, and Winterhaven soils are in the lower positions. Lacoste, Olmos, and Valco soils are in the higher positions.

The Bookout soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, and wheat. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Clay Loam.

BoC—Bookout clay loam, 3 to 5 percent slopes. This very deep, gently sloping, loamy soil is on smooth plains on the scarps of stream terraces along the Frio River. The shape of the slopes is convex. Individual areas are elongated and range from 8 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 13 inches; brown, moderately alkaline clay loam

Subsoil:
13 to 28 inches; light yellowish brown, moderately alkaline clay
28 to 40 inches; light yellowish brown, moderately alkaline clay loam
40 to 62 inches or more; very pale brown, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Moderate

Bookout and similar soils make up 85 percent or more of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Bookout soil but have more than 15 percent sand coarser than very fine sand in the subsoil. Also included are small areas of Bookout soils that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Bigfoot, Caid, Divot, Olmos, Uvalde, Valco, and Winterhaven soils. Caid and Uvalde soils are in landscape positions similar to those of the Bookout soil. Bigfoot, Divot, and Winterhaven soils are in the lower positions. Olmos and Valco soils are in the higher positions.

The Bookout soil is used mainly as rangeland or wildlife habitat.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is poorly suited to dryland crops and moderately suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling, Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IVe, nonirrigated, and Ille, irrigated. The range site is Clay Loam.

BrA—Brystal very fine sandy loam, 0 to percent slopes. This very deep, nearly level, loamy soil is on smooth plains. The shape of the slopes is linear or concave. Individual areas are irregular in shape and range from 8 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches; reddish brown, mildly alkaline very fine sandy loam

Subsoil:
11 to 17 inches; reddish brown, mildly alkaline sandy clay loam
17 to 41 inches; red, mildly alkaline sandy clay loam 41 to 56 inches; red, moderately alkaline sandy clay loam
56 to 72 inches or more; reddish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Brystal and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Brystal soil but have a dark surface layer or a gravelly subsoil. Also included are small areas of Brystal soils that have slopes of 1 to 3 percent and small areas of Duval soils, which have sandstone bedrock at a depth of 40 to 60 inches and have less lime in the subsoil than the Brystal soil.

The contrasting soils in this map unit include small areas of Caid, Dilley, Goldfinch, Hindes, Lacoste, Poteet, Tiocano, Webb, Yologo, and Zavco soils. Caid, Webb, and Zavco soils are in landscape positions similar to those of the Brystal soil. Dilley, Goldfinch, Hindes, Lacoste, and Yologo soils are in the higher positions. Poteet and Tiocano soils are in the lower positions.

The Brystal soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, wheat, potatoes, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Coastal bermudagrass, kleingrass, and buffelgrass are the main pasture grasses.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent dustiness in areas that are subject to foot traffic.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Sandy Loam.

BrB—Brystal very fine sandy loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; reddish brown, neutral very fine sandy loam

Subsoil:
10 to 15 inches; reddish brown, mildly alkaline sandy clay loam
15 to 22 inches; yellowish red, mildly alkaline sandy clay loam
22 to 30 inches; reddish yellow, mildly alkaline sandy clay loam
30 to 40 inches; reddish yellow, moderately alkaline sandy clay loam
40 to 64 inches or more; reddish yellow, mildly alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Brystal and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Brystal soil but have a dark surface layer or a gravelly subsoil. Also included are small areas of Brystal soils that have slopes of 0 to 1 percent or 3 to 5 percent and small areas of Duval soils, which have sandstone bedrock at a depth of 40 to 60 inches and have less lime in the subsoil than the Brystal soil.

The contrasting soils in this map unit include small areas of Caid, Dilley, Goldfinch, Hindes, Lacoste, Poteet, Tiocano, Webb, Yologo, and Zavco soils. Caid, Webb, and Zavco soils are in landscape positions similar to those of the Brystal soil. Dilley, Goldfinch, Hindes, Lacoste, and Yologo soils are in the higher positions. Poteet and Tiocano soils are in the lower positions.

The Brystal soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, peanuts, wheat, potatoes, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Coastal bermudagrass, kleingrass, and buffelgrass are the most common pasture grasses.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Sandy Loam.

CaA—Caid very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on smooth plains on stream terraces along the Frio and Leona Rivers

and along large creeks. The shape of the slopes is linear. Individual areas are subrounded or irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 13 inches; dark brown, moderately alkaline very fine sandy loam

Subsoil:
13 to 34 inches; strong brown, moderately alkaline sandy clay loam
34 to 48 inches; reddish yellow, moderately alkaline clay loam
48 to 64 inches; brownish yellow, moderately alkaline clay loam
64 to 72 inches or more; reddish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Caid and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Caid soil but have a noncalcareous surface layer, a light colored surface layer, or a dark surface layer that is 7 to 10 inches thick. Also included are Caid soils that have a surface layer of sandy clay loam or that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Bigfoot, Bookout, Brystal, Divot, Duval, Montell, Tiocano, Uvalde, Winterhaven, and Zavco soils. Amphion, Bigfoot, Divot, Montell, Tiocano, and Winterhaven soils are lower on the landscape than the Cad soil. Bookout, Brystal, Duval, Uvalde, and Zavco soils are in landscape positions similar to or higher than those of the Caid soil.

The Caid soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers and other vegetables. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Coastal bermudagrass, kleingrass, and buffelgrass are the main pasture grasses.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Gray Sandy Loam.

CaB—Caid very fine sandy loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on smooth plains on stream terraces along the Frio and Leona Rivers and along large creeks. The shape of the slopes is convex or linear. Individual areas are subrounded or irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches; dark brown, moderately alkaline very fine sandy loam

Subsoil:
11 to 32 inches; light brown, moderately alkaline sandy clay loam
32 to 60 inches; reddish yellow, moderately alkaline sandy clay loam
60 to 72 inches or more; brownish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Caid and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Caid soil but have a noncalcareous surface layer, a light colored surface layer, or a dark surface layer that is 7 to 10 inches thick. Also included are Caid soils that have a surface layer of sandy clay loam or that have slopes of 0 to 1 percent or 3 to 5 percent.

The contrasting soils in this map unit include small areas of Amphion, Bigfoot, Bookout, Brystal, Divot, Duval, Montell, Tiocano, Uvalde, Winterhaven, and Zavco soils. Amphion, Bigfoot, Divot, Montell, Tiocano, and Winterhaven soils are lower on the landscape than the Caid soil. Bookout, Brystal, Duval, Uvalde, and Zavco soils are in landscape positions similar to or higher than those of the Caid soil.

The Caid soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers and other vegetables. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Kleingrass, coastal bermudagrass, and buffelgrass are the main pasture grasses.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil.
Properly designing building foundations helps to prevent the structural damage caused by

shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Gray Sandy Loam.

CdA—Caid sandy clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on smooth plains on stream terraces along the Frio and Leona Rivers and along large creeks. The shape of the slopes is linear. Individual areas are elongated or irregular in shape and range from 8 to 2,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 15 inches; dark brown, mildly alkaline sandy clay loam

Subsoil:
15 to 25 inches; brown, mildly alkaline sandy clay loam
25 to 38 inches; light yellowish brown, moderately alkaline sandy clay loam
38 to 56 inches; pink, moderately alkaline clay loam
56 to 80 inches or more; reddish yellow, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Caid and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Caid soil but have a noncalcareous surface layer or a light colored surface layer. Also included are Caid soils that have a surface layer of very fine sandy loam or that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Bigfoot, Bookout, Brystal, Divot, Duval, Montell, Tiocano, Uvalde, Winterhaven, and Zavco soils. Amphion, Bigfoot, Divot, Montell, Tiocano, and Winterhaven soils are lower on the landscape than the Caid soil. Bookout, Brystal, Duval, Uvalde, and Zavco soils are in landscape positions similar to or higher than those of the Caid soil.

The Caid soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers, cabbage, and other vegetables. Wind erosion is the main hazard. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Kleingrass, coastal bermudagrass, and buffelgrass are the main pasture grasses.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Clay Loam.

CdB—Caid sandy clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on smooth plains on stream terraces along the Frio and Leona Rivers and along large creeks. The shape of the slopes is convex or linear. Individual areas are subrounded or irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 17 inches; dark grayish brown, mildly alkaline sandy clay loam

Subsoil:
17 to 23 inches; dark brown, moderately alkaline sandy clay loam
23 to 38 inches; strong brown, moderately alkaline clay loam
38 to 72 inches or more; reddish yellow, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Caid and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Caid soil but have a noncalcareous surface layer or a light colored surface layer. Also included are Caid soils that have a surface layer of very fine sandy loam or that have slopes of 0 to 1 percent or 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Bigfoot, Bookout, Brystal, Divot, Duval, Montell, Tiocano, Uvalde, Winterhaven, and Zavco soils. Amphion, Bigfoot, Divot, Montell, Tiocano, and Winterhaven soils are lower on the landscape than the Caid soil. Bookout, Brystal, Duval, Uvalde, and Zavco soils are in landscape positions similar to or higher than those of the Caid soil.

The Caid soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers, cabbage, and

other vegetables. The main hazards are wind erosion and water erosion. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Kleingrass, coastal bermudagrass, and buffelgrass are the main pasture grasses.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Clay Loam.

CmA—Campbellton clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on smooth plains and the toe slopes of hills and ridges. The shape of the slopes is linear or concave. Individual areas are irregular in shape and range from 8 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches; dark grayish brown, mildly alkaline, nonsaline clay loam
4 to 9 inches; grayish brown, mildly alkaline, nonsaline clay loam

Subsoil:
9 to 15 inches; pale brown, mildly alkaline, nonsaline clay loam
15 to 33 inches; very pale brown, moderately alkaline, very slightly saline clay
33 to 48 inches; light yellowish brown, moderately alkaline, slightly saline clay
48 to 59 inches; very pale brown, moderately alkaline, moderately saline clay

Substratum:
59 to 72 inches or more; light gray, moderately alkaline, moderately saline clay intermingled with soft shale fragments

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Campbellton and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Campbellton soil but have a surface layer that is 7 to 10 inches thick or a solum that is more than 60 inches thick. Also included are small areas of Campbellton soils that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Denhawken, Duval, Elmendorf, Laparita, Monteola, Schattel, Webb, and Zavco soils.

Schattel soils are higher on the landscape than the Campbellton soil. The other soils are in landscape positions similar to or lower than those of the Campbellton soil.

The Campbellton soil is used as rangeland, wildlife habitat, or cropland.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and poorly suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are grain sorghum, wheat, and oats. The main limitations are the salinity of the subsoil and the moderate available water capacity, and the main hazard is wind erosion. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Saline Clay Loam.

CmB—Campbellton clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to 400 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches; dark grayish brown, mildly alkaline, nonsaline clay loam

Subsoil:
12 to 18 inches; brown, moderately alkaline, very slightly saline clay
18 to 24 inches; yellowish brown, moderately alkaline, very slightly saline clay
24 to 35 inches; yellowish brown, moderately alkaline, slightly saline clay
35 to 48 inches; very pale brown, moderately alkaline, slightly saline clay intermingled with soft shale fragments

Substratum:
48 to 60 inches or more; light gray, mildly alkaline, moderately saline clay intermingled with soft shale fragments

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Medium

Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Campbellton and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Campbellton soil but have a surface layer that is 7 to 10 inches thick or a solum that is more than 60 inches thick. Also included are small areas of Campbellton soils that have slopes of 0 to 1 percent or 3 to 5 percent.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Denhawken, Duval, Elmendorf, Laparita, Monteola, Schattel, Webb, and Zavco soils. Schattel soils are in landscape positions similar to or higher than those of the Campbellton soil. The other soils are in landscape positions similar to or lower than those of the Campbellton soil.

The Campbellton soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and poorly suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are grain sorghum, wheat, and oats. The main limitations are the salinity of the subsoil and the moderate available water capacity, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIe, nonirrigated and irrigated. The range site is Saline Clay Loam.

CoB—Comitas loamy fine sand, 0 to 3 percent slopes. This very deep, nearly level and gently undulating, sandy soil is on smooth plains and the foot slopes of hills and ridges. The shape of the slopes is concave to convex. Individual areas are elongated or irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 30 inches; yellowish brown, neutral loamy fine sand

Subsoil:
30 to 75 inches; strong brown, neutral fine sandy loam
75 to 80 inches or more; light brown, neutral fine sandy loam

Important soil properties—

Drainage class: Well drained

Permeability: Moderately rapid
Available water capacity: Moderate
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Severe

Comitas and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Comitas soil but have more clay in the subsoil or have a thicker surface layer. Also included are small areas of Comitas soils that have slopes of 3 to 5 percent.

The contrasting soils in this map unit include small areas of Bobillo, Dilley, Duval, Falfurrias, Goldfinch, Poteet, Poth, and Wilco soils. Poteet soils are lower on the landscape than the Comitas soil. Dilley and Goldfinch soils are higher on the landscape than the Comitas soil. The other soils are in landscape positions similar to those of the Comitas soil. Also included are some small severely eroded areas and areas of soils that are similar to Duval soils but have sandstone at a depth of 20 to 40 inches.

The Comitas soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are used by turkey. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

This soil is poorly suited to dryland crops and moderately suited to irrigated crops. The sandy surface layer limits the number of suitable crops. The chief crops are forage sorghum, grain sorghum, wheat, oats, peanuts, and watermelons. The main limitation is the moderate available water capacity, and the main hazard is wind erosion. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Coastal bermudagrass is the main pasture grass.

This soil is moderately suited to most urban uses. The main limitation is the moderately rapid permeability of the soil. Seepage of pollutants from sewage lagoons and sanitary landfills is likely unless special liners are used. Properly designed septic tank absorption fields can function well on this soil. Droughtiness affects lawns and landscaping.

This soil is moderately suited to most recreational uses. The sandy surface layer and the limited available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IVe, nonirrigated, and IIIe, irrigated. The range site is Loamy Sand.

DED—Devine very gravelly sandy loam, rolling. This very deep, very gravelly, loamy soil is on the summit and shoulder slopes of hills and ridges. The shape of the slopes is convex. The slopes range from 1 to 12 percent. Individual areas are subrounded or irregular in shape and range from 8 to 150 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 38 inches; dark brown, neutral very gravelly sandy loam

Subsoil:
38 to 62 inches; mottled red, brown, and strong brown, slightly acid very gravelly sandy clay

Bedrock:
62 to 80 inches; reddish yellow, weakly cemented sandstone that has red, white, and yellow mottles

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Low
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Slight

Based on three transects, the best estimate is that Devine and similar soils make up 93 percent of this map unit and contrasting soils make up 7 percent. There is an 80 percent probability that the true composition of the entire map unit is 85 to 100 percent Devine soil and 0 and 15 percent contrasting soils.

Included in this map unit are small areas of soils that are similar to the Devine soil but have a surface layer of gravelly sandy loam, gravelly loamy sand, or very gravelly loamy sand, have less clay in the subsoil, have a dark surface layer, or have sandstone at a depth of 40 to 60 inches.

The contrasting soils in this map unit are small areas of Amphion, Dilley, Duval, Hindes, Miguel, Poth, Webb, Yologo, and Zavco soils. Dilley, Hindes, and Yologo soils are in landscape positions similar to those of the Devine soil. Amphion, Duval, Miguel, Poth, Webb, and Zavco soils are in the lower positions.

The Devine soil is used as rangeland or wildlife habitat. It is a potential source of gravel for construction.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail, are good sites for dove, and are used by turkey and deer.

This soil is not suited to cropland. The very gravelly surface layer and the low available water capacity are the main limitations, and water erosion is the main hazard.

This soil is poorly suited to pasture. Because of the high content of gravel and the low available water capacity, establishing or maintaining pasture grasses is difficult. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion.

This soil is moderately suited to most urban uses. Because of droughtiness and the very gravelly surface layer, topsoil is needed in areas used for lawns and landscaping. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. The very gravelly subsoil can result in seepage of pollutants from sewage lagoons and sanitary landfills.

This soil is poorly suited to most recreational uses. The high content of gravel and the low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is VIs, nonirrigated and irrigated. The range site is Gravelly Ridge.

DfC—Dilley fine sandy loam, 1 to 5 percent slopes. This shallow, gently undulating, loamy soil is 10 to 20 inches deep over sandstone bedrock. It is on the summit and shoulder slopes of hills and ridges and on plains. The shape of the slopes is convex. Individual areas are subrounded or irregular in shape and range from 8 to 700 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches; reddish brown, neutral fine sandy loam

Subsoil:
6 to 12 inches; yellowish red, neutral fine sandy loam

Bedrock:
12 to 60 inches or more; fractured, yellowish brown, strongly cemented sandstone

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Very low
Root zone: Shallow
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Moderate

Dilley and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Dilley soil but have sandstone bedrock at a depth of 20 to 30 inches or at a depth of 7 to 9 inches or have slopes of 5 to 8 percent. Also included are small areas of Dilley soils having a surface layer that is gravelly or is loamy fine sand.

The contrasting soils in this map unit include small areas of Brystal, Comitas, Duval, Goldfinch, Hindes, Lacoste, Webb, and Yologo soils. Also included are small areas of rock outcrop. Goldfinch, Hindes, Lacoste, and Yologo soils and rock outcrop are in landscape positions similar to or higher than those of the Dilley soil. Brystal, Comitas, Duval, and Webb soils are in the lower positions.

The Dilley soil is used as rangeland, wildlife habitat, or cropland.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is not suited to dryland crops and is poorly suited to irrigated crops. The main limitations are the very low available water capacity and the shallow root zone, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is poorly suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the limited depth to bedrock. Because of the shallowness to sandstone, droughtiness affects lawns and landscaping. The depth to bedrock makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

This soil is poorly suited to most recreational uses. The shallowness to sandstone and the very low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is VIe, nonirrigated, and IVe, irrigated. The range site is Shallow Sandy Loam.

Do—Divot silty clay loam, occasionally flooded. This very deep, nearly level, loamy soil is on flood plains along rivers and large creeks. The shape of the slopes is linear or concave. The slopes are mainly less than 1 percent but range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 18 inches; dark grayish brown, mildly alkaline silty clay loam
18 to 34 inches; dark brown, mildly alkaline silty clay loam

Subsoil:
34 to 50 inches; brown, mildly alkaline silty clay loam
50 to 72 inches or more; light yellowish brown, mildly alkaline silty clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years and usually lasts less than 2 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Divot and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of Bigfoot soils and small areas of soils that are similar to the Divot soil but that have a light colored surface layer or slopes of 2 to 3 percent. Also included are small areas of Divot soils that are flooded more often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Bookout, Caid, Imogene, Laparita, Miguel, Montell, Poteet, Poth, Tiocano, Uvalde, Winterhaven, and Zavco soils. Imogene, Laparita, Poteet, and Winterhaven soils are in landscape positions similar to those of the Divot soil. Tiocano soils are in the slightly lower positions. The other soils are in the higher positions.

The Divot soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby rivers and creeks provide water for wildlife.

This soil is well suited to cropland. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are forage sorghum, grain sorghum, wheat, and oats. The main hazard is the flooding. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding. Coastal bermudagrass and kleingrass are the main pasture grasses.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. Because of the content of clay, the subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned.

The land capability classification is IIw, nonirrigated and irrigated. The range site is Loamy Bottomland.

Dt—Divot silty clay loam, frequently flooded. This very deep, nearly level, loamy soil is on flood plains along rivers and large creeks. The shape of the slopes is concave or linear. Because of braided channels and sloughs, the surface appears undulating. The slopes are mainly less than 1 percent but range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 14 inches; dark grayish brown, mildly alkaline silty clay loam
14 to 24 inches; grayish brown, moderately alkaline silty clay

Subsoil:
24 to 34 inches; light brownish gray, moderately alkaline silty clay
34 to 80 inches; pale brown, moderately alkaline silty clay

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: Frequent; occurs more often than 50 times in 100 years and usually lasts less than 7 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Divot and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of Bigfoot soils and small areas of soils that are similar to the Divot soil but have a light colored surface layer or slopes of 2 to 3 percent. Also included are small areas of Divot soils that are flooded less often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Bookout, Caid, Imogene, Laparita, Miguel, Montell, Poteet, Poth, Tiocano, Uvalde, Winterhaven, and Zavco soils. Imogene, Laparita, Poteet, and Winterhaven soils are in landscape positions similar to or slightly higher than those of the Divot soil. Tiocano soils are in the slightly lower positions. The other soils are in the higher positions.

The Divot soil is used as rangeland, wildlife habitat, or pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby rivers and creeks provide water for wildlife.

This soil is not suited to cropland. The flooding and the resultant scouring of bare areas are the main hazards.

This soil is poorly suited to dryland pasture and is not suited to irrigated pasture. Floodwater can destroy irrigation systems. The removal of native trees and brush near stream channels can result in severe scouring and streambank erosion during periods of flooding. Coastal bermudagrass is the main pasture grass.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. The clayey subsoil can be worked by earthmoving equipment only within a narrow range in moisture content, Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other areas are planned.

The land capability classification is Vw, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Loamy Bottomland.

DuC—Duval loamy fine sand, 0 to 5 percent slopes. This deep, nearly level and gently undulating, sandy soil is 40 to 60 inches deep over sandstone bedrock. It is on broad, smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; yellowish red, neutral loamy fine sand
8 to 18 inches; yellowish red, slightly acid loamy fine sand

Subsoil:
18 to 36 inches; yellowish red, slightly acid sandy clay loam
36 to 44 inches; red, slightly acid sandy clay loam

Bedrock:
44 to 62 inches or more; reddish yellow, weakly cemented sandstone

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Low
Root zone: Deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

Duval and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Duval soil but have sandstone bedrock at a depth of more than 60 inches or at a depth of

30 to 40 inches, a surface layer of loamy fine sand 20 to 30 inches thick, or slopes of 5 to 7 percent. Also included are Duval soils that have a surface layer of very fine sandy loam.

The contrasting soils in this map unit include small areas of Comitas, Dilley, Goldfinch, Miguel, Poteet, Poth, Tiocano, Webb, and Wilco soils. Comitas, Miguel, Path, Webb, and Wilco soils are in landscape positions similar to those of the Duval soil. Dilley and Goldfinch soils are in the higher positions on hills and ridges. Poteet and Tiocano soils are in the lower positions. Also included are some small severely eroded areas, gullied areas, and areas of soils that are similar to Dilley soils but have sandstone bedrock at a depth of 20 to 30 inches.

The Duval soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are used by turkey. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

This soil is moderately suited to a wide variety of dryland and irrigated crops. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts (fig. 9), wheat, potatoes, and watermelons. Water erosion and wind erosion are the main hazards, and the low available water capacity is the main limitation. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are coastal bermudagrass and kleingrass.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the depth to bedrock and the restricted permeability of the soil.

This soil is moderately suited to most recreational uses. The sandy surface layer limits plant growth on golf fairways.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Loamy Sand.

DvA—Duval very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, loamy soil is 40 to 60 inches deep over sandstone bedrock. It is on broad, smooth plains. The shape of the slopes is linear. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 15 inches; reddish brown, neutral very fine sandy loam

Subsoil:

15 to 18 inches; red, slightly acid very fine sandy loam

18 to 30 inches; red, slightly acid sandy clay loam 30 to 45 inches; red, neutral sandy clay loam

Bedrock:

45 to 60 inches or more; yellowish brown, strongly cemented sandstone

Figure 9.—Irrigated peanuts in an area of Duval loamy fine sand, 0 to 5 percent slopes.

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Root zone: Deep
Shrink-swell potential: Low
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Duval and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Duval soil but have sandstone bedrock at a depth of 30 to 40 inches or at a depth of more than 60 inches or have a dark surface layer. Also included are small areas of Duval soils that have slopes of 1 to 3 percent or have a surface layer of loamy fine sand.

The contrasting soils in this map unit include small areas of Brystal, Dilley, Goldfinch, Miguel, Poteet, Tiocano, Webb, and Zavco soils. Brystal, Miguel, Webb, and Zavco soils are in landscape positions similar to those of the Duval soil. Dilley and Goldfinch soils are in the higher positions. Poteet and Tiocano soils are in the lower positions.

The Duval soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cotton, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, onions, potatoes, squash, spinach, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the depth to bedrock and the restricted permeability of the soil.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Sandy Loam.

DvB—Duval very fine sandy loam, 1 to 3 percent slopes. This deep, gently undulating, loamy soil is 40 to 60 inches deep over sandstone bedrock. It is on broad, smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 16 inches; yellowish red, slightly acid very fine sandy loam

Subsoil:
16 to 22 inches; yellowish red, neutral sandy clay loam
22 to 44 inches; red, mildly alkaline sandy clay loam
44 to 52 inches; red, moderately alkaline sandy clay loam

Bedrock:
52 to 72 inches or more; white, weakly cemented, moderately alkaline sandstone that is mottled in shades of red, brown, and yellow

Important soil properties—

Drainage: Well drained
Permeability: Moderate
Available water capacity: Moderate
Root zone: Deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Duval and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Duval soil but have sandstone bedrock at a depth of 30 to 40 inches or at

a depth of more than 60 inches or have a dark surface layer. Also included are small areas of Duval soils that have slopes of 0 to 1 percent or 3 to 5 percent or have a surface layer of loamy fine sand.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Dilley, Goldfinch, Hindes, Lacoste, Miguel, Poteet, Tiocano, Webb, Yologo, and Zavco soils. Brystal, Caid, Miguel, Webb, and Zavco soils are in landscape positions similar to those of the Duval soil. Dilley, Goldfinch, Hindes, Lacoste, and Yologo soils are in the higher positions. Amphion, Poteet, and Tiocano soils are in the lower positions. Also included are some small severely eroded areas and gullied areas (fig. 10).

Figure 10.—A gully included in an area of Duval very fine sandy loam, 1 to 3 percent slopes.

The Duval soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cotton, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, onions, potatoes, squash, spinach, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind Stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the depth to bedrock and the restricted permeability of the soil.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Sandy Loam.

DvC—Duval very fine sandy loam, 3 to 5 percent slopes. This deep, gently undulating, loamy soil is 40 to 60 inches deep over sandstone bedrock. It is on smooth plains and the back slopes of hills and ridges. The shape of the slopes is convex or linear. Individual areas are irregular in shape and range from 8 to 200 acres in brown, neutral very fine sandy loam size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 12 inches; brown, neutral very fine sandy loam

Subsoil:

12 to 26 inches; reddish brown, neutral sandy clay loam
26 to 36 inches; yellowish red, neutral very fine sandy loam
36 to 40 inches; yellowish red, moderately alkaline very fine sandy loam

Bedrock: 40 to 60 inches or more; light gray, weakly cemented sandstone

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Root zone: Deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Moderate

Duval and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Duval soil but have sandstone bedrock at a depth of 30 to 40 inches or at a depth of more than 60 inches. Also included are small areas of Duval soils that have slopes of 1 to 3 percent or a surface layer of loamy fine sand.

The contrasting soils in this map unit include areas of Amphion, Brystal, Dilley, Goldfinch, Lacoste, Miguel, Poteet, Tiocano, Webb, and Zavco soils. Brystal, Miguel, Webb, and Zavco soils are in landscape positions similar to those of the Duval soil. Dilley, Goldfinch, and Lacoste soils are in the higher positions. Amphion, Poteet, and Tiocano soils are in the lower positions. Also included are some small severely eroded areas and gullied areas.

The Duval soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to cropland. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, potatoes, squash, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop

rotation that includes high-residue or soil-improving crops maybe needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is well suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the depth to bedrock and the restricted permeability of the soil.

This soil is well suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is Ille, nonirrigated and irrigated. The range site is Sandy Loam.

EdA—Elmendorf-Denhawken complex, 0 to 1 percent slopes. These are very deep, nearly level, loamy soils on smooth plains and the toe slopes of hills and ridges. The shape of the slopes is linear or concave. Individual areas are irregular in shape and range from 8 to 1,000 acres in size.

The Elmendorf and Denhawken soils occur as areas so intricately mixed that they could not be mapped separately. They occur in a repeating pattern in the map unit. The Elmendorf soil is in microvalleys, and the Denhawken soil is on microridges.

The typical sequence, depth, and composition of the layers of the Elmendorf soil are as follows—

Surface layer:
0 to 14 inches; dark gray, mildly alkaline clay loam

Subsoil:
14 to 20 inches; dark gray, moderately alkaline clay
20 to 32 inches; dark grayish brown, moderately alkaline clay
32 to 44 inches; mottled light yellowish brown and grayish brown, moderately alkaline clay
44 to 64 inches; light yellowish brown, moderately alkaline clay loam

Important properties of the Elmendorf soil—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

The typical sequence, depth, and composition of the layers of the Denhawken soil are as follows—

Surface layer:
0 to 6 inches; brown, mildly alkaline clay loam
6 to 10 inches; brown, moderately alkaline clay loam

Subsoil:
10 to 30 inches; grayish brown, moderately alkaline clay loam
30 to 42 inches; grayish brown, moderately alkaline clay

Substratum:
42 to 62 inches or more; yellow, moderately alkaline clay

Important properties of the soil—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

Based on three transects, the best estimate is that Elmendorf and similar soils make up 67 percent of this map unit. Denhawken and similar soils make up 29 percent, and contrasting soils make up 4 percent. There is an 80 percent probability that the true composition of the entire map unit is 60 to 70 percent Elmendorf soil, 30 to 40 percent Denhawken soil, and 0 to 10 percent contrasting soils.

Included in this map unit are areas of soils that are similar to the Denhawken soil but have a dark surface layer and soils that are similar to the Elmendorf and Denhawken soils but are more saline in the lower part of the subsoil. Also included are areas of Elmendorf and Denhawken soils that have slopes of 1 to 3 percent or a gravelly surface layer.

The contrasting soils in this map unit include small areas of Amphion, Caid, Campbellton, Imogene, Laparita, Monteola, Uvalde, Webb, and Zavco soils. Amphion, Caid, Imogene, Laparita, and Uvalde soils are lower on the landscape than the Elmendorf and Denhawken soils. Campbellton, Monteola, Webb, and Zavco soils are in landscape positions similar to or higher than those of the Elmendorf and Denhawken soils.

The Elmendorf and Denhawken soils are used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

These soils are well suited to cropland. The alkalinity of the surface layer in the Denhawken soil limits the number of suitable crops. The chief crops are forage sorghum, grain sorghum, oats, and wheat. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

These soils are well suited to pasture. Kleingrass is the main pasture grass.

These soils are poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soils. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

These soils are moderately suited to most recreational uses. Because of the very slow permeability, special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IIs, nonirrigated and irrigated. The range site is Clay Loam.

EdB—Elmendorf-Denhawken complex, 1 to 3 percent slopes. These are very deep, gently undulating, loamy soils on smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to 1,000 acres in size.

The Elmendorf and Denhawken soils occur as areas so intricately mixed that they could not be mapped separately. They occur in a repeating pattern in the map unit. The Elmendorf soil is in microvalleys, and the Denhawken soil is on microridges.

The typical sequence, depth, and composition of the layers of the Elmendorf soil are as follows—

Surface
0 to 8 inches; very dark gray, mildly alkaline clay loam

Subsoil:
8 to 16 inches; black, mildly alkaline clay
16 to 30 inches; very dark gray, moderately alkaline clay
30 to 42 inches; dark grayish brown, moderately alkaline clay that has brown mottles
42 to 54 inches; yellowish brown, moderately alkaline clay that has dark grayish brown mottles
54 to 63 inches or more; light brown, moderately alkaline clay that has strong brown and dark grayish brown mottles

Important properties of the Elmendorf soil—

Drainage: Well drained
Permeability: Very slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

The typical sequence, depth, and composition of the layers of the Denhawken soil are as follows—

Surface layer:
0 to 6 inches; grayish brown, moderately alkaline clay loam

Subsoil:
6 to 22 inches; brown, moderately alkaline clay
22 to 39 inches; yellowish brown, moderately alkaline clay
39 to 52 inches; light yellowish brown, moderately alkaline clay

Substratum:
52 to 63 inches or more; brownish yellow, moderately alkaline clay that has strong brown mottles

Important properties of the Denhawken soil—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development

Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Based on three transects, the best estimate is that Elmendorf and similar soils make up 45 percent of this map unit, Denhawken and similar soils make up 33 percent, and contrasting soils make up 22 percent. There is an 80 percent probability that the true composition of the entire map unit is 40 to 50 percent Elmendorf soil, 30 to 40 percent Denhawken soil, and 10 to 30 percent contrasting soils.

Included in this map unit are small areas of soils that are similar to the Denhawken soil but have a dark surface layer and soils that are similar to the Elmendorf and Denhawken soils but are more saline in the lower part of the subsoil. Also included are small areas of Elmendorf and Denhawken soils that have slopes of 0 to 1 percent or a gravelly surface layer.

The contrasting soils in this map unit include small areas of Amphion, Caid, Campbellton, Imogene, Laparita, Monteola, Uvalde, Webb, and Zavco soils. Amphion, Caid, Imogene, Laparita, and Uvalde soils are lower on the landscape than the Elmendorf and Denhawken soils. Campbellton, Monteola, Webb, and Zavco soils are in landscape positions similar to or higher than those of the Elmendorf and Denhawken soils.

The Elmendorf and Denhawken soils are used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

These soils are moderately suited to cropland. The alkalinity of the surface layer in the Denhawken soil limits the number of suitable crops. The chief crops are forage sorghum, grain sorghum, oats, and wheat. The main hazard is water erosion. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

These soils are well suited to pasture. Kleingrass is the main pasture grass.

These soils are poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soils. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

These soils are moderately suited to most recreational uses. Because of the very slow permeability, special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Clay Loam.

GFD—Goldfinch very gravelly sandy loam, rolling. This shallow, very gravelly, loamy soil is 10 to 20 inches deep over sandstone bedrock, It is on the summit and shoulder slopes of hills and ridges. The shape of the slopes is convex. The slopes range from 1 to 12 percent but average about 6 percent. About 20 percent of the surface is covered with sandstone gravel and cobbles. Individual areas are irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; reddish brown, slightly acid very gravelly sandy loam

Subsoil:
8 to 16 inches; reddish brown, neutral extremely gravelly sandy clay loam

Bedrock:
16 to 48 inches or more; strong brown, moderately alkaline fractured, weakly cemented sandstone

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Very low
Root zone: Shallow
Shrink-swell potential: Low
Surface runoff: Medium or rapid
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Slight

Based on four transects, the best estimate is that Goldfinch and similar soils make up 83 percent of this map unit and contrasting soils make up 17 percent. There is an 80 percent probability that the true composition of the entire map unit is 75 to 90 percent Goldfinch soil and 10 and 25 percent contrasting soils.

Included in this map unit are small areas of soils that are similar to the Goldfinch soil but have less gravel in the surface layer or sandstone bedrock at a depth of 20 to 30 inches. Also included are small areas of Goldfinch soils that have a very cobbly or extremely gravelly surface layer.

The contrasting soils in this map unit include small areas of Comitas, Dilley, and Duval soils. Dilley soils are in landscape positions similar to or slightly lower than those of the Goldfinch soil. Comitas and Duval soils are in the lower positions. Also included are scattered small areas of rock outcrop, soils that are similar to Dilley soils but have sandstone bedrock at a depth of 7 to 9 inches, and small areas that are covered with large stones.

The Goldfinch soil is used as rangeland or wildlife habitat.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail, are good sites for dove, and are used by turkey and deer.

This soil is not suited to cropland. The main limitations are the very gravelly surface layer, the shallow root zone, and the very low available water capacity, and the main hazard is water erosion.

This soil is not suited to pasture. Because of the very gravelly surface layer, the very low available water capacity, and the hazard of water erosion, establishing or maintaining pasture grasses is impractical.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the limited depth to bedrock. Because of the shallow root zone, droughtiness affects lawns and landscaping. Because of the very gravelly surface layer, topsoil is needed in areas used for lawns and landscaping. The shallowness to bedrock makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

This soil is poorly suited to most recreational uses. The shallowness to sandstone and the very low available water capacity restrict plant growth. Special surfacing material

may be needed in areas that are subject to foot traffic. Because of the high content of gravel and the slope, special surfacing material may be needed in areas that are subject to foot traffic and topsoil may be needed on sites for golf fairways.

The land capability classification is VIIs, nonirrigated and irrigated. The range site is Gravelly Ridge.

HYD—Hindes-Yologo complex, roiling. These are moderately deep to very shallow, very gravelly, loamy soils that are 7 to 40 inches deep over cemented caliche. These soils are on hills and ridges. The shape of the slopes is convex. The Yologo soil has slopes of 1 to 8 percent, and the Hindes soil has slopes of 1 to 12 percent. Individual areas are subrounded or irregular in shape and range from 8 to several thousand acres in size.

The Hindes and Yologo soils occur as areas so intricately mixed that they could not be mapped separately.

The typical sequence, depth, and composition of the layers of the Hindes soil are as follows—

Surface layer:
0 to 9 inches; dark grayish brown, neutral very gravelly loam

Subsoil:
9 to 18 inches; reddish brown, neutral extremely gravelly clay loam
18 to 32 inches; reddish brown, neutral extremely gravelly clay

Underlying material:
32 to 60 inches or more; pink, weakly cemented, moderately alkaline caliche

Important properties of the Hindes soil—

Drainage class: Well drained
Permeability: Moderately slow above the underlying material
Available water capacity: Very low
Root zone: Moderately deep
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Slight

The typical sequence, depth, and composition of the layers of the Yologo soil are as follows—

Surface layer:
0 to 6 inches; dark brown, mildly alkaline very gravelly loam

Subsoil:
6 to 14 inches; reddish brown, mildly alkaline extremely gravelly clay loam

Underlying material:
14 to 16 inches; pink, moderately alkaline, strongly cemented caliche
16 to 60 inches or more; white, moderately alkaline, weakly cemented caliche

Important properties of the Yologo soil—

Drainage class: Well drained
Permeability: Moderate above the underlying material
Available water capacity: Very low
Root zone: Very shallow or shallow
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None

Hazard of water erosion: Severe
Hazard of wind erosion: Slight

Based on four transects, the best estimate is that Hindes and similar soils make up 53 percent of this map unit, Yologo and similar soils make up 45 percent, and contrasting soils make up 2 percent. There is an 80 percent probability that the true composition of the entire map unit is 50 to 55 percent Hindes soil, 40 to 50 percent Yologo soil, and 0 and 10 percent contrasting soils.

Included in this map unit are small areas of Hindes and Yologo soils that have less gravel in the surface layer or a light colored surface layer and soils that are similar to the Yologo soil but have cemented caliche at a depth of 20 to 30 inches. Also included are small areas of soils that are similar to the Hindes soil but have slopes of 12 to 15 percent and soils that are similar to the Yologo soil but have slopes of 8 to 12 percent.

The contrasting soils in this map unit include small areas of Brystal, Caid, Devine, Dilley, Duval, Goldfinch, Lacoste, Olmos, Schattel, Uvalde, Webb, and Zavco soils. Lacoste and Olmos soils are in landscape positions similar to or slightly lower than those of the Hindes and Yologo soils. The other soils are in the lower positions. Also included are small areas of caliche and gravel pits.

The Hindes and Yologo soils are used mainly as rangeland or wildlife habitat. They are a potential source of caliche and gravel for construction.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail, are good sites for dove, and are used by turkey and deer.

These soils are not suited to cropland. The main limitations are the very gravelly surface layer and the very low available water capacity, and the main hazard is water erosion.

These soils are not suited to pasture. Because of the very gravelly surface layer, the very low available water capacity, and the hazard of water erosion, establishing or maintaining pasture grasses is impractical.

The Hindes soil is moderately suited to most urban uses, and the Yologo soil is poorly suited. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the Hindes soil and the shallowness to a cemented pan in the Yologo soil. Because of the very gravelly surface layer, topsoil is needed in areas used for lawns and landscaping. Because of the shallow or very shallow root zone and the high content of gravel, droughtiness in the Yologo soil affects lawns and landscaping. The shallowness to cemented caliche in the Yologo soil makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

These soils are poorly suited to most recreational uses. The shallow root zone in the Yologo soil and the very low available water capacity of both soils limit plant growth. Special surfacing material may be needed in areas that are subject to foot traffic. Because of the high content of gravel, topsoil may be needed on sites for golf fairways.

The land capability classification is VIIs, nonirrigated. The soils are not assigned to an irrigated land capability classification. The range site is Gravelly Ridge.

Im—Imogene very fine sandy loam, occasionally flooded. This very deep, nearly level, loamy soil has a sodic subsoil. It is on flood plains and low stream terraces along creeks. The shape of the slopes is linear or concave. The slopes are mainly less than 1 percent but range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches; dark brown, slightly acid, nonsaline very fine sandy loam

Subsoil:
5 to 12 inches; dark brown, neutral, nonsaline, sodic sandy clay loam
12 to 17 inches; brown, moderately alkaline, nonsaline, sodic sandy clay loam
17 to 27 inches; pale brown, mildly alkaline, slightly saline, sodic clay loam that has reddish yellow and light gray mottles
27 to 40 inches; very pale brown, mildly alkaline, slightly saline, sodic sandy clay loam that has reddish yellow and light gray mottles

Substratum:
40 to 65 inches; light gray, mildly alkaline, moderately saline, sodic sandy clay loam that has brownish yellow and brown mottles
65 to 74 inches or more; light gray, neutral, moderately saline, sodic sandy clay loam that has strong brown mottles

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Low
Root zone: Very deep; however, the subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years, usually lasts less than 2 days, and is of low velocity
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Imogene and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Imogene soil but have more clay in the upper part of the subsoil. Also included are small areas of Imogene soils that have a surface layer of loom, have slopes of 2 to 3 percent, or are flooded less often than 5 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Denhawken, Divot, Elmendorf, Laparita, Miguel, Monteola, Poteet, Sinton, Tiocano, Webb, and Zavco soils. Divot, Poteet, Sinton, and Tiocano soils are in landscape positions similar to or slightly lower than those of the Imogene soil. Amphion, Denhawken, Elmendorf, Laparita, Miguel, Monteola Webb, and Zavco soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Imogene soil is used mainly as rangeland or wildlife habitat.

Rangeland productivity is medium, Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is poorly suited to cropland. Excess salinity in the subsoil limits the number of suitable crops. The main limitations are the low available water capacity and the salinity of the subsoil, and the main hazards are wind erosion and flooding. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed. Because of the sodium and salinity in the subsoil, the soil is droughty and

plant growth is limited. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned. The sodium in the subsoil restricts plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IVs, nonirrigated, and IIIs, irrigated. The range site is Tight Sandy Loam.

LaC—Lacoste very fine sandy loam, 1 to 5 percent slopes. This shallow, gently undulating, loamy soil is 10 to 20 inches deep over cemented caliche. It is on the summit and shoulder slopes of hills and ridges and on smooth plains. The shape of the slopes is convex. Individual areas are elongated or irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark brown, mildly alkaline very fine sandy loam

Subsoil:
10 to 17 inches; yellowish red, neutral fine sandy loam

Underlying material:
17 to 19 inches; pinkish white, strongly cemented, moderately alkaline gravelly caliche
19 to 60 inches; white, weakly cemented, moderately alkaline gravelly caliche

Important soil properties—

Drainage class: Well drained
Permeability: Moderate above the underlying material
Available water capacity: Very low
Root zone: Shallow
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Moderate

Lacoste and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Lacoste soil but are 20 to 30 inches deep over the underlying material.

The contrasting soils in this map unit include small areas of Brystal, Caid, Dilley, Duval, Goldfinch, Hindes, Olmos, Tiocano, Valco, Yologo, Webb, and Zavco soils. Dilley, Goldfinch, Hindes, Olmos, Valco, and Yologo soils are in landscape positions similar to those of the Lacoste soil. Brystal, Caid, Duval, Tiocano, Webb, and Zavco soils are in the lower positions. Also included are small areas of caliche and gravel pits.

The Lacoste soil is used as rangeland, wildlife habitat, cropland, or pasture. It is a potential source of caliche for construction.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is poorly suited to dryland crops and moderately suited to irrigated crops. The main limitations are the very low available water capacity and the shallow root zone, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is poorly suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion. Buffelgrass and kleingrass are the main pasture grasses.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the shallowness to a cemented pan. Because of the shallow root zone, droughtiness affects lawns and landscaping. The shallowness to cemented caliche makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

This soil is poorly suited to most recreational uses. The shallow root zone and the very low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic. The shallowness to cemented caliche affects landscaping and the establishment of golf fairways.

The land capability classification is IVe, nonirrigated, and IIIe, irrigated. The range site is Shallow Sandy Loam.

LpA—Laparita clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on smooth plains adjacent to drainageways. The shape of the slopes is linear or concave. Individual areas are subrounded or elongated and range from 8 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches; very dark grayish brown, slightly acid, nonsaline clay loam

Subsoil:
6 to 13 inches; very dark grayish brown, mildly alkaline, slightly saline clay
13 to 20 inches; brown, moderately alkaline, moderately saline clay
20 to 30 inches; brown, mildly alkaline, moderately saline clay that has light yellowish brown mottles
30 to 56 inches; light yellowish brown, moderately alkaline, moderately saline clay loam

Substratum:
56 to 63 inches or more; very pale brown, moderately alkaline, moderately saline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Low
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: High; the soil shrinks and cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

Laparita and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Laparita soil but have a light colored surface layer or have a substratum below a depth of 60 inches. Also included are small areas of Laparita soils that have a surface layer of loam or sandy clay loam or have slopes of 2 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Campbellton, Denhawken, Elmendorf, Imogene, Monteola, Poteet, Sinton, and Zavco soils. Campbellton, Denhawken, Elmendorf, Monteola, and Zavco soils are higher on the landscape than the Laparita soil Amphion, Imogene, Poteet, and Sinton soils are in the lower positions.

The Laparita soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and poorly suited to irrigated crops. Excess salinity in the subsoil limits the number of suitable crops. The chief crops are grain sorghum, oats, wheat, and melons. The main limitations are the low available water capacity and the salinity of the subsoil. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity in the surface layer can increase and cause problems in areas of irrigated pasture.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Because of the salinity in the subsoil, droughtiness affects lawns and landscaping. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. The low available water capacity limits plant growth in areas that are subject to foot traffic.

The land capability classification is IIIc, nonirrigated, and IIs, irrigated. The range site is Claypan Prairie.

MgA—Miguel very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on smooth plains. The shape of the slopes is linear or concave. Individual areas are elongated and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 18 inches; brown, neutral very fine sandy loam

Subsoil:

18 to 26 inches; yellowish brown, neutral sandy clay that has brownish yellow, brown, and yellowish red mottles

26 to 40 inches; yellowish brown, mildly alkaline sandy clay loam that has reddish yellow and red mottles

40 to 60 inches; mottled reddish yellow, strong brown, and red, moderately alkaline sandy clay loam

Substratum:

60 to 66 inches or more; brownish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Miguel and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Miguel soil but have a dark surface layer or a surface layer that is 20 to 25 inches thick. Also included are small areas of Miguel soils that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Duval, Imogene, Poteet, Poth, Tiocano, Webb, Wilco, and Zavco soils. Duval, Poth, Webb, Wilco, and Zavco soils are in landscape positions similar to or higher than those of the Miguel soil. Amphion and Imogene soils are in landscape positions similar to or lower than those of the Miguel soil. Poteet and Tiocano soils are in the lower positions.

The Miguel soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to cropland. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are cowpeas, forage sorghum, grain sorghum, oats, peanuts, cotton, potatoes, wheat, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Because of the very slow permeability, special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IIIs, nonirrigated and irrigated. The range site is Tight Sandy Loam.

MgB—Miguel very fine sandy loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains. The shape of the slopes is convex or linear. Individual areas are irregular in shape and range from 8 to 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 15 inches; grayish brown, neutral very fine sandy loam

Subsoil:
15 to 25 inches; brown, neutral sandy clay that has dark red and brownish yellow mottles
25 to 36 inches; brown, neutral sandy clay that has yellowish red, red, and brownish yellow mottles
36 to 60 inches; reddish yellow, moderately alkaline sandy clay loam mottled in shades of red, yellow, brown, and gray

Substratum:
60 to 66 inches or more; brownish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Miguel and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Miguel soil but have a dark surface layer or a surface layer that is 20 to 25 inches thick. Also included are small areas of Miguel soils that have slopes of 0 to 1 percent.

The contrasting soils in this map unit include small areas of Amphion, Duval, Imogene, Poteet, Poth, Tiocano, Webb, Wilco, and Zavco soils. Duval, Poth, Webb, Wilco, and Zavco soils are in landscape positions similar to or higher than those of the Miguel soil. Amphion and Imogene soils are in landscape positions similar to or lower than those of the Miguel soil. Poteet and Tiocano soils are in the lower positions.

The Miguel soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to cropland. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are cowpeas, forage sorghum, grain sorghum, oats, peanuts, cotton, potatoes, wheat, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil.
Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Because of the very slow permeability, special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Tight Sandy Loam,

MoA—Montell clay, 0 to 1 percent slopes. This very deep, nearly level, clayey soil is on broad, smooth plains on stream terraces along the Frio River and along large creeks. The shape of the slopes is linear or concave. Individual areas are irregular in shape and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark gray, mildly alkaline, nonsaline clay
10 to 27 inches; gray, moderately alkaline, nonsaline clay

Subsoil:
27 to 42 inches; grayish brown, moderately alkaline, very slightly saline clay
42 to 60 inches; pale brown, mildly alkaline, slightly saline clay
60 to 74 inches or more; very pale brown, mildly alkaline, slightly saline clay

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Very high; the soil shrinks and forms wide, deep cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Montell and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Montell soil but have 15 percent exchangeable sodium within 30 inches of the surface, have a dark surface layer, or are flooded less often than 50 times in 100 years. Also included are small areas of Montell soils that have slopes of 1 to 2 percent.

The contrasting soils in this map unit include small areas of Caid, Divot, Duval, Monteola, Tiocano, Uvalde, Valco, Webb, and Zavco soils. Caid, Monteola, and Uvalde soils are in landscape positions similar to or slightly higher than those of the Montell soil. Duval, Valco, Webb, and Zavco soils are in the higher positions. Divot and Tiocano soils are in the lower positions.

The Montell soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is moderately suited to cropland. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, cotton, forage sorghum, grain sorghum, oats, and wheat. Wind erosion is the main hazard. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are coastal bermudagrass and kleingrass.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. This clayey soil can be worked by earthmoving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Because of the very slow permeability and the clayey surface layer, special surfacing material may be needed during wet periods in areas that are subject to foot traffic.

The land capability classification is IVs, nonirrigated, and IIIs, irrigated. The range site is Clay Flat.

MtA—Monteola clay, saline, 0 to 1 percent slopes. This very deep, nearly level, clayey soil is on smooth plains. The shape of the slopes is linear or concave. Individual areas are elongated or irregular in shape and range from 8 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 16 inches; very dark gray, mildly alkaline, nonsaline clay
16 to 27 inches; very dark gray, mildly alkaline, slightly saline clay

Subsoil:
27 to 36 inches; grayish brown, mildly alkaline, moderately saline clay
36 to 58 inches; light brownish gray, mildly alkaline, moderately saline clay

Substratum:
58 to 72 inches; light yellowish brown, mildly alkaline, moderately saline clay
72 to 78 inches or more; brownish yellow and yellow, mildly alkaline, moderately saline clay intermingled with light gray, soft shale fragments

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Low
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Very high; the soil shrinks and forms wide, deep cracks as it dries and swells as it becomes moist
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Monteola and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Monteola soil but have a light colored surface layer. Also included are small areas of Monteola soils that have a surface layer of gravelly clay or slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Campbellton, Denhawken, Elmendorf, Imogene, Laparita, Schattel, and Zavco soils. Amphion, Denhawken, Elmendorf, and Laparita soils are in landscape positions similar to those of the Monteola soil. Campbellton, Schattel, and Zavco soils are in the higher positions. Imogene soils are in the lower positions.

The Monteola soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of

forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is moderately suited to dryland crops and poorly suited to irrigated crops. The alkalinity of the surface layer and the salinity of the subsoil limit the number of suitable crops. The chief crops are grain sorghum, oats, and wheat. The main limitations are the low available water capacity and the salinity of the subsoil, and the main hazard is wind erosion. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture. Kleingrass is the main pasture grass.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Because of the salinity in the subsoil, droughtiness affects lawns and landscaping. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. This clayey soil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Because of the very slow permeability and the clayey surface layer, special surfacing material may be needed during wet periods in areas that are subject to foot traffic. Salinity limits plant growth in these areas.

The land capability classification is IIIs, nonirrigated and irrigated. The range site is Saline Clay.

MtB—Monteola clay, saline, 1 to 3 percent slopes. This very deep, gently undulating, clayey soil is on smooth plains. The shape of the slopes is convex or linear. Individual areas are subrounded, elongated, or irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches; very dark gray, mildly alkaline, nonsaline clay
9 to 22 inches; very dark gray, mildly alkaline, slightly saline clay

Subsoil:
22 to 30 inches; very dark gray, mildly alkaline, moderately saline clay
30 to 41 inches; grayish brown, mildly alkaline, moderately saline clay
41 to 51 inches; very pale brown, mildly alkaline, moderately saline clay

Substratum:
51 to 63 inches; light yellowish brown, mildly alkaline, moderately saline clay
63 to 72 inches or more; brownish yellow, mildly alkaline, moderately saline clay that is intermingled with light brownish gray, soft shale fragments and has yellowish mottles

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Low
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Very high; the soil shrinks and forms wide, deep cracks as it dries and swells as it becomes moist
Surface runoff: Medium
Flooding: None

Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Monteola and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Monteola soil but have a light colored surface layer. Also included are small areas of Monteola soils that have a surface layer of gravelly clay or have slopes of 0 to 1 percent or 3 to 5 percent.

The contrasting soils in this map unit include small areas of Amphion, Campbellton, Denhawken, Elmendorf, Imogene, Laparita, Schattel, and Zavco soils. Amphion, Denhawken, Elmendorf, and Laparita soils are in landscape positions similar to those of the Monteola soil. Campbellton, Schattel, and Zavco soils are in the higher positions. Imogene soils are in the lower positions.

The Monteola soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is poorly suited cropland. The alkalinity of the surface layer and the salinity of the subsoil limit the number of suitable crops. The chief crops are grain sorghum, oats, and wheat. The main limitations are the low available water capacity and the salinity of the subsoil, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is moderately suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture. Kleingrass is the main pasture grass.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Because of the salinity in the subsoil, droughtiness affects lawns and landscaping. This clayey soil can be worked by earth-moving equipment only within a narrow range in moisture content. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Because of the very slow permeability and the clayey surface layer, surfacing material may be needed in areas that are subject to foot traffic. Salinity limits plant growth in these areas.

The land capability classification is IVe, nonirrigated and irrigated. The range site is Saline Clay.

OMD—Olmos very gravelly loam, undulating. This very shallow or shallow, very gravelly, loamy soil is 4 to 20 inches deep over cemented caliche. It is on hills and ridges. The shape of the slopes is convex. The slopes range from 1 to 8 percent. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 14 inches; dark grayish brown, mildly alkaline very gravelly loam

Underlying material:
14 to 18 inches; white, strongly cemented caliche
18 to 60 inches or more; white, weakly cemented caliche

Important soil properties—

Drainage class: Well drained
Permeability: Moderate above the underlying material
Available water capacity: Very low
Root zone: Very shallow or shallow
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Olmos and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Olmos soil but have a light colored surface layer, slopes of 8 to 12 percent, or a surface layer that is 20 to 25 inches thick and is underlain by cemented caliche.

The contrasting soils in this map unit include small areas of Bookout, Brystal, Caid, Divot, Duval, Hindes, Lacoste, Schattel, Uvalde, Valco, Webb, and Yologo soils. Hindes, Lacoste, Valco, and Yologo soils are in landscape positions similar to those of the Olmos soil, Bookout, Brystal, Caid, Divot, Duval, Hindes, Lacoste Schattel, Uvalde, and Webb soils are in the lower positions. Also included are small areas of caliche pits.

The Olmos soil is used mainly as rangeland or wildlife habitat. It is a potential source of caliche for construction.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses, forbs, and browse for livestock. These areas are preferred sites for quail, are good sites for dove, and are used by turkey and deer.

This soil is not suited to cropland. The main limitations are the very gravelly surface layer, the very low available water capacity, and the shallow root zone, and the main hazard is water erosion.

This soil is not suited to pasture. Because of the very gravelly surface layer and the very low available water capacity, establishing pasture grasses is impractical.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the shallowness to a cemented pan. Because of the shallow root zone and the high content of gravel, droughtiness affects lawns and landscaping. Because of the very gravelly surface layer, topsoil is needed in areas used for lawns and landscaping. The shallowness to cemented caliche makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

This soil is poorly suited to most recreational uses. The shallowness to cemented caliche and the very low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic. Because of the high content of gravel, topsoil may be needed on sites for golf fairways.

The land capability classification is VIIs, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Shallow Ridge.

Pa—Pits. This map unit consists of areas from which caliche and gravel have been excavated or mined for use as road construction material. In most areas the caliche or gravel has been excavated to a depth of 3 to 20 feet. Most of the pits are in areas of Devine, Duval, Hindes, Lacoste, Olmos, Valco, and Yologo soils. Individual areas are irregular in shape and range from 3 to 25 acres in size.

The surface material in these pits is caliche, gravel, and soil material that has been disturbed during excavation. The original soils were either pushed to the perimeter of the pits or carried away with the caliche and gravel.

Drainage, permeability, the shrink-swell potential, surface runoff, flooding, ponding, and available water capacity vary in this map unit. The hazards of water erosion and wind erosion are slight.

Most areas support little or no vegetation. This map unit is not suited to rangeland, cropland, wildlife habitat, or urban and recreational uses unless reclamation measures are applied. These measures generally include grading and shaping, spreading topsoil, and establishing a permanent plant cover.

The land capability classification is VIIIs, nonirrigated. The unit is not assigned to an irrigated land capability classification or a range site.

Pe—Poteet very fine sandy loam, occasionally flooded. This very deep, nearly level, loamy soil is in narrow upland drainageways near creeks (fig. 11). The shape of the slopes is concave or linear. The slopes are 0 to 1 percent. Individual areas are long and narrow and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 12 inches; very dark grayish brown, neutral very fine sandy loam

12 to 34 inches; dark grayish brown, neutral very fine sandy loam

Subsoil:

34 to 48 inches; dark grayish brown, slightly acid sandy clay loam that has mottles in shades of yellow, brown, and gray

48 to 58 inches; brown, neutral sandy clay loam that has mottles in shades of red and brown

58 to 62 inches or more; strong brown, neutral sandy clay loam that has yellowish brown mottles

Important soil properties—

Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years, usually lasts less than 2 days, and is of low velocity
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Poteet and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Poteet soil but have 4 to 12 inches of loamy overwash, have no visible calcium carbonates in the subsoil, or have a dark surface layer and subsoil, the combined thickness of which is more than 40 inches. Also included, generally adjacent to stream channels, are small areas of Poteet soils that are flooded more often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Duval, Imogene, Miguel, Poth, Sinton, Tiocano, Webb, and Zavco soils. Imogene and Sinton soils are in landscape positions similar to or lower than those of the Poteet soil. Tiocano soils are in the lower positions. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

Figure 11.—Flooding in an area of Poteet very fine sandy loam, occasionally flooded, along Todos Santos Creek.

The Poteet soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove.

This soil is well suited to cropland. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cotton, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, onions, potatoes, squash, spinach, and watermelons. The main hazards are flooding and wind erosion. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed.

This soil is moderately suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned.

The land capability classification is IIw, nonirrigated and irrigated. The range site is Loamy Bottomland.

PoB—Poth loamy fine sand, 0 to 3 percent slopes. This very deep, nearly level and gently undulating, sandy soil is on broad, smooth plains. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches; brown, slightly acid loamy fine sand
12 to 21 inches; brown, medium acid loamy fine sand

Subsurface layer:
21 to 30 inches; light brown, medium acid loamy fine sand

Subsoil:
30 to 47 inches; dark yellowish brown, neutral clay that has yellowish red and brownish yellow mottles
47 to 58 inches; yellowish brown, mildly alkaline sandy clay that has red and dark brown mottles
58 to 64 inches or more; strong brown, mildly alkaline sandy clay loam that has reddish yellow mottles

Important soil properties—

Drainage: Well drained
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Low
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Severe

Poth and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Poth soil but have a surface layer of fine sandy loam, sandstone bedrock at a depth of 50 to 60 inches, or gray mottles in the subsoil. Also included are small areas of Poth soils that have slopes of 3 to 5 percent.

The contrasting soils in this map unit include small areas of Antosa, Bobillo, Comitas, Dilley, Duval, Falfurrias, Poteet, Tiocano, and Wilco soils. Antosa, Bobillo, Comitas, Falfurrias, and Wilco soils are in landscape positions similar to or higher than those of the Poth soil. Poteet and Tiocano soils are in the lower positions. Dilley and Duval soils are in the higher positions.

The Poth soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

This soil is moderately suited to cropland. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, peanuts, wheat, potatoes, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grass is coastal bermudagrass.

This soil is moderately suited to most urban uses. The main limitation is the moderately rapid permeability in the surface layer. Seepage of pollutants from sewage lagoons and sanitary landfills is likely unless special liners are used. Properly designing septic tank absorption fields helps to overcome the slow permeability in the subsoil. Because of the sandy surface layer, droughtiness affects lawns and landscaping.

This soil is moderately suited to most recreational uses. The sandy surface layer and the limited available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Loamy Sand.

Ra—Ramadero sandy clay loam, occasionally flooded. This very deep, nearly level, loamy soil is in narrow upland drainageways near small creeks. The shape of the slopes is concave or linear. The slopes are 0 to 1 percent. Individual areas are long and narrow and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 22 inches; very dark grayish brown, mildly alkaline sandy clay loam

Subsoil:
22 to 44 inches; dark yellowish brown, mildly alkaline sandy clay loam
44 to 52 inches; yellowish brown, moderately alkaline clay loam

Substratum:
52 to 60 inches or more; light yellowish brown, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more than 5 times in 100 years, usually lasts less than 2 days, and is of low velocity
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Ramadero and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Ramadero soil but have slopes of 1 to 2 percent; have a dark surface layer and subsoil, the combined thickness of which is 30 to 40 inches; or have a dark surface layer that is 15 to 20 inches thick. Also included are small areas of Ramadero soils that are flooded more often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Duval, Imogene, Poteet, Webb, and Zavco soils. Imogene and Poteet soils are in landscape positions similar to those of the Ramadero soil. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Ramadero soil is used mainly as rangeland, wildlife habitat, or pasture. Some small areas are used as cropland.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove.

This soil is well suited to cropland. The alkalinity of the surface layer limits the number of suitable crops. The main hazards are flooding and wind erosion. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed.

This soil is moderately suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned.

The land capability classification is IIw, nonirrigated and irrigated. The range site is Ramadero.

RBC—Ruiz-Falfurrias-Bobillo complex, gently undulating. These very deep, nearly level and gently undulating, sandy soils are on broad, smooth plains. The shape of the slopes is convex or linear. The slopes range from 0 to 5 percent. Individual areas are irregular in shape and range from 8 to 1,100 acres in size.

The Ruiz, Falfurrias, and Bobillo soils occur as areas so intricately mixed that they could not be mapped separately.

The typical sequence, depth, and composition of the layers of the Ruiz soil are as follows—

Surface layer:
0 to 24 inches; pale brown, neutral loamy sand
24 to 48 inches; brown, neutral loamy sand

Subsurface layer:
48 to 80 inches or more; pink, neutral loamy sand that has thin horizontal bands of reddish yellow material

Important properties of the Ruiz soil—

Drainage class: Somewhat excessively drained
Permeability: Rapid
Available water capacity: Low
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Very slow
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

The typical sequence, depth, and composition of the layers of the Falfurrias soil are as follows—

Surface layer:
0 to 30 inches; pale brown, neutral sand

Underlying material:
30 to 72 inches; reddish yellow, neutral sand
72 to 80 inches or more; pink, neutral sand

Important properties of the Falfurrias soil—

Drainage class: Somewhat excessively drained
Permeability: Rapid
Available water capacity: Low
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Very slow
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

The typical sequence, depth, and composition of the layers of the Bobillo soil are as follows—

Surface layer:
0 to 16 inches; yellowish brown, neutral loamy sand
16 to 56 inches; pink, neutral loamy sand

Subsurface layer:
56 to 68 inches; white, neutral loamy sand

Subsoil:
68 to 81 inches; pale brown, slightly acid sandy clay loam that has mottles in shades of yellow, brown, and gray
81 to 88 inches or more; white, slightly acid sandy loam that has mottles in shades of yellow, brown, and gray

Important properties of the Bobillo soil—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Low
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Very slow
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Severe

Based on three transects, the best estimate is that Ruiz and similar soils make up 44 percent of this map unit, Falfurrias and similar soils make up 19 percent, Bobillo and similar soils make up 19 percent, and contrasting soils make up 18 percent. There is an 80 percent probability that the true composition of the entire map unit is 40 to 50 percent Ruiz soil, 15 to 25 percent Falfurrias soil, 15 to 20 percent Bobillo soil, and 5 to 30 percent contrasting soils.

Included in this map unit are small areas of soils that are similar to the Bobillo soil but have sandstone bedrock at a depth of 70 to 80 inches and small areas of soils that are similar to the Ruiz soil but have more lamellae.

The contrasting soils in this map unit include small areas of Antosa, Comitas, Duval, Poth, Ramadero, and Wilco soils. Antosa, Comitas, Duval, Poth, and Wilco soils are in landscape positions similar to those of the Ruiz, Falfurrias, and Bobillo soils. Ramadero soils are in the lower positions.

The Ruiz, Falfurrias, and Bobillo soils are used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and

are used by turkey. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

These soils are not suited to dryland crops and are poorly suited to irrigated crops. The sandy surface layer limits the number of suitable crops. The chief crops are oats, wheat, peanuts, and watermelons. The main limitation is the low available water capacity, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth. A permanent plant cover may be needed to control wind erosion.

The Ruiz and Falfurrias soils are poorly suited to pasture, and the Bobillo soil is moderately suited. Because of the sandy surface layer and the low available water capacity, the number of suitable pasture grasses is limited and establishing or maintaining a stand is difficult. The main pasture grass is coastal bermudagrass.

These soils are poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soils. The sandy surface layer is rapidly permeable. As a result, the surface layer and subsurface layer of the soils do not adequately filter the effluent in septic tank absorption fields. Seepage of pollutants from other sanitary facilities is likely unless special liners are used. Because of the sandy surface layer, droughtiness affects lawns and landscaping.

These soils are poorly suited to most recreational uses. The sandy surface layer and the low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is VIe, nonirrigated, and IVe, irrigated. The Ruiz and Bobillo soils are in the Sandy range site, and the Falfurrias soil is in the Sand Hill range site.

ShD—Schattel clay loam, 1 to 8 percent slopes. This deep, gently undulating and undulating, loamy soil is on plains, hills, and ridges. The shape of the slopes is convex or linear. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer
0 to 6 inches; brown, mildly alkaline, nonsaline clay loam

Subsoil:
6 to 14 inches; pale brown, mildly alkaline, nonsaline clay
14 to 26 inches; light yellowish brown, moderately alkaline, nonsaline clay
26 to 44 inches; light gray, mildly alkaline, slightly saline clay that is intermingled with soft shale fragments and has reddish yellow and light brown mottles

Substratum:
44 to 63 inches or more; white, mildly alkaline, slightly saline, soft shale that is intermingled with clay and has reddish yellow and light brown mottles

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Low
Root zone: Deep, however, the clayey substratum restricts the movement of air and water and root development
Shrink-swell potential: High
Surface runoff: Rapid
Flooding: None

Hazard of water erosion: Severe
Hazard of wind erosion: Slight

Schattel and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Schattel soil but have a gravelly surface layer, slopes of 8 to 12 percent, or a dark surface layer that is 7 to 10 inches thick.

The contrasting soils in this map unit include small areas of Amphion, Caid, Campbellton, Denhawken, Elmendorf, Laparita, Webb, and Zavco soils.

Campbellton and Zavco soils are in landscape positions similar to or lower than those of the Schattel soil. Amphion, Caid. Denhawken, Elmendorf, Laparita, and Webb soils are in the lower positions.

The Schattel soil is used as rangeland or wildlife habitat.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is not suited to cropland. The main hazard is water erosion, and the main limitations are the low available water capacity and the salinity of the subsoil.

This soil is poorly suited to pasture. The degree of salinity can increase and cause problems in areas of irrigated pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. The clayey subsoil and substratum can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets. Because of the low available water capacity, droughtiness affects lawns and landscaping.

This soil is moderately suited to most recreational uses. The low available water capacity limits plant growth on golf fairways.

The land capability classification is VIe, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Saline Clay Loam.

Sn—Sinton clay loam, frequently flooded. This very deep, nearly level, loamy soil is on narrow flood plains along creeks. Most of the acreage is in the southeastern part of the bottom land along San Miguel Creek. The shape of the slopes is concave. The slopes range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; very dark grayish brown, mildly alkaline clay loam
8 to 34 inches; dark grayish brown, mildly alkaline sandy clay loam that has dark yellowish brown and dark brown mottles

Underlying material:
34 to 52 inches; brown, mildly alkaline sandy clay loam that has strong brown mottles
52 to 62 inches or more; yellowish brown, mildly alkaline sandy clay loam that has dark grayish brown mottles

Important soil properties—

Drainage class: Well drained

Permeability: Moderate
Available water capacity: Moderate
Root zone: Very deep
Shrink-swell potential: Low
Surface runoff: Slow
Flooding: Frequent; occurs more often than 50 times in 100 years and usually lasts less than 2 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Sinton and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Sinton soil but have a light colored surface layer, have a dark surface layer that is only 10 to 20 inches thick, or have more clay in the subsoil. Also included are small areas of Sinton soils that are flooded less often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Amphion, Antosa, Bobillo, Comitas, Divot, Imogene, Laparita, Miguel, Poteet, Webb, and Zavco soils. Divot, Imogene, and Poteet soils are in landscape positions similar to or slightly higher than those of the Sinton soil. The other soils are in the higher positions.

The Sinton soil is used mainly as rangeland or wildlife habitat. Some small areas are used as pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby creeks supply water for wildlife.

This soil is not suited to cropland. The flooding and the resultant scouring of bare areas are the main hazards.

This soil is poorly suited to dryland pasture and is not suited to irrigated pasture. Floodwater can destroy irrigation systems. The removal of native trees and brush near stream channels can result in severe scouring and streambank erosion during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood-control measures are needed.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas or playgrounds unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when other recreational areas are planned.

The land capability classification is Vw, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Loamy Bottomland.

Tc—Tiocano clay. This very deep, nearly level, clayey soil is in depressions and playas. The shape of the slopes is concave. The slopes are 0 to 1 percent. Individual areas are circular and range from 3 to 150 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 34 inches; dark gray, neutral clay

Subsoil:
34 to 52 inches; grayish brown, mildly alkaline clay that has dark gray and light yellowish brown mottles

Substratum:
52 to 68 inches or more; light yellowish brown, neutral clay

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Very high; the soil shrinks and forms wide, deep cracks as it dries and swells as it becomes moist
Surface runoff: Ponded
Seasonal water table: Perched 6 feet below to 2 feet above the surface after periods of heavy rainfall
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Tiocano and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Tiocano soil but have 6 to 12 inches of loamy overwash or have a high content of exchangeable sodium near the surface.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Divot, Duval, Imogene, Lacoste, Miguel, Montell, Poteet, Poth, Webb, Wilco, and Zavco soils. All of the contrasting soils are slightly higher on the landscape than the Tiocano soil, mainly on the perimeter of the mapped areas.

The Tiocano soil is used mainly as rangeland or wildlife habitat.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. When ponded, they provide resting sites for migrating waterfowl.

This soil is not suited to cropland. The main limitation is the perched water table, and the main hazard is the ponding.

This soil is moderately suited to pasture. Coastal bermudagrass is the main pasture grass.

The ponding and the perched water table severely limit all kinds of building site development and onsite waste disposal on this soil. Measures that lower the water table and reduce the hazard of ponding are needed. Properly designing building foundations and paved roads helps to prevent the damage caused by shrinking and swelling. This clayey soil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. Measures that reduce the hazard of ponding are needed. Because of the clayey surface layer, special surfacing material may be needed in areas that are subject to foot traffic.

The land capability classification is Vlw, nonirrigated and irrigated. The range site is Lakebed.

UvA—Uvalde clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on broad, smooth plains on stream terraces along rivers and large creeks. The shape of the slopes is linear. Individual areas are elongated or irregular in shape and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches; dark grayish brown, mildly alkaline clay loam
12 to 18 inches; dark brown, mildly alkaline clay loam

Subsoil:
18 to 37 inches; dark yellowish brown, mildly alkaline clay
37 to 56 inches; pink, moderately alkaline clay
56 to 62 inches or more; light brown, mildly alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Uvalde and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Uvalde soil but have more clay in the subsoil or have a light colored surface layer. Also included are small areas of Uvalde soils that have a surface layer of silty clay loam or slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Bigfoot, Bookout, Caid, Devine, Divot, Duval, Hindes, Montell, Olmos, Valco, Winterhaven, Yologo, and Zavco soils. Bookout, Caid, and Montell soils are in landscape positions similar to those of the Uvalde soil. Bigfoot, Divot, and Winterhaven soils are in the lower positions. The other soils are in the higher positions.

The Uvalde soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers, cabbage, carrots, onions, spinach, and other vegetables. Wind erosion is the main hazard. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Clay Loam.

UvB—Uvalde clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains on stream terraces along rivers and large creeks. The shape of the slopes is convex or linear. Individual areas are elongated or irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark grayish brown, mildly alkaline clay loam

Subsoil:
10 to 15 inches; brown, mildly alkaline clay loam 15 to 40 inches; yellowish brown, moderately alkaline clay
40 to 52 inches; light brown, moderately alkaline clay
52 to 62 inches or more; pink, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Uvalde and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Uvalde soil but have more clay in the subsoil or a light colored surface layer. Also included are small areas of Uvalde soils that have a surface layer of silty clay loam or slopes of 0 to 1 percent.

The contrasting soils in this map unit include small areas of Bigfoot, Bookout, Caid, Devine, Divot, Duval, Hindes, Montell, Olmos, Valco, Winterhaven, Yologo, and Zavco soils. Bookout, Caid, and Montell soils are in landscape positions similar to those of the Uvalde soil. Bigfoot, Divot, and Winterhaven soils are in the lower positions. The other soils are in the higher positions.

The Uvalde soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are corn, forage sorghum, grain sorghum, oats, wheat, cotton, and peppers, cabbage, carrots, onions, spinach, and other vegetables. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by

shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Clay Loam.

VaB—Valco clay loam, 0 to 3 percent slopes. This shallow, nearly level and gently undulating, loamy soil is 10 to 20 inches deep over cemented caliche. It is on smooth plains on stream terraces. The shape of the slopes is linear or convex. The slopes are dominantly about 1 percent. Individual areas are elongated or irregular in shape and range from 8 to 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches; dark grayish brown, mildly alkaline clay loam
8 to 18 inches; dark brown, mildly alkaline clay loam

Underlying material:
18 to 21 inches; white, moderately alkaline, strongly cemented caliche
21 to 60 inches or more; white, moderately alkaline, weakly cemented caliche

Important soil properties—

Drainage class: Well drained
Permeability: Moderate above the underlying material
Available water capacity: Very low
Root zone: Shallow
Shrink-swell potential: Low
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Valco and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Valco soil but have a surface layer that is 20 to 30 inches thick and is underlain by cemented caliche or have a light colored surface layer.

The contrasting soils in this map unit include small areas of Caid, Hindes, Lacoste, Montell, Olmos, Uvalde, Winterhaven, and Yologo soils. Lacoste and Olmos soils are in landscape positions similar to or higher than those of the Valco soil. Hindes and Yologo soils are in the higher positions. Caid, Montell, Uvalde, and Winterhaven soils are in the lower positions. Also included are small areas of caliche pits.

The Valco soil is used as rangeland or wildlife habitat. It is a potential source of caliche for construction.

Rangeland productivity is low. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of forage for livestock and wildlife. These areas are used by deer, quail, dove, and turkey, but they are not preferred sites.

This soil is poorly suited to dryland crops and moderately suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The main limitations are the very low available water capacity and the shallow root zone, and the main hazards are water erosion and wind erosion. Crop residue management, cover crops, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is poorly suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion.

This soil is poorly suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the shallowness to a cemented pan. Because of the shallow root zone and the very low available water capacity, droughtiness affects lawns and landscaping. The shallowness to cemented caliche makes shallow excavations difficult and limits the suitability for all kinds of building site development and sanitary facilities.

This soil is poorly suited to most recreational uses. The shallowness to a cemented pan and the very low available water capacity restrict plant growth. Special surfacing material may be needed in areas that are subject to foot traffic. The shallowness to cemented caliche limits landscaping. Topsoil may be needed on sites for lawns or golf fairways.

The land capability classification is IVe, nonirrigated, and IIIe, irrigated. The range site is Shallow.

WeA—Webb very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on broad, smooth plains. The shape of the slopes is linear. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; brown, neutral very fine sandy loam

Subsoil:
10 to 19 inches; reddish brown, neutral sandy clay
19 to 45 inches; reddish brown, mildly alkaline sandy clay loam
45 to 60 inches; yellowish red, mildly alkaline very fine sandy loam

Substratum:
60 to 72 inches or more; light yellowish brown, mildly alkaline very fine sandy loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Webb and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Webb soil but have sandstone bedrock at a depth of 50 to 60 inches or have a gravelly surface layer, a gravelly subsoil, or a dark surface layer. Also included are small areas of Webb soils that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Duval, Hindes, Imogene, Miguel, Olmos, Poteet, Poth, Schattel, Tiocano, Wilco, Yologo, and Zavco soils. Amphion, Brystal, Caid, Duval, Miguel, Poth, Wilco, and Zavco soils are in landscape positions similar to those of the Webb soil. Imogene, Poteet, and Tiocano soils are in the lower positions. Hindes, Olmos, Schattel, and Yologo soils are in the higher positions.

The Webb soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cotton, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, onions, potatoes, squash, spinach, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Tight Sandy Loam.

WeB—Webb very fine sandy loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark brown, slightly acid very fine sandy loam

Subsoil:
10 to 19 inches; reddish brown, slightly acid sandy clay
19 to 26 inches; reddish brown, neutral sandy clay loam
26 to 38 inches; yellowish red, moderately alkaline sandy clay loam
38 to 65 inches; yellowish red, mildly alkaline sandy clay loam
65 to 72 inches; strong brown, neutral sandy clay loam

Bedrock:
72 to 80 inches or more; white, neutral, weakly cemented sandstone

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None

Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Webb and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Webb soil but have sandstone bedrock at a depth of 50 to 60 inches or have a gravelly surface layer, a gravelly subsoil or a dark surface layer. Also included are small areas of Webb soils that have slopes of 0 to 1 percent or 3 to 5 percent.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Duval, Hindes, Imogene, Miguel, Olmos, Poteet, Poth, Schattel, Tiocano, Wilco, Yologo, and Zavco soils. Brystal, Caid, Duval, Miguel, Poth, Wilco, and Zavco soils are in landscape positions similar to those of the Webb soil. Amphion, Imogene, Poteet, and Tiocano soils are in the lower positions. Hindes, Olmos, Schattel, and Yologo soils are in the higher positions. Also included are some small severely eroded areas and gullied areas.

The Webb soil is used as rangeland wildlife habitat, cropland or pasture.

Rangeland productivity is medium Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife (fig. 12). These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. It is suitable for a wide variety of dryland and irrigated crops. The chief crops are corn, cotton, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, onions, potatoes, squash, spinach, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Tight Sandy Loam.

Figure 12.—An area of Webb very fine sandy loam, 1 to 3 percent slopes, where the range Is in good condition. The vegetation includes mesquite, blackbrush, twisted acacia, whitebrush, trichloris, pink pappusgrass, and silver bluestem.

WeC—Webb very fine sandy loam, 3 to 5 percent slopes. This very deep, gently undulating, loamy soil is on smooth plains and the back slopes of hills and ridges. The shape of the slopes is convex or linear. Individual areas are irregular in shape and range from 8 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches; brown, slightly acid very fine sandy loam

Subsoil:
7 to 17 inches; red, neutral clay
17 to 36 inches; yellowish red, mildly alkaline and moderately alkaline sandy clay
36 to 60 inches; reddish yellow, moderately alkaline sandy clay loam
60 to 72 inches or more; reddish yellow, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development

Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of wind erosion: Moderate

Webb and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Webb soil but have sandstone bedrock at a depth of 50 to 60 inches or have a gravelly surface layer, a gravelly subsoil, or a dark surface layer. Also included are small areas of Webb soils that have slopes of 1 to 3 percent.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Duval, Hindes, Imogene, Miguel, Olmos, Poteet, Poth, Schattel, Tiocano, Wilco, Yologo, and Zavco soils. Brystal, Caid, Duval, Miguel, Poth, Wilco, and Zavco soils are in landscape positions similar to those of the Webb soil. Amphion, Imogene, Poteet, and Tiocano soils are in the lower positions. Hindes, Olmos, Schattel, and Yologo soils are in the higher positions. Also included are some small severely eroded areas and gullied areas.

The Webb soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to cropland. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, mung beans, oats, peanuts, wheat, cabbage, cantaloupes, potatoes, squash, and watermelons. Water erosion and wind erosion are the main hazards. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Proper grazing use and timely deferment of grazing are needed to maintain a vigorous stand and protect the pasture against water erosion. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to foot traffic.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Tight Sandy Loam.

WoB—Wilco loamy fine sand, 0 to 3 percent slopes. This very deep, nearly level and gently undulating, sandy soil is on broad, smooth plains. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches; brown, slightly acid loamy fine sand
7 to 16 inches; pale brown, neutral loamy fine sand

Subsoil:
16 to 29 inches; light yellowish brown, strongly acid sandy clay that has red, yellowish red, and reddish yellow mottles
29 to 42 inches; light yellowish brown, medium acid sandy clay that has reddish yellow and strong brown mottles
42 to 56 inches; strong brown, slightly acid sandy clay loam that has reddish yellow mottles

Substratum:
56 to 72 inches or more; reddish yellow, neutral fine sandy loam

Important soil properties—

Drainage class: Well drained
Permeability: Slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Severe

Wilco and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Amphion soil but have sandstone bedrock at a depth of 50 to 60 inches or have a surface layer that is 7 to 10 inches thick. Also included are small areas of Wilco soils that have slopes of 3 to 5 percent.

The contrasting soils in this map unit include small areas of Comitas, Duval, Miguel, Poteet, Poth, Tiocano, and Webb soils. Comitas, Duval, Miguel, Poth, and Webb soils are in landscape positions similar to those of the Wilco soil. Poteet and Tiocano soils are in the lower positions. Also included are some small severely eroded areas.

The Wilco soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a variety of grasses and forbs for livestock. These areas are preferred sites for quail and dove and are used by turkey. The population of deer generally is lower in the more extensive areas, which have a limited variety of browse plants.

This soil is moderately suited to cropland. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, peanuts, wheat, potatoes, and watermelons. Wind erosion is the main hazard. Crop residue management, cover crops, wind stripcropping, contour or field stripcropping, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grass is coastal bermudagrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. The sandy surface layer limits plant growth on golf fairways.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Loamy Sand.

Wr—Winterhaven silty clay loam, occasionally flooded. This very deep, nearly level, loamy soil is on broad flood plains along the Frio River and its tributaries. The shape of the slopes is linear or concave. The slopes range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to several thousand acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 20 inches; grayish brown, mildly alkaline silty clay loam

Subsoil:
20 to 30 inches; pale brown, mildly alkaline silty clay loam
30 to 40 inches; pale brown, moderately alkaline silty clay loam

Substratum:
40 to 60 inches or more; very pale brown, moderately alkaline silty clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Occasional; occurs less often than 50 times in 100 years but more often than 5 times in 100 years, usually lasts less than 2 days, and is of low velocity
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Winterhaven and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Winterhaven soil but have a dark surface layer, less clay in the subsoil, or slopes of 2 to 3 percent. Also included are small areas of Winterhaven soils that are flooded more often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Bigfoot, Bookout, Caid, Divot, Lacoste, Olmos, and Uvalde soils. Bigfoot and Divot soils are in landscape positions similar to those of the Winterhaven soil. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Winterhaven soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby rivers and creeks supply water for wildlife.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The alkalinity of the surface layer limits the number of suitable crops. The chief crops are forage sorghum, grain sorghum, wheat, and oats. The main hazard is the flooding. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. Maintaining an adequate plant cover helps to protect the pasture against scouring during periods of flooding. Coastal bermudagrass and kleingrass are the main pasture grasses.

The main hazard affecting most urban uses is the flooding. Flood control measures are needed. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is moderately suited to most recreational uses. It should not be used as a site for camp areas unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when playgrounds and other recreational areas are planned.

The land capability classification is IIIc, nonirrigated, and IIs, irrigated. The range site is Loamy Bottomland.

Wv—Winterhaven silty clay loam, frequently flooded. This very deep, nearly level, loamy soil is on flood plains along the Frio River and its tributaries. The shape of the slopes is linear or concave. The slopes range from 0 to 2 percent. Individual areas are long and narrow and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches; grayish brown, mildly alkaline silty clay loam

Subsoil:
11 to 32 inches; pale brown, moderately alkaline silty clay loam

Substratum:
32 to 62 inches or more; light yellowish brown, moderately alkaline silty clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Root zone: Very deep
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: Frequent; occurs more often than 50 times in 100 years and usually lasts less than 7 days
Hazard of water erosion: Slight; a hazard of scouring by floodwater in bare areas, especially near stream channels
Hazard of wind erosion: Moderate

Winterhaven and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Winterhaven soil but have a dark surface layer, a surface layer of silty clay, less clay in the subsoil, or slopes of 2 to 3 percent. Also included are small areas of Winterhaven soils that are flooded less often than 50 times in 100 years.

The contrasting soils in this map unit include small areas of Bigfoot, Bookout, Caid, Divot, and Uvalde soils. Bigfoot and Divot soils are in landscape positions similar to those of the Winterhaven soil. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Winterhaven soil is used as rangeland or wildlife habitat.

Rangeland productivity is high. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of forage for livestock and excellent food and cover for wildlife. These areas are preferred sites for turkey and are heavily used by deer, quail, and dove. The nearby rivers and creeks supply water for wildlife.

This soil is not suited to cropland. The flooding and the resultant scouring of bare areas are the main hazards.

This soil is poorly suited to dryland pasture and is not suited to irrigated pasture. Floodwater can destroy irrigation systems. The removal of native trees and brush near stream channels can result in severe scouring and streambank erosion during periods of flooding.

The main hazard affecting most urban uses is the flooding. Flood control measures are needed. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is poorly suited to most recreational uses. It should not be used as a site for camp areas or playgrounds unless it is protected from flooding. The season, duration, and frequency of flooding should be considered when other recreational areas are planned.

The land capability classification is Vw, nonirrigated. The soil is not assigned to an irrigated land capability classification. The range site is Loamy Bottomland.

ZaA—Zavco sandy clay loam, 0 to 1 percent slopes. This very deep, nearly level, loamy soil is on broad, smooth plains and on narrow plains along small drainageways. The shape of the slopes is concave or linear. Individual areas are elongated or irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark brown, neutral sandy clay loam
10 to 19 inches; dark reddish brown, neutral sandy clay loam

Subsoil:
19 to 36 inches; yellowish red, neutral sandy clay
36 to 48 inches; yellowish red, mildly alkaline clay
48 to 72 inches or more; light yellowish brown, mildly alkaline sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Slow
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Zavco and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Zavco soil but have a light colored surface layer or have a dark surface layer and subsoil, the combined thickness of which is 20 to 30 inches. Also included are small areas of Zavco soils that have a gravelly surface layer.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Campbellton, Duval, Hindes, Imogene, Laparita, Monteola, Poteet, Schattel, Tiocano, Webb, and Yologo soils. Amphion, Laparita, and Monteola soils are in landscape positions similar to those of the Zavco soil. Imogene, Poteet and Tiocano soils are in the lower positions. The other soils are in the higher positions. Also included are small areas of bare soils in stream channels.

The Zavco soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, wheat, and cabbage, potatoes, and other vegetables. Wind erosion is the main hazard. Crop residue management, cover crops, diversions, grassed waterways, or a crop rotation that includes high-residue crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIc, nonirrigated, and I, irrigated. The range site is Clay Loam.

ZaB—Zavco sandy clay loam, 1 to 3 percent slopes. This very deep, gently undulating, loamy soil is on broad, smooth plains and the foot slopes of hills and ridges. The shape of the slopes is convex to concave. Individual areas are irregular in shape and range from 8 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches; dark brown, neutral sandy clay loam
10 to 16 inches; dark brown, mildly alkaline sandy clay loam

Subsoil:
16 to 38 inches; yellowish red, moderately alkaline sandy clay
38 to 58 inches; reddish yellow, moderately alkaline sandy clay

Substratum:
58 to 72 inches or more; light brown, moderately alkaline clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: Moderate
Root zone: Very deep; however, the clayey subsoil restricts the movement of air and water and root development
Shrink-swell potential: Moderate
Surface runoff: Medium
Flooding: None
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Zavco and similar soils make up more than 85 percent of this map unit, and contrasting soils make up the rest. Included in the unit are small areas of soils that are similar to the Zavco soil but have a light colored surface layer or have a dark surface layer and subsoil, the combined thickness of which is 20 to 30 inches. Also included are small areas of Zavco soils that have slopes of 3 to 5 percent or a gravelly surface layer.

The contrasting soils in this map unit include small areas of Amphion, Brystal, Caid, Campbellton, Duval, Hindes, Imogene, Laparita, Monteola, Poteet, Schattel, Tiocano, Webb, and Yologo soils. Amphion, Laparita, and Monteola soils are in landscape positions similar to those of the Zavco soil. Imogene, Poteet and Tiocano soils are in the lower positions. The other soils are in the higher positions. Also included are small gullied areas and small areas of bare soils in stream channels.

The Zavco soil is used as rangeland, wildlife habitat, cropland, or pasture.

Rangeland productivity is medium. Proper grazing use and timely deferment of grazing are needed if areas that support native vegetation are to produce a wide variety of grasses, forbs, and browse plants for livestock and wildlife. These areas are preferred sites for deer, are good sites for quail, and are used by dove and turkey.

This soil is moderately suited to dryland crops and well suited to irrigated crops. The chief crops are corn, cowpeas, forage sorghum, grain sorghum, oats, wheat, and cabbage, potatoes, and other vegetables. Wind erosion is the main hazard. Crop residue management, cover crops, contour or field stripcropping, terraces, diversions, grassed waterways, contour farming, or a crop rotation that includes high-residue or soil-improving crops may be needed to control erosion, conserve moisture, and maintain tilth.

This soil is well suited to pasture. The main pasture grasses are buffelgrass, blue panicum, coastal bermudagrass, and kleingrass.

This soil is moderately suited to most urban uses. Properly designing septic tank absorption fields helps to overcome the restricted permeability of the soil. Properly designing building foundations helps to prevent the structural damage caused by shrinking and swelling. The clayey subsoil can be worked by earth-moving equipment only within a narrow range in moisture content. Because of low soil strength, suitable base material is needed to minimize the maintenance required on local roads and streets.

This soil is well suited to most recreational uses.

The land capability classification is IIIe, nonirrigated, and IIe, irrigated. The range site is Clay Loam.

Prime Farmland

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

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

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

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures.

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

The map units that are considered prime farmland in Frio County are listed in table 5. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have an inadequate supply of moisture qualify as prime farmland if this limitation is overcome by irrigation. If applicable, the need for irrigation is indicated in parentheses after the map unit name in table 5. Onsite evaluation is necessary to determine if the limitation has been overcome by corrective measures.

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 avoid soil-related failures in land uses.

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

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

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

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

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

Crops and Pasture

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

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

About 206,000 acres in Frio County, or more than 28 percent of the land area, is used for crops, pasture, or orchards.

Management of Cropland

About 178,000 acres in the county is cropland. About 55,000 to 70,000 acres is irrigated each year. The rest of the cropland is nonirrigated.

The major nonirrigated crops are grain sorghum, forage sorghum, wheat, oats, corn, cowpeas, watermelons, and cantaloupes. The major irrigated crops are peanuts, corn, cotton, grain sorghum, wheat, and forage sorghum and watermelons, potatoes, cabbage, peppers, squash (fig. 13), and other truck crops. Peanuts are the most important of the cash crops grown in irrigated areas. In most fields they are rotated with other irrigated crops or with dryland crops.

Irrigation water is drawn mainly from wells in the Carrizo Sand Aquifer. Both surface and sprinkler irrigation systems are used. Most of the surface systems are on the nearly level terraces along the part of the Frio River west of Pearsall.

Figure 13.—Irrigated squash in an area of Duval very fine sandy loam, 1 to 3 percent slopes.

Sprinkler systems throughout the county include center-pivot systems, lateral-move systems, and hand lines. Center-pivot systems are the most common. Low-pressure linear systems are advantageous because of energy efficiency, the ability to irrigate rectangular fields, and the uniform application of water across the fields. Hand lines are very labor intensive.

Irrigation water management is important because of the high cost of pumping water and the need to conserve the water in the Carrizo Sand Aquifer.

Irrigation water should be applied at the proper time and in the amounts required by the crop. The timing of irrigation can be determined by the feel and appearance method: by moisture monitoring devices, such as gypsum blocks and tensiometers; and by the moisture accounting method. Crop needs for various growth stages can be determined from consumptive use curves.

Irrigation water should be distributed evenly to all parts of the field. Annual or biennial evaluations of surface and sprinkler irrigation systems are recommended in order to locate and correct inefficiencies in distribution. Where surface systems are used, land leveling, land grading, surge irrigation systems, shortening of irrigation runs, and cutback head irrigation systems can increase the efficiency of water distribution. Replacing worn nozzles can increase the efficiency of sprinkler systems. Also, operating the systems at the pressures recommended by manufacturers can ensure a high degree of efficiency.

In all areas of cropland, soil and water conservation are important management concerns. Crop residue management and other measures, such as furrow diking, contour stripcropping, field stripcropping, wind stripcropping, cover crops, contour farming, and terraces can help to control wind and water erosion, conserve moisture, and maintain or improve tilth. Measures that conserve moisture generally result in higher crop yields.

Crop residue management includes crop residue use, delayed seedbed preparation, and conservation tillage. Leaving crop residue on the surface helps to protect the soil against wind erosion; minimizes surface crusting and the detachment of soil particles and thus helps to control runoff and water erosion; reduces the rate at which soil moisture evaporates; improves tilth in the surface layer; and minimizes compaction by farm machinery.

Tillage should be sufficient to prepare a good seedbed and to control weeds without damaging the structure of the soil. Heavy traffic on the soil, especially during wet periods, can cause the formation of a compaction pan by destroying soil structure. Compaction reduces soil porosity and restricts root growth into and through the compacted layer. It limits the ability of the root system of a crop to take up moisture and nutrients and thus decreases yields. Compaction also increases the loss of moisture and nutrients through runoff and erosion. Deep chiseling and controlled traffic patterns can minimize compaction. Roughening the surface through emergency tillage helps to control wind erosion.

Properly applied fertilizer is needed on all cultivated soils. Soil analysis and knowledge of the history of fertilizer application on a field can help in making accurate estimates of the kind and amount of nutrients needed to produce a specific yield. An annual soil analysis can detect a buildup or depletion of required nutrients for each crop. Also, plant analyses can be used to determine nutrient deficiencies in a growing crop.

Management of Pasture and Hayland

Pasture and hayland make up about 27,000 acres in the county. About 8,000 acres is irrigated, and the rest of the acreage is nonirrigated.

Management of pasture and hayland includes selecting plants that are suited to the soil, applying fertilizer, rotating pastures for proper grazing use, and controlling weeds. Efficient water management is important in areas where pasture or hayland is irrigated.

Many highly productive grasses are suitable for improved pasture. The most widely used grasses are buffelgrass, kleingrass, improved bermudagrass, and blue panicum. Improved bermudagrasses are the most widely grown grasses in areas of irrigated pasture; however, kleingrass and buffelgrass also are grown on a small acreage.

Applications of fertilizer are needed for economical forage production in areas of irrigated pasture and hay. In areas of nonirrigated pasture, fertilizer should be applied when the amount of soil moisture is adequate. All fertilizer should be applied according to the results of soil or plant analysis.

Rotating pastures for proper grazing use is an important management practice. Timely rotation allows for the maximum production of improved grasses. Weeds can be controlled by mowing, by prescribed burning, or by applying approved herbicides.

Management of Orchards

About 1,000 acres in the county is used for orchards. These orchards are irrigated by trickle irrigation systems.

Pecans are the most important of the orchard crops grown in the county. A number of soils in the county are well suited to the production of pecans. Interest in pecans has increased considerably in the past few years, and a number of pecan orchards have been established. Most of the soils used for irrigated row crops also are suited to the production of pecans. Other potential orchard crops include grapes, walnuts, and apples.

The management measures needed in orchards are similar to those needed in areas of other irrigated crops. They include proper tillage, management of crop residue, applications of fertilizer, timely disease and insect control, and management of irrigation water.

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 loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

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

Crops other than those shown in table 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 Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. 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 (9). Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Rangeland

Kenneth D. Sparks, area range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland occurs as areas where the native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetation is generally suitable for grazing by livestock and is in sufficient amounts to justify grazing. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by the soil, climate, topography, overstory canopy, and grazing management.

About 503,000 acres in Frio County, or more than 69 percent of the land area, is rangeland. The original vegetation grew dominantly on open grassland. It consisted of mid and short grasses interspersed with some trees and woody shrubs.

The vegetative community on the rangeland in the county has changed significantly during the past 80 years. Widely fluctuating climatic conditions, heavy, continuous grazing by livestock, and the elimination of all fires, except for wildfires, are the major factors that have caused the plant community to change. Woody plants have increased in abundance on much of the rangeland. The more productive grasses and forbs have been grazed out in some areas and have been replaced by a mixture of short grasses and predominantly annual forbs.

Most of the ranches in the county are cow-calf enterprises. Some are stocker calf and yearling enterprises, however, and some ranchers supplement their cow herds with stockers. These ranchers have greater flexibility in adjusting livestock numbers during periods of drought and moisture stress.

In many areas the forage provided by native grassland is supplemented by tame pasture and by small grain, forage sorghum, and other crops that can be grazed by livestock, Buffelgrass, kleingrass, improved bermudagrass, blue panicum, and Kleberg bluestem are common tame pasture grasses.

Forage production in areas of rangeland occurs primarily during two distinct growth periods. Approximately 60 percent of the annual growth occurs in April, May, and June, when spring rains and moderate temperatures favor the growth of warm-season plants. A secondary growth period usually occurs in September and October, when fall rains and gradually cooling temperatures are common.

Droughts of varying lengths are frequent in this county. Short periods of drought normally occur during midsummer. Droughty periods that last for several months are common.

Different kinds of soils vary in their capacity to produce plants for grazing animals. Soils that produce about the same kinds, amounts, and proportions of forage plants make up a range site. The climax vegetation on a range site is the stabilized plant

community that the site is capable of producing. It reproduces itself and changes very little as long as the environment remains unchanged. It consists of the plants that were growing on the site when the region was first settled. Unless cultivated crops are grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Three kinds of plants can be identified on a site that has deteriorated because of grazing pressure. These are decreasers, increasers, and invaders.

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

Increasers are plants in the climax vegetation that increase in relative amounts as the more desirable decreaser plants are reduced by close, continuous grazing. They are generally less palatable to livestock than decreasers.

Invaders are plants that normally cannot compete with the plants in the climax plant community for moisture, nutrients, and light. After the extent of the climax vegetation has been reduced, they invade and grow along with the increasers.

Range condition is judged according to standards that apply to the particular range site. Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other factors. The classes show the present condition of the native vegetation on a range site in relation to the climax plant community for that site. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the amount of moisture available to plants during the growing season.

Table 7 shows, for each soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, or proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range 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.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the climax plant community. Total production includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants, but 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.

Range management requires knowledge of the kinds of soil and of the potential climax plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the climax plant community on a particular range site. The more closely the existing community resembles the climax community, the better the range condition. Range

condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential climax plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

A primary objective of good range management is keeping the range in excellent or good condition and thus conserving water, improving yields, and protecting the soils. The main management concern is recognizing important changes that occur in the kinds of plants on a range site. These changes take place gradually and can be misinterpreted or overlooked. Plant growth that occurs because of heavy rainfall can lead to the conclusion that the range is in good condition when the plant community actually has a large percentage of annual plants and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods may have a degraded appearance that temporarily conceals its quality and ability to recover.

Following years of prolonged overuse, seed sources of desirable vegetation will be eliminated. Under these conditions, the vegetation must be reestablished before management can be effective. The condition of the range can be improved by controlling brush, range seeding, fencing, developing water sources, or using other mechanical treatment to revitalize stands of native plants. Thereafter, deferred grazing, proper grazing use, and a planned grazing system can help to maintain or improve the range.

The county has 19 range sites. These are Clay Flat, Clay Loam, Clayey Bottomland, Claypan Prairie, Gravelly Ridge, Gray Sandy Loam, Lakebed, Loamy Bottomland, Loamy Sand, Ramadero, Saline Clay, Saline Clay Loam, Sand Hill, Sandy, Sandy Loam, Shallow, Shallow Ridge, Shallow Sandy Loam, and Tight Sandy Loam.

Clay Flat Range Site

The Montell soil in map unit MoA is in this range site.

The potential plant community grows on an open grassland. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and a few scattered woody plants.

The predominant plants are pink pappusgrass, pinhole bluestem, and fourflower trichloris, 40 percent; plains bristlegrass, vine mesquite, white tridens, and alkali sacaton, 20 percent; curlymesquite and buffalograss, 20 percent; plains lovegrass, Arizona cottontop, lovegrass tridens, Texas wintergrass, and Texas cupgrass, 15 percent; forbs, such as bundleflower, bush sunflower, and ruellia, 5 percent; and a trace of woody plants, such as guayacan, spiny hackberry, Wright acacia, catclaw acacia, and mesquite.

Such plants as pinhole bluestem, fourflower trichloris, bush sunflower, plains lovegrass, vine mesquite, and plains bristlegrass decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as buffalograss and curlymesquite and by woody plants. If overgrazing continues, the woody plants native to the site continue to increase in abundance and such plants as whitebrush, cacti, and condalia invade. The woody plants dominate an understory of such plants as curlymesquite, red grama, halls panicum, whorled dropseed, perennial threeawn, Texas grama, and annual forbs.

Clay Loam Range Site

The Amphion, Bookout, Caid, Denhawken, Elmendorf, Uvalde, and Zavco soils in map units AmA, AmB, BoB, BoC, CdA, CdB, EdA, EdB, UvA, UvB, ZaA, and ZaB are in this range site.

The potential plant community grows on open grassland interspersed with some mesquite trees or woody shrubs. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The predominant plants are plains lovegrass, fourflower trichloris, Arizona cottontop, pinhole bluestem, and plains bristlegrass, 40 percent; buffalograss and curlymesquite, 20 percent; pink pappusgrass, 15 percent; Texas wintergrass, lovegrass tridens, white tridens, and perennial threeawn, 15 percent; forbs, such as bundleflower, bush sunflower, and orange zexmania, 5 percent; and woody plants, such as mesquite, condalia, spiny hackberry, guayacan, and cacti, 5 percent.

Plains lovegrass, fourflower trichloris, and plains bristlegrass are preferred by livestock and thus are grazed out under heavy, continuous grazing. These plants are replaced initially by woody plants, such as mesquite and whitebrush, and by grasses, such as curlymesquite. If overgrazing continues, the site is dominated by a wide variety of woody plants and an understory of short grasses, such as red grama, perennial threeawn, curlymesquite, and halls panicum.

Clayey Bottomland Range Site

The Bigfoot soils in map units Bb and Bf are in this range site.

The potential plant community is a mixture of trees, shrubs, grasses, and forbs. The composition, by weight, is about 80 percent grasses, 10 percent forbs, and 10 percent trees and shrubs.

The predominant plants are southwestern bristlegrass, plains bristlegrass, fourflower trichloris, big sandbur, and big sacaton, 30 percent; Virginia wildrye, Texas wintergrass, and sedge, 10 percent; plains bristlegrass, pink pappusgrass, vine mesquite, and white tridens, 25 percent; buffalograss and curlymesquite, 15 percent; forbs, such as bundleflower, sensitive brier, and ruellia, 10 percent; and trees and woody plants, such as live oak, elm, hackberry, greenbrier, clematis, spiny aster, and mesquite, 10 percent.

The taller grasses, such as southwestern bristlegrass, fourflower trichloris, and big sandbur, decrease in abundance under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as buffalograss, sedges, and woody species. if overgrazing continues, the site may be dominated by such plants as retama, spiny aster, bitter sneezeweed, prairie coneflower, and annual weeds and grasses.

Claypan Prairie Range Site

The Laparita soil in map unit LpA is in this range site.

The potential plant community consists of mid and short grasses interspersed with a few woody plants. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and a trace amount of woody plants.

The predominant plants are fourflower trichloris, 10 percent; plains bristlegrass, 15 percent; Arizona cottontop, pink pappusgrass, vine mesquite, and pinhole bluestem, 35 percent; buffalograss and curlymesquite, 15 percent; hooded windmillgrass, fall witchgrass, lovegrass tridens, plains lovegrass, Texas wintergrass, slim tridens, and white tridens, 20 percent; and forbs, such as bundleflower, bush sunflower, sensitive brier, and ruellia, 5 percent.

Such plants as plains bristlegrass and fourflower trichloris are preferred by livestock and thus are grazed out under heavy, continuous grazing. These plants are replaced initially by such plants as curlymesquite, buffalograss, hooded windmillgrass, and fall witchgrass and by invading woody plants, such as mesquite, spiny hackberry, amargosa, and condalia. if overgrazing continues, the woody plants continue to invade and increase in abundance along with an understory of short grasses, such as red grama, whorled dropseed, halls panicum, tumble windmillgrass, and perennial threeawn.

Gravelly Ridge Range Site

The Devine, Goldfinch, Hindes, and Yologo soils in map units DED, GFD, and HYD are in this range site (fig. 14).

Figure 14.—Horses grazing sideoats grama and pink pappusgrass in an area of Devine very gravelly sandy loam, rolling, which is in the Gravelly Ridge range site. The vegetation includes live oak, lantana, and croton.

The potential plant community grows on an open grassland interspersed with a variety of scattered woody shrubs and perennial forbs. The composition, by weight, is about 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

The predominant plants are tanglehead, green sprangletop, pinhole bluestem, plains bristlegrass, plains lovegrass, twoflower trichloris, Arizona cottontop, lovegrass tridens, sideoats grama, Nealley grama, and pink pappusgrass, 60 percent; reverchon panicum, fall witchgrass, slim tridens, hooded windmillgrass, hairy grama, and perennial threeawn, 20 percent; buffalograss and curlymesquite, 5 percent; forbs, such as bush sunflower, orange zexmania, menodora, and bundleflower, 5 percent; and woody plants, such as guajillo, blackbrush, range ratany, falsemesquite calliandra, ephedra, guayacan, desert yaupon, littleleaf sumac, live oak, Texas colubrina, feather dalea, and cenizo, 10 percent. Live oak grows mainly in map unit DED.

Green sprangletop, plains lovegrass, pinhole bluestem, plains bristlegrass, and bush sunflower are preferred by livestock and thus are grazed out under heavy, continuous grazing. These plants are replaced initially by such plants as fall witchgrass, slim tridens, and panicum and by woody shrubs. If overgrazing continues, the site is dominated by woody plants, such as blackbrush, guajillo, littleleaf sumac, shrubby blue salvia, and cenizo, and an understory of short grasses, such as red grama, hairy tridens, perennial threeawn, halls panicum, and annual forbs and grasses.

Gray Sandy Loam Range Site

The Caid soils in map units CaA and CaB are in this range site.

The potential plant community grows on an open grassland interspersed with scattered woody plants. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The predominant plants are tanglehead, four-flower trichloris, lovegrass tridens, Arizona cottontop, pinhole bluestem, and pink pappusgrass, 40 percent; plains bristlegrass, 20 percent; fall witchgrass, vine mesquite, buffalograss, and curlymesquite, 25 percent; perennial threeawn and slim tridens, 5 percent; forbs, such as bundleflower, bush sunflower, and orange zexmania, 5 percent; and woody plants, such as mesquite, blackbrush, ephedra, guayacan, desert yaupon, cacti, Texas kidneywood, and Texas colubrina, 5 percent.

Tanglehead, fourflower trichloris, pinhole bluestem, and plains bristlegrass decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as hooded windmillgrass, curlymesquite, and perennial threeawn and by woody plants. If overgrazing continues, the woody plants may form a dense canopy over a sparse cover of such plants as perennial threeawn, halls panicum, western ragweed, croton, tumblegrass, red grama, sandbur, and annual weeds and grasses.

Lakebed Range Site

The Tiocano soil in map unit Tc is in this range site.

The potential plant community grows on an open grassland that has varying degrees of wetness. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

The predominant plants are hartweg paspalum, white tridens, switchgrass, and vine mesquite, 55 percent; buffalograss and curlymesquite, 20 percent; knotroot bristlegrass, filly panicum, sedges, and rushes, 20 percent; and forbs, such as ruellia, bundleflower, and fogfruit, 5 percent.

Switchgrass, white tridens, hartweg paspalum, and vine mesquite decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by sedges, rushes, buffalograss, bermudagrass, and knotroot bristlegrass. Retama and mesquite also invade. If overgrazing continues, the site is dominated by such plants as retama and mesquite and an understory of sedges, rushes, bermudagrass, roundhead sneezeweed, and annual forbs.

Loamy Bottomland Range Site

The Divot, Poteet, Sinton, and Winterhaven soils in map units Do, Dt, Pe, Sn, Wr, and Wv are in this range site.

The potential plant community is a mixture of trees, shrubs, grasses, and forbs. The composition, by weight, is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs. It varies, depending on the frequency and amount of overflow and the position on the landscape.

The predominant plants are fourflower trichloris, southwestern bristlegrass, big sandbur, big sacaton, and switchgrass, 40 percent; Texas wintergrass and Virginia wildrye, 10 percent; white tridens, vine mesquite, and pink pappusgrass, 15 percent; buffalograss, plains bristlegrass, and sedges, 15 percent; forbs, such as bundleflower, ruellia, and sensitive brier, 5 percent; and woody plants, such as hackberry, pecan, elm, willow, live oak, and mesquite, 15 percent.

The taller grasses, such as fourflower trichloris, switchgrass, big sandbur, southwestern bristlegrass, and big sacaton, decrease in abundance under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as sedges, buffalograss, hooded windmillgrass, and fall witchgrass and by a wide variety of woody plants. If overgrazing continues, the woody plants, such as mesquite, spiny hackberry, whitebrush, and huisache, continue to invade and increase in abundance and dominate an understory of such plants as sedges, red threeawn, halls panicum, filly panicum, bermudagrass, tumble windmillgrass, and annual grasses and forbs.

Loamy Sand Range Site

The Comitas, Duval, Poth, and Wilco soils in map units CoB, DuC, PoB, and WoB are in this range site.

The potential plant community grows on an open grassland interspersed with a few mesquite trees. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The predominant plants are seacoast bluestem, tanglehead, and trichloris, 45 percent; pinhole bluestem, Arizona cottontop, and plains bristlegrass, 25 percent; fall witchgrass, hooded windmillgrass, hairy grama, and fringeleaf paspalum, 15 percent; Wright threeawn and balsamscale, 5 percent; forbs, such as Engelmann daisy, bush sunflower, western indigo, sensitive brier, and sida, 5 percent; and woody plants, such as mesquite, hackberry, Texas colubrina, spiny hackberry, wolfberry, pricklypear, and tasajillo, 5 percent.

The taller grasses, such as seacoast bluestem, tanglehead, and trichloris, decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as hooded windmillgrass and fall witchgrass and by woody plants. If overgrazing continues, the woody plants continue to invade and increase in abundance along with such plants as red lovegrass, fringed signalgrass, threeawn, burgrass, beebalm, and annual forbs and grasses.

Ramadero Range Site

The Amphion and Ramadero soils in map units An and Ra are in this range site.

The potential plant community grows on a semiopen riparian savannah interspersed with an understory of productive grasses and a moderate canopy of trees and tall brush. Periodic range fires have kept the brush canopy open.

The predominant plants are twoflower trichloris and fourflower trichloris, 35 percent; Arizona cottontop, 5 percent; southwestern bristlegrass and cane bluestem, 10 percent; lovegrass tridens and big sandbur, 5 percent; plains bristlegrass and pink pappusgrass, 20 percent; curlymesquite and buffalograss. 5 percent; vine mesquite, 5 percent; hooded windmillgrass 5 percent; forbs, such as Engelmann daisy, bush sunflower, orange zexmania bundleflower, ruellia, and dayflower, 5 percent; and trees and brush, such as mesquite, hackberry, spiny hackberry, spiny bumelia, coyotillo whitebrush, bluewood condalia, kidneywood, pricklypear, guayacan, tasajillo, Texas persimmon, and ephedra, 5 percent.

Heavy, continuous grazing by livestock can cause deterioration of the climax plant community. Initially, twoflower trichloris, fourflower trichloris, Arizona cottontop, southwestern bristlegrass, cane bluestem, lovegrass tridens, big sandbur, and the most palatable forbs decrease in abundance and are eventually grazed out. As these desirable plants decrease in abundance, they are replaced initially by plains bristlegrass, pink pappusgrass, curlymesquite, buffalograss, hooded windmillgrass, and the less palatable forbs and brush. If overgrazing continues, the dominant understory plants are halls panicum, Texas bristlegrass, whorled dropseed, threeawns, tumblegrass, unpalatable perennial forbs, and annual forbs. A combination of overgrazing and a lack of periodic range fires can cause the formation of a dense, impenetrable thicket of mesquite, whitebrush, and other climax brush species. Under these conditions, a surface crust forms. The crust limits the infiltration of rainfall and seedling germination and thus causes excessive erosion.

Saline Clay Range Site

The Monteola soils in map units MtA and MtB are in this range site.

The potential plant community consists of mid and short grasses interspersed with a few woody plants. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The predominant plants are twoflower trichloris, fourflower trichloris, and alkali sacaton, 25 percent; pinhole bluestem and Arizona cottontop, 10 percent; white tridens, vine mesquite, and pappusgrass, 20 percent; buffalograss and curlymesquite, 15 percent; plains bristlegrass, 10 percent; whorled dropseed, halls panicum, and threeawn, 10 percent; forbs, such as bundleflower, dwarf screwbean, and ruellia, 5 percent; and woody plants, such as fourwing saltbush, armed saltbush, spiny hackberry, mesquite, guayacan, condalia cacti, and desert yaupon, 5 percent.

Trichloris, vine mesquite, and Arizona cottontop are grazed out under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as curlymesquite and halls panicum and by brush. If overgrazing continues, the woody plants continue to invade and increase in abundance along with such plants as whorled dropseed, red grama, annual lovegrass, and gummy lovegrass.

Saline Clay Loam Range Site

The Campbellton and Schattel soils in map units CmA, CmB, and ShD are in this range site (fig. 15).

The potential plant community consists of mid and short grasses interspersed with scattered blackbrush and other woody shrubs. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The predominant plants are twoflower trichloris and fourflower trichloris, 15 percent; plains bristlegrass, Arizona cottontop, and bristle panicum, 15 percent; white tridens, vine mesquite, and pink pappusgrass, 35 percent; buffalograss and curlymesquite, 15 percent; fall witchgrass, halls panicum, and perennial threeawn, 10 percent; forbs, such as bundleflower, bush sunflower, and orange zexmania, 5 percent; and woody plants, such as guajillo, blackbrush, spiny hackberry, mesquite, guayacan, condalia, cacti, and desert yaupon, 5 percent.

Trichloris, vine mesquite, and bush sunflower are grazed out under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as curlymesquite and halls panicum and by brush. If overgrazing continues, the woody plants continue to invade and increase in abundance along with blackbrush and other mixed brush species to form a dense canopy.

Sand Hill Range Site

The Falfurrias soil in map unit RBC is in this range site.

The potential plant community grows on an open prairie interspersed with motts of mesquite trees. The composition, by weight, is about 85 percent grasses, 10 percent forbs and legumes, and 5 percent woody plants.

The predominant plants are seacoast bluestem, tanglehead, and indiangrass, 50 percent; fringeleaf paspalum, low panicums, and hooded windmillgrass, 25 percent; balsamscale and Wright threeawn, 10 percent; forbs, such as bundleflower, sensitive brier, American snoutbean, and western indigo, 10 percent; and woody plants, such as pricklypear, spiny hackberry, mesquite, catclaw, and condalia, 5 percent.

Seacoast bluestem indiangrass, and tanglehead decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as fringeleaf paspalum, Wright threeawn and balsamscale. If overgrazing continues, such plants as burgrass, red lovegrass, fringed signalgrass, and many annual forbs invade. Woody plants, mainly pricklypear, tasajillo,and catclaw, increase slightly in abundance.

Figure 15.—An area of Schattel clay loam, 1 to 8 percent slopes, which is in the Saline Clay Loam range site. The native vegetation includes blackbrush, guayacan, pricklypear, paloverde, curlymesquite, and halls panicum.

Sandy Range Site

The Antosa. Bobillo. and Ruiz soils in map units ATC and RBC are in this range site.

The potential plant community grows on an open grassland. It consists of tall and mid grasses and a few scattered mesquite and live oak trees and spiny bumelia molts.

The predominant plants are seacoast bluestem, 40 percent; tanglehead, giant dropseed and indiangrass, 25 percent; fringeleaf paspalum, fall witchgrass, sand witchgrass, hooded windmillgrass, balsamscale, sand dropseed, and Wright threeawn, 30 percent; and forbs, such as snoutbean, sensitive brier, copperleaf, and showy partridge pea, 5 percent.

Seacoast bluestem, indiangrass, and tanglehead are preferred by livestock and thus are grazed out under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as hooded windmillgrass, perennial threeawn, witchgrass, and fall witchgrass. If overgrazing continues, the site is dominated by scattered threeawn and balsamscale and by invaders, such as red lovegrass, tumble lovegrass, burgrass, and annual grasses and forbs.

Sandy Loam Range Site

The Brystal and Duval soils in map units BrA, BrB, DvA, DvB, and DvC are in this range site.

The potential plant community grows on an open grassland dominated by mid grasses and interspersed with some forbs and woody plants. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The predominant plants are tanglehead, twoflower trichloris, and fourflower trichloris, 25 percent; pinhole bluestem, plains bristlegrass, hooded windmillgrass, pappusgrass, and plains lovegrass, 50 percent; slim tridens, reverchon panicum, bristle panicum, lovegrass tridens, perennial threeawn, fall witchgrass, hairy grama, and fringeleaf paspalum, 15 percent; forbs, such as Engelmann daisy, sensitive brier, and bundleflower, 5 percent; and woody plants, such as condalia, kidneywood, blackbrush, ephedra, desert yaupon, spiny hackberry, guayacan, mesquite, and pricklypear, 5 percent.

The taller grasses, such as fourflower trichloris and tanglehead, and the more palatable forbs, such as Engelmann daisy, decrease in abundance under heavy, continuous grazing by livestock. These plants are replaced initially by such grasses as hooded windmillgrass, perennial threeawn, and fall witchgrass and by woody plants, which rapidly increase in abundance. If overgrazing continues, a wide variety of woody plants continue to invade and increase in abundance along with an understory of such plants as perennial threeawn, red grama, red lovegrass, halls panicum, tumble windmillgrass, burgrass, and annual grasses and forbs.

Shallow Range Site

The Valco soil in map unit VaB is in this range site.

The potential plant community grows on an open grassland interspersed with some scattered woody shrubs and perennial forbs. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The predominant plants are pinhole bluestem and pink pappusgrass, 20 percent; plains bristlegrass, plains lovegrass, reverchon panicum, and Arizona cottontop, 35 percent; fall witchgrass, slim tridens, hooded windmillgrass, and perennial threeawn, 20 percent; buffalograss and curlymesquite, 15 percent; forbs, such as bush sunflower, bundleflower, orange zexmania, and halfshrub sundrop, 5 percent; and woody plants, such as guajillo, guayacan, ephedra, skeletonleaf goldeneye, condalia, blackbrush, cenizo, mesquite, cacti, littleleaf sumac, and bush sunflower, 5 percent.

Plains bristlegrass, plains lovegrass, and pinhole bluestem are preferred by livestock and thus are grazed out under heavy, continuous grazing by livestock. These plants are replaced initially by such plants as perennial threeawn, fall witchgrass, and slim tridens and by woody plants. If overgrazing continues, the woody shrubs invade and increase in abundance and dominate a sparse understory of short grasses, such as red grama, hairy tridens, perennial threeawns, and gray coldenia, and annual weeds.

Shallow Ridge Range Site

The Olmos soil in map unit OMD is in this range site.

The potential plant community grows on an open grassland interspersed with a variety of scattered woody plants and perennial forbs. The composition, by weight, is about 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

The predominant plants are silver bluestem, sideoats grama, Nealley grama, green sprangletop, tanglehead, Arizona cottontop, pappusgrass, and lovegrass tridens, 45 percent; plains bristlegrass, 10 percent; reverchon panicum, hooded windmillgrass, fall witchgrass, slim tridens, buffalograss, curlymesquite, hairy grama, and perennial threeawn, 30 percent; forbs, such as bush sunflower, orange zexmania, menodora, and bundleflower, 5 percent; and woody plants, such as guajillo, Texas kidneywood, range ratany, ephedra, calliandra, guayacan, colubrina, feather dalea, and cenizo, 10 percent.

Such plants as sideoats grama, green sprangletop, plains lovegrass, and plains bristlegrass decrease in abundance under heavy, continuous grazing by livestock. If overgrazing continues, the woody shrubs continue to invade and increase in abundance and the site generally is dominated by cenizo and has a sparse understory of such plants as perennial threeawn, red grama, hairy tridens, gray coldenia, and annual weeds.

Shallow Sandy Loam Range Site

The Dilley and Lacoste soils in map units DfC and LaC are in this range site.

The potential plant community grows on an open grassland interspersed with a few scattered woody plants and a wide variety of forbs. The composition, by weight, is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

The predominant plants are tanglehead, plains bristlegrass, silver bluestem, and Arizona cottontop, 45 percent; hooded windmillgrass, pink pappusgrass, slender grama, and perennial threeawn, 20 percent; fall witchgrass, slim tridens, and sand dropseed, 20 percent; forbs, such as menodora, dalea, bundleflower, bush sunflower, orange zexmania, and sensitive brier, 10 percent; and woody plants, such as guajillo, blackbrush, range ratany, Texas kidneywood, ephedra, spiny hackberry, desert yaupon, condalia, and cacti, 5 percent.

Tanglehead, bush sunflower, plains bristlegrass, silver bluestem, and Arizona cottontop decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as perennial threeawn, hooded windmillgrass, hairy grama, and fall witchgrass and by a wide variety of woody plants. If overgrazing continues, the site is dominated by a wide variety of woody plants, such as blackbrush, leatherstem, shrubby blue sage, spiny hackberry, Texas colubrina, and cacti and an understory of such plants as slender grama, red grama, perennial threeawn, gummy lovegrass, and annual grasses and forbs.

Tight Sandy Loam Range Site

The Imogene, Miguel, and Webb soils in map units Im, MgA, MgB, WeA, WeB, and WeC are in this range site.

The potential plant community grows on an open grassland interspersed with scattered woody plants and some forbs. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The predominant plants are fourflower trichloris, pinhole bluestem, tanglehead, Arizona cottontop, and pink pappusgrass, 40 percent; plains bristlegrass and plains lovegrass, 15 percent; hooded windmillgrass, slender grama, fringeleaf paspalum, and threeawn, 20 percent; buffalograss and curlymesquite, 15 percent; forbs, such as bush sunflower, Engelmann daisy, orange zexmania, and bundleflower, 5 percent; and woody plants, such as Texas kidneywood, ephedra, spiny bumelia, mesquite, condalia, spiny hackberry, and cacti, 5 percent.

The taller grasses, such as fourflower trichloris, pinhole bluestem, tanglehead, and plains lovegrass, decrease in abundance under heavy, continuous grazing by livestock. They are replaced initially by such plants as hooded windmillgrass and curlymesquite and by brush. If overgrazing continues, the woody plants that are native to the site and such plants as twisted acacia, whitebrush, and goldenweed form a moderately dense canopy and the understory consists of such plants as lantana, broomweed, croton, red grama, Texas grama, perennial threeawn, and fringed signalgrass.

Recreation

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

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

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

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

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

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

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

Wildlife Habitat

Jerry Turrentine, area biologist, Soil Conservation Service, helped prepare this section.

Wildlife resources are very important to landowners in Frio County. Leasing land for recreational hunting is a major source of income for farmers and ranchers in the county. Most of the land that supports wildlife is leased for hunting or is used by the landowners for hunting. On many ranches the net income from hunting leases is equal to the net income from cattle sales. Because of careful management of wildlife habitat, many wildlife species in the county are increasing in number.

The improvement of habitat for game species has been given special emphasis in the county. Whitetail deer, bobwhite quail, turkey, javelina, and mourning dove are the main game species sought by hunters. Jackrabbit, cottontail rabbit, armadillo, badger, raccoon, skunk, squirrel, opossum, bats, mice, wood rat, gopher, and feral hogs also inhabit the county. The most common predators are coyote and bobcat.

The extent of surface water areas can increase dramatically in wet years. The Frio River, the Leona River, and the ponds in the county are widely used by animals and birds and provide habitat for amphibians. Several species of reptiles inhabit the county. Western diamondback rattlesnake is the best known of these species.

Migrating waterfowl and water-associated species of birds use the existing ponds and cropland in the county as resting sites and as sources of food. The most common migratory waterfowl are the Canada goose, white-fronted goose, widgeon, pintail, gadwall, teal, shoveler, and canvasback. The water-associated species include sandpipers, killdeer, herons, and cormorants. Other birds in the county include black vultures, turkey vultures, several species of songbirds, and several types of doves. Many raptors, such as hawks, falcons, kites, and owls, inhabit the county or migrate through it.

Proper management of wildlife habitat is important. Areas of corn and grain sorghum provide food for dove and quail. Small grain can provide food for quail, dove, and deer if suitable cover is nearby. Leaving crop residue on the surface can provide forage for numerous species of wildlife. Small areas of unharvested grain can provide food and cover. Properly managed waterways can provide cover for small mammals and birds. Additional cover can be provided by leaving brush in fence rows. Disking field borders can greatly increase the food supply available in pastures. Brush in pastured areas provides food and cover. Kleingrass, sorghum almum, and blue panicgrass provide seed for birds.

Management of habitat for rangeland wildlife should include several rangeland improvement practices. Proper grazing use, planned grazing systems, and deferred grazing can increase the amount of forage available to wildlife. Proper stocking rates help to control competition, The population of deer should not exceed the food supply. A good vegetative cover can provide cover for quail and turkey and fawning areas for deer. If allowed to mature, many grasses can provide seed for dove, quail, and turkey. Brush management is important. If brush is cleared in strips or other patterns, a diversity of food sources for various species of wildlife is created. Other measures that can improve the habitat include disking, planting food plots, and prescribed burning.

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

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

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

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

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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are blue panicgrass, kleingrass, lovegrass, and clover.

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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, bristlegrass, Johnsongrass, panicums, paspalums, tricholoris,buckwheat, crotons, daisies, partridge pea, poppies, ragweed, snoutbean, sunflowers, and talloweeds.

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 blackbrush, desert yaupon, granjeno, guajillo, guayacan, mesquite, and twisted acacia.

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

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

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

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

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

Habitat for rangeland wildlife consists of areas of shrubs, trees, and wild herbaceous plants. Wildlife attracted to rangeland include whitetail deer, turkey, quail, jackrabbit, coyote, bobcat, and javelina.

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. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind 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 estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

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

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

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

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

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

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that 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, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

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

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water Management

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

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

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

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

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

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

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

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

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

Soil Properties

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

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

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

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

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

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

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

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

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

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low,* a change of less than 3 percent; *moderate,* 3 to 6 percent; and *high,* more than 6 percent. *Very high,* greater than 9 percent is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

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

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible (fig. 16). Crops can be grown if intensive measures to control wind erosion are used.

Figure 16.—Wind erosion in an area of Duval loamy fine sand, 0 to 5 percent slopes, used for grain sorghum. After the crop was planted, a rain shower broke down the surface clods and left the soil susceptible to wind erosion.

3. Coarse sandy loams, sandy loans, fine sandy loans, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

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

4. Clays, silty clays, noncalcareous clay learns, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt barns that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loans that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

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

The information on flooding 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 absence of distinctive horizons characteristic of soils that are not subject to flooding.

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.

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 specified as 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.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated, or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated, or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

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

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

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

Physical and Chemical Analyses of Selected Soils

The results of chemical and other analyses of several typical pedons in the survey area are given in table 17 and the results of physical analysis in table 18. The data are for soils sampled at carefully selected sites. Soil samples were analyzed by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska, and the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (11).

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm (3B1).
Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Carbonate clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1a).
Fine clay—(fraction less than 0.0002 mm) pipette-centrifuge extraction, weight percentages of material less than 2 mm (3A1b).
Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material; $^{1}/_{3}$ or $^{1}/_{10}$ ($^{3}/_{10}$) bar (4B1).
Moist bulk density—of less than 2 mm material, saran-coated clods (4A1d).
Linear extensibility—change in clod dimension based on less than 2 mm material (4D1).
Organic carbon—dichromate, ferric sulfate titration (6A1c).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A8a).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—calcium chloride (8C1e).

Carbonate as calcium carbonate—manometric (6E1b).
Gypsum—indirect estimate (6F1b).
Electrical conductivity—saturation extract (8A1a).
Exchangeable sodium percentage (5D2).

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The soil samples were tested by the Texas State 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 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM); and Specific gravity—T 100 (AASHTO), D 653 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (10). 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 on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is 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 burnt or dry climate, 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; 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 old development, 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 is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup having a soil moisture regime that approaches the aridic regime. An example is Aridic Paleustalfs.

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 considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, hyperthermic Aridic Paleustalfs.

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. Texture terms in the first sentence of each series description refer to the surface layer. 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" (8). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (10). Following the pedon description is the range of important characteristics of the soils in the series.

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

Amphion Series

The Amphion series consists of very deep, well drained, loamy soils on smooth uplands and stream terraces. These soils formed in loamy and clayey, calcareous sediments. Slopes range from 0 to 3 percent.

Typical pedon of Amphion sandy clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 0.4 mile east on Farm Road 140, about 8.8 miles north on Farm Road 2779, and about 600 feet west of a fence, in an area of rangeland:

A—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, friable; common fine and few medium roots; few medium tubular pores; mildly alkaline; abrupt smooth boundary.

BA—8 to 20 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine roots; few fine and medium tubular pores; few distinct clay films on faces of peds; neutral; clear wavy boundary.

Btk1—20 to 29 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; few fine roots; few fine tubular pores; few fine threads and films of calcium carbonate; common distinct clay films on faces of peds; about 7 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk2—29 to 36 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; common medium faint brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; very hard, very firm; few distinct very dark grayish brown organic coatings; few fine roots; few fine tubular pores; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; common distinct clay films on faces of peds; about 10 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk3—36 to 60 inches; brownish yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; common medium and coarse faint pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, very firm; few distinct very dark grayish brown organic coatings; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; few distinct clay films on vertical faces of peds; about 10 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btkyz—60 to 63 inches; yellow (10YR 7/6) clay loam, brownish yellow (10YR 6/6) moist; common medium and coarse distinct strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; hard, very firm; few distinct very dark grayish brown organic coatings; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; few fine threads and clusters of gypsum and other salt crystals; few distinct clay films on vertical faces of peds; about 10 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the solum is 60 to more than 72 inches. The mollic epipedon is 20 to 40 inches thick. The depth to a prominent zone in which calcium carbonates have accumulated ranges from about 29 to 46 inches. A few gypsum and other salt crystals are below a depth of about 60 inches in some pedons.

The A and BA horizons are dark grayish brown, very dark grayish brown, dark gray, or very dark gray. They are sandy clay loam or clay loam. Reaction is neutral to moderately alkaline. Some pedons do not have a BA horizon.

The upper part of the Bt horizon is black, dark brown, very dark gray, grayish brown, dark gray, dark grayish brown, or very dark grayish brown. It is clay loam or clay. The total content of clay is 35 to 50 percent. Reaction is neutral to moderately alkaline.

The Btk horizon is brownish yellow, yellow, light yellowish brown, yellowish brown, grayish brown, dark grayish brown, dark brown, or brown. Reddish yellow and strong brown mottles are in the lower part of this horizon in most pedons. The content of visible calcium carbonates ranges from 1 to 5 percent, by volume. This horizon is clay loam, clay, or sandy clay loam. The total content of clay is 30 to 50 percent. Reaction is mildly alkaline or moderately alkaline.

The Btkyz horizon has colors and textures very similar to those of the Btk horizon. It has gypsum and other salts.

Antosa Series

The Antosa series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in sandy and loamy residuum reworked by the wind. Slopes range from 0 to 3 percent.

Typical pedon of Antosa loamy sand, in an area of Antosa-Bobillo complex, gently undulating; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 12.9 miles north on U.S. Highway 81 to Farm Road 462 in Moore, 3.4 miles east on Farm Road 462, about 2.05 miles north on McCulloch Road, and 125 feet northwest of a gate, in an area of cropland:

Ap—0 to 8 inches; light brownish gray (2.5YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable; few fine roots; slightly acid; abrupt smooth boundary.

A—8 to 17 inches; light brownish gray (2.5YR 6/2) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable; few fine roots; slightly acid; gradual smooth boundary.

E—17 to 26 inches; light gray (10YR 7/2) loamy sand, pale brown (10YR 6/3) moist; few fine faint light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; massive; soft, very friable; few fine roots; slightly acid; abrupt wavy boundary.

Btc1—26 to 40 inches; light gray (2.5YR 7/2) sandy clay loam, light gray (10YR 7/2) moist; common fine distinct brownish yellow (10YR 6/6), yellow (10YR 7/6), very pale brown (10YR 7/3), and light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots; common fine tubular pores; common distinct clay films on vertical faces of peds; few coarse, rounded, weakly cemented, black ferromanganese nodules; slightly acid; gradual wavy boundary.

Btc2—40 to 54 inches; pale yellow (2.5YR 7/4) sandy clay loam, pale yellow (2.5YR 7/4) moist; common medium distinct strong brown (7.5YR 5/6), reddish yellow (7.5YR 6/6), yellow (10YR 7/6), and very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; very hard, firm; few fine tubular pores; few distinct clay films on vertical faces of peds; few coarse, rounded, weakly cemented, black ferromanganese nodules; neutral; gradual wavy boundary.

Btc3—54 to 72 inches; pale yellow (2.5YR 7/4) sandy clay loam, pale yellow (2.5YR 7/4) moist; many coarse distinct reddish yellow (7.5YR 7/6), yellow (10YR 7/6), brownish yellow (10YR 6/6), and very pale brown (10YR 7/3) mottles; weak fine subangular blocky structure; very hard, firm; few fine tubular pores; few fine, soft masses of calcium carbonate; few distinct clay films on vertical faces of peds; few coarse, rounded, weakly cemented, black ferromanganese nodules; neutral.

The thickness of the solum is 60 to more than 80 inches. The depth to a zone in which soft, powdery calcium carbonates have accumulated ranges from about 50 to more than 60 inches. Depth to the Btc horizon ranges from 20 to 40 inches. By weighted average, the total content of clay in the upper 20 inches of the Btc horizon is 28 to 35 percent. Some pedons have few or common fragments of sandstone below a depth of 50 inches.

The A horizon is grayish brown, yellowish brown, or light brownish gray. Most pedons have an E horizon, which has the same textures as the A horizon and is light gray or very pale brown. The A and E horizons are medium acid to neutral.

The upper part of the Btc horizon is light gray, grayish brown, or light brownish gray. It has fine or medium mottles in shades of brown, gray, or yellow. It is sandy loam or sandy clay. The total content of clay is 28 to 40 percent. Reaction is medium acid to neutral.

The lower part of the Btc horizon is pale yellow or light gray. It has medium or coarse mottles in shades of gray, brown, yellow, or red. It is sandy clay loam or sandy loam. Reaction is neutral to moderately alkaline.

Some pedons have a Cr horizon below a depth of 60 inches. This horizon is sandstone.

Bigfoot Series

The Bigfoot series consists of very deep, well drained, clayey soils on flood plains. These soils formed in calcareous, clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Bigfoot silty clay, occasionally flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 0.65 miles west on Farm Road 140 to Farm Road 1581; about 8.05 miles southwest on Farm Road 1581 and 100 feet north of a fence, in an area of rangeland:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; very hard, very firm; many fine and medium roots; common fine tubular pores; few snail shell fragments; about 46 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear smooth boundary.

A2—9 to 22 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; very hard, very firm; few fine roots; few fine tubular pores; few snail shell fragments; about 50 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bw1—22 to 33 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine tubular pores; few films and threads of calcium carbonate; few snail shell fragments; about 62 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—33 to 44 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine tubular pores; few films and threads of calcium carbonate; few snail shell fragments; about 58 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk—44 to 63 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine tubular pores; common threads and films of calcium carbonate along faces of peds; few snail shell fragments; about 60 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The solum is more than 80 inches thick. The thickness of the mollic epipedon is 20 to 30 inches. During dry periods cracks 0.25 to 0.5 inch wide form at the surface. They extend to a depth of 20 to 30 inches. They taper to less than 0.4 inch wide at a depth of about 20 inches. The coefficient of linear extensibility (COLE) ranges from 0.04 to 0.07 in the A horizon and decreases with increasing depth. It does not equal or exceed 0.07 in any layer more than 20 inches thick. The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 65 percent. By weighted average, the total content of clay in the control section is 40 to 55 percent and the content of silicate clay is 35 to 45 percent. The total content of sand is less than 5 percent. The soils are calcareous throughout. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is dark gray, dark grayish brown, or grayish brown. The calcium carbonate equivalent ranges from 35 to 50 percent.

The Bw and Bk horizons are gray, pale brown, grayish brown, brown, or light yellowish brown. They are silty clay or clay. The number of soft accumulations of calcium carbonate ranges from none to common.

Bobillo Series

The Bobillo series consists of very deep, well drained, sandy soils on uplands. These soils formed in sandy and loamy residuum reworked by the wind. Slopes range from 0 to 3 percent.

Typical pedon of Bobillo sand, in an area of Antosa-Bobillo complex, gently undulating; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 12.9 miles north on U.S. Highway 81 to Farm Road 462 in Moore; 3.4 miles east on Farm Road 462, about 2.5 miles north on McCulloch Road, and 100 feet west of a road, in an area of cropland:

Ap—0 to 8 inches; pale brown (10YR 6/3) sand, yellowish brown (10YR 5/4) moist; single grained; loose; common fine roots; neutral; abrupt smooth boundary.

A—8 to 12 inches; pale brown (10YR 6/3) sand, yellowish brown (10YR 5/4) moist; single grained; loose; few fine roots; neutral; clear smooth boundary.

E—12 to 52 inches; very pale brown (10YR 7/3) sand, light yellowish brown (10YR 6/4) moist; single grained; loose; few fine roots; neutral; abrupt smooth boundary.

Bt1—52 to 56 inches; very pale brown (10YR 7/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common fine distinct reddish yellow (7.5YR 6/6), yellow (10YR 7/6), and light brown (7.5YR 6/4) mottles; weak fine and medium subangular blocky structure; hard, friable; few fine roots; common fine tubular pores; few distinct clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt2—56 to 68 inches; light gray (10YR 7/2) sandy clay loam, very pale brown (10YR 7/3) moist; many coarse distinct yellowish red (5YR 5/6), strong brown (7.5YR 5/6), light brown (7.5YR 6/4), and very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; common fine tubular pores; few distinct clay films on faces of peds; clay bridges between sand grains; slightly acid; gradual wavy boundary.

Bt3—68 to 74 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; many coarse prominent dark red (2.5YR 3/6), red (2.5YR 4/6), yellowish red (5YR 5/6), reddish yellow (5YR 6/6), and pinkish gray (7.5YR 6/2) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; common fine tubular pores; few distinct clay films on faces of peds; slightly acid.

The thickness of the solum is 80 to more than 100 inches. Depth to the Bt horizon is 40 to 80 inches. Few or common fragments of sandstone are below a depth of 60 inches in some pedons.

The Ap and A horizons are brown, pale brown, very pale brown, light brown, yellowish brown, or light yellowish brown. They are sand or loamy sand. Reaction is medium acid to neutral.

The E horizon is very pale brown, pink, white, or light brown. It is sand or loamy sand. Reaction is medium acid to neutral.

The Bt horizon is light brownish gray, light gray, white, pale brown, very pale brown, or pale yellow. It has common or many, fine or medium, faint or distinct mottles in various shades of brown, red, or gray. It is sandy clay loam or sandy loam. The content of clay is 15 to 32 percent. Reaction is slightly acid to mildly alkaline.

Some pedons have a Cr horizon below a depth of 80 inches. This horizon is sandstone.

Bookout Series

The Bookout series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in calcareous, loamy and clayey old alluvium. Slopes range from 1 to 5 percent.

Typical pedon of Bookout clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 11.1 miles south on U.S. Highway 81 and 150 feet east of a fence, in an area of cropland:

Ap—0 to 8 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, very friable; few fine roots; many fine tubular pores; few wormcasts; few snail shell fragments; about 27 percent calcium carbonate equivalent; calcareous; mildly alkaline; abrupt smooth boundary.

A—8 to 16 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, very friable; few fine roots; many fine tubular pores; few wormcasts; common snail shell fragments; about 27 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk1—16 to 32 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 27 percent calcium carbonate equivalent; calcareous; mildly alkaline; gradual wavy boundary.

Bk2—32 to 44 inches; very pale brown (10YR 7/4) clay, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; about 15 percent, by volume, threads, films, soft masses, and medium, rounded, strongly cemented nodules of calcium carbonate; about 27 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk3—44 to 62 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; about 20 percent, by volume, threads, films, soft masses, and medium, rounded, strongly cemented nodules of calcium carbonate; about 27 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the solum is 60 to more than 80 inches. The calcium carbonate equivalent ranges from 20 to 40 percent in the 10- to 40-inch control section. Reaction is mildly alkaline or moderately alkaline throughout the profile. The control section is clay loam or clay. By weighted average, the total content of clay in the control section is 35 to 45 percent and the content of silicate clay is 25 to 35 percent. The content of clay-sized calcium carbonates ranges from 3 to 15 percent. The content of sand coarser than very fine sand is less than 15 percent in the control section.

The A horizon is grayish brown, brown, light brownish gray, pale brown, or very pale brown. It is 9 to 20 inches thick.

The Bk horizon is pale brown, very pale brown, light yellowish brown, or pink. Accumulations of calcium carbonate in the form of soft masses or nodules make up about 1 to 25 percent of the volume in the Bk2 and underlying horizons. The Bk horizon is clay loam or clay.

Brystal Series

The Brystal series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy slope wash. Slopes range from 0 to 3 percent.

Typical pedon of Brystal very fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 0.65 mile west on Farm Road 140, about 13.9 miles southwest on Farm Road 1581, about 4.4 miles northwest on Farm Road 117, about 0.7 mile north on Kolos Lane, and 100 feet east of a fence, in an area of rangeland:

A—0 to 10 inches; reddish brown (5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine tubular pores; few wormcasts; few ironstone pebbles; neutral; clear smooth boundary.

Btk1—10 to 15 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; common fine tubular and vesicular pores; few fine wormcasts; few threads of calcium carbonate; few sandstone pebbles; few faint clay films on faces of peds; noncalcareous matrix; mildly alkaline; gradual smooth boundary.

Btk2—15 to 22 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; common fine tubular pores; few wormcasts; few threads of calcium carbonate; common distinct clay films on vertical faces of peds; calcareous; mildly alkaline; gradual wavy boundary.

Btk3—22 to 30 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; about 2 percent, by volume, threads and films of calcium carbonate; few faint clay films on vertical faces of peds; about 9 percent calcium carbonate equivalent; calcareous; mildly alkaline; gradual wavy boundary.

Btk4—30 to 40 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine tubular pores; few sandstone pebbles; about 8 percent, by volume, threads, films, soft masses, and coarse, rounded, strongly cemented nodules of calcium carbonate; few faint clay films on vertical faces of peds; about 19 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk5—4 to 64 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine pores; about 12 percent, by volume, threads, films, soft masses, and coarse, rounded, strongly cemented nodules of calcium carbonate; few fine streaks of uncoated sand grains; few faint patchy clay films on vertical faces of peds; about 21 percent calcium carbonate equivalent; calcareous; mildly alkaline.

The thickness of the solum is 60 to more than 90 inches. The depth to a prominent accumulation of soft, powdery calcium carbonates ranges from about 20 to 35 inches.

The A horizon is brown or reddish brown. It is 6 to 15 inches thick. Reaction is neutral or mildly alkaline.

The upper part of the Bt horizon is reddish brown, yellowish red, brown, strong brown, reddish yellow, light reddish brown, or red. It is very fine sandy loam, fine sandy loam, or sandy clay loam. The total content of clay is 18 to 32 percent. Reaction is neutral to moderately alkaline. Some pedons have as much as 15 percent, by volume, ironstone and siliceous gravel.

The lower part of the Bt horizon is reddish yellow, yellowish red, strong brown, or red. It has reddish mottles in some pedons. It is very fine sandy loam, fine sandy loam, or sandy clay loam. The content of calcium carbonate in the form of soft masses or nodules ranges from 1 to 25 percent, by volume. Reaction is mildly alkaline or moderately alkaline.

Some pedons have a Cr horizon below a depth of 60 inches. This horizon is weakly cemented to strongly cemented sandstone.

Caid Series

The Caid series consists of very deep, well drained, calcareous, loamy soils on stream terraces. These soils formed in calcareous, loamy old alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Caid sandy clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 11.15 miles west on Farm Road 140. about 6.4 miles northeast on U.S. Highway 57, about 0.75 mile south on a caliche road, about 0.1 mile west on a ranch road, 0.4 mile southwest on a ranch road, 0.8 mile northwest to a pasture gate, 0.1 mile northwest along a fence line, then 30 feet southwest, in an area of rangeland:

A—0 to 17 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; common medium tubular pores; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; common snail shell fragments; about 7 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear smooth boundary.

Btk1—17 to 23 inches; dark brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots; common medium tubular pores; few threads and films of calcium carbonate, mainly along faces of peds; about 12 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk2—23 to 38 inches; strong brown (7.5YR 5/6) clay loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; few threads and films of calcium carbonate; few faint clay films on vertical faces of peds; few fine roots; about 13 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk3—38 to 57 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure, slightly hard, friable; few fine roots; few fine tubular pores; few faint clay films on vertical faces of peds; about 10 percent, by volume, threads, films, soft masses, and medium, rounded, strongly cemented nodules of calcium carbonate; about 29 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk4—57 to 72 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine tubular pores; few faint clay films on vertical faces of peds; about 15 percent, by volume, threads, films, soft masses, and medium, rounded, strongly cemented nodules of calcium carbonate; about 31 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the solum is 60 to 100 inches. The depth to a prominent zone in which calcium carbonates have accumulated is 25 to 40 inches. The soils are calcareous throughout. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is brown, dark grayish brown, grayish brown, very dark grayish brown, or dark brown. It is 10 to 20 inches thick. It is sandy clay loam or very fine sandy loam.

The Btk horizon is reddish brown, brown, yellowish brown, pale brown, very pale brown, light brown, dark yellowish brown, dark brown, strong brown, pink, yellowish red, reddish yellow, light yellowish brown, or brownish yellow. The redder colors are mainly in the lower part. This horizon is clay loam or sandy clay loam. By weighted average, the content of clay in the upper 20 inches of the horizon is 24 to 35 percent. The upper part of the horizon has a few calcium carbonates in the form of threads, soft masses, or nodules. The content of these carbonates is as much as 30 percent, by volume, in the lower part of the horizon.

Some pedons have a Cr horizon below a depth of 60 inches. This horizon is weakly cemented sandstone or weakly cemented sandstone interbedded with soft shale.

Campbellton Series

The Campbellton series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy and clayey material weathered from interbedded shale and siltstone. Slopes range from 0 to 3 percent.

Typical pedon of Campbellton clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 1.5 miles south on U.S. Highway 81, about 11.7 miles southeast on Farm Road 1582, about 0.25 mile southwest on a ranch road, 1.1 miles southeast on a sendero, 1.1 miles south on a ranch road, then 50 feet west of the road, in an area of rangeland:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; mildly alkaline; many fine and medium roots; few fine tubular pores; noncalcareous; mildly alkaline; abrupt smooth boundary.

A2—3 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; few fine and medium tubular pores; few fine threads and films of calcium carbonate; about 6 percent calcium carbonate equivalent; very slightly saline; calcareous; mildly alkaline; clear wavy boundary.

Bt1—12 to 18 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; very hard, firm; common fine roots; few fine tubular pores; common distinct clay films on faces of peds; few siliceous pebbles; few fine threads and films of calcium carbonate; about 18 percent calcium carbonate equivalent; very slightly saline; calcareous; moderately alkaline; clear wavy boundary.

Bt2—18 to 24 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; common distinct clay films on faces of peds; few fine threads and films of calcium carbonate; about 17 percent calcium carbonate equivalent; very slightly saline; calcareous; moderately alkaline; gradual wavy boundary.

Btkz—24 to 35 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; few faint clay films on vertical faces of peds; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 16 percent calcium carbonate equivalent; slightly saline; calcareous; moderately alkaline; gradual wavy boundary.

Bkyz/Ckyz—35 to 48 inches; very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; intermingled with common coarse irregular light olive gray (5YR 6/2) and light gray (5YR 7/2), soft shale fragments; weak fine subangular blocky structure; very hard, very firm; few fine roots in the upper part; common fine to coarse clusters and soft masses of gypsum and other salt crystals; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 7 percent calcium carbonate equivalent; slightly saline; calcareous; moderately alkaline; gradual wavy boundary.

Ckyz—48 to 60 inches; light gray (5YR 7/2) clay intermingled with soft shale fragments, light olive gray (5YR 6/2) moist; many coarse distinct reddish yellow (7.5YR 6/6) mottles; massive with rock structure; very hard, very firm; about 10 percent, by volume, medium or coarse clusters of gypsum and other salt crystals; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 5 percent calcium carbonate equivalent; moderately saline; calcareous; mildly alkaline.

The thickness of the solum is 40 to 60 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, or dark brown. It is 9 to 18 inches thick. The matrix is noncalcareous or calcareous in the upper part and calcareous in the lower part.

The Bt, Btk, and Btkz horizons are light brown, grayish brown, brown, yellowish brown, light yellowish brown, pale brown, brownish yellow, dark grayish brown, very pale brown, or reddish yellow. They are clay or clay loam. By weighted average, the total content of clay in the upper 20 inches is 37 to 48 percent and the content of silicate clay is 35 to 40 percent. The calcium carbonate equivalent ranges from 10 to 25 percent. Electrical conductivity at 25 degrees C is less than 4 millimhos per centimeter in the Bt and Btk horizons and 4 to 12 millimhos per centimeter in the underlying horizons.

The Bkyz/Ckyz horizon is 1 to 2 units higher in value or chroma than the overlying horizon. The Ckyz horizon is light gray, white, very pale brown or pale yellow. It is clay or clay loam interbedded with soft shale or siltstone. It has a few to 30 percent visible accumulations of calcium carbonate, gypsum, and other salts, by volume.

Comitas Series

The Comitas series consists of very deep, well drained, sandy soils on uplands. These soils formed in sandy and loamy sediments reworked by the wind. Slopes range from 0 to 3 percent.

Typical pedon of Comitas loamy fine sand, 0 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 1.6 miles east on Farm Road 140 to Keystone Road; 1.85 miles southeast on Keystone Road to a farm road, 0.3 mile northeast to a fence line, and 300 feet southeast, in an area of cropland:

A1—to 20 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable; common very fine and fine roots; few fine tubular pores; neutral; gradual smooth boundary.

A2—20 to 30 inches; yellowish brown (10YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine and subangular blocky structure; very friable; few very fine and fine roots; few fine tubular pores; neutral; clear wavy boundary.

Bt1—30 to 75 inches; strong brown (7.5YR 5/6) fine sandy loam, strong brown (7.5YR 4/6) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; few very fine and fine roots; few fine tubular pores; few faint clay films on faces of prisms; clay bridges between sand grains; neutral; diffuse wavy boundary.

Bt2—75 to 90 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few very fine roots; few fine tubular pores; few faint clay films on vertical faces of prisms; clay bridges between sand grains; neutral.

The thickness of the solum is 60 to more than 90 inches. The thickness of the loamy fine sand in the upper part of the profile ranges from 20 to 40 inches.

The A horizon is light brown, reddish brown, brown, dark brown, dark yellowish brown, or yellowish brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish yellow, reddish brown, yellowish red, light brown, brown, or strong brown. It is fine sandy loam or sandy clay loam. The total content of clay is 6 to 24 percent. Reaction is slightly acid to moderately alkaline.

Denhawken Series

The Denhawken series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Denhawken clay loam, on a microridge in an area of Elmendorf-Denhawken complex, 1 to 3 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 9.65 miles north on U.S. Highway 81, about 0.85 mile west on U.S. Highway 57, and 30 feet northwest of a fence, in an area of rangeland:

A—0 to 6 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; common fine and medium roots; common fine and few medium tubular pores; few snail shell fragments; few fine threads and films of calcium carbonate; about 11 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Bk1—6 to 22 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, very firm; common fine roots; few fine and medium tubular pores; few fine threads and films of calcium carbonate; few cracks filled with dark grayish brown material; few distinct stress surfaces; about 21 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Bk2—22 to 39 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; extremely hard, very firm; common fine roots; few fine tubular pores; common fine faint strong brown (7.5YR 5/6) mottles; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 23 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk3—39 to 52 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; weak fine subangular structure; very hard, very firm; few fine roots; few fine tubular pores; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 20 percent calcium carbonate equivalent; calcareous; very slightly saline; moderately alkaline; gradual wavy boundary.

BCk—52 to 63 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; weak fine subangular structure; very hard, firm; few medium streaks of dark grayish brown material; common fine faint strong brown (7.5YR 5/6) mottles; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 21 percent calcium carbonate; calcareous; very slightly saline; moderately alkaline.

The depth to a C, BC, or CB horizon is 40 to 64inches. During dry periods cracks as much as 2 inches wide form at the surface. They extend to a depth of more than 25 inches. Electrical conductivity at 25 degrees C is less than 4 millimhos per centimeter in the A horizon and the upper part of the Bk horizon. It increases to as much as 12 millimhos per centimeter in the lower part of the Bk horizon in some pedons.

The A horizon is grayish brown, pale brown, or brown. It is 4 to 10 inches thick. Reaction is mildly alkaline or moderately alkaline.

The upper part of the Bk horizon is grayish brown, light brownish gray, brown, yellowish brown or light yellowish brown. The lower part is brown, pale brown, grayish brown, brownish yellow or light yellowish brown. This horizon is clay or clay loam. The total content of clay is 35 to 50 percent. The content of visible accumulations of calcium carbonate is as much as 10 percent, by volume. In some pedons crystals of gypsum and other salts make up as much as 2 percent of the volume.

The BCk horizon is generally 2 to 3 units higher in value and chroma than the Bk horizon. Visible accumulations of calcium carbonate, gypsum, and other salts make up as much as 15 percent of the volume.

The C horizon, if it occurs, is light gray, white, yellow, brownish yellow, or light yellowish brown clay or clay loam interbedded with soft shale. Visible accumulations of calcium carbonate, gypsum, and other salts make up as much as 30 percent of the volume.

Devine Series

The Devine series consists of very deep, well drained, very gravelly, loamy soils on uplands. These soils formed in very gravelly, loamy ancient alluvium over sandstone bedrock. Slopes range from 1 to 12 percent.

Typical pedon of Devine very gravelly sandy loam, rolling; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 5.2 miles north on U.S. Highway 81, about 0.7 mile southeast on a ranch road, 1.1 miles northeast along a fence line, and 100 feet southeast, in an area of rangeland, at the edge of a gravel pit:

A1—0 to 12 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; many very fine and medium roots; about 35 percent siliceous gravel and 5 percent siliceous cobbles, by volume; neutral; clear wavy boundary.

A2—12 to 38 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; common very fine and fine roots; about 50 percent siliceous gravel and 5 percent siliceous cobbles, by volume; neutral; clear wavy boundary.

Bt—38 to 62 inches; red (2.5YR 5/6) very gravelly sandy clay, red (2.5YR 4/6) moist; many medium distinct red (2.5YR 4/8) and brown (7.5YR 5/4) and few fine distinct strong brown (7.5YR 5/8) mottles; moderate fine subangular blocky structure; hard, firm; few fine roots; common distinct red, brown, and dark red clay films on faces of peds and on coarse fragments; about 60 percent siliceous gravel and 5 percent siliceous cobbles, by volume; slightly acid; abrupt wavy boundary.

2Cr—62 to 80 inches; reddish yellow (7.5YR 6/6), weakly cemented sandstone; many medium distinct red (2.5YR 4/8), white (5YR 8/1), and yellow (10YR 7/8) mottles; noncalcareous.

The thickness of the solum, or the depth to sandstone, is more than 60 inches. Reaction ranges from medium acid to mildly alkaline.

The A horizon is 20 to 40 inches thick. It is brown, dark brown, dark yellowish brown, light brown, or pale brown. The content of coarse fragments ranges from 35 to 75 percent, by volume, and the content of gravel ranges from 10 to 70 percent. This horizon has a few to 20 percent cobbles. In some pedons it has as much as 2 percent stones. Reaction is medium acid to neutral.

The Bt horizon is yellowish red, red, or reddish brown. Where the hue is 2.5YR, the moist value is more than 4. In most pedons this horizon is mottled in shades of brown, red, or yellow. It is very gravelly sandy clay, very gravelly clay, extremely gravelly sandy

clay, or extremely gravelly clay. The content of coarse fragments ranges from 40 to 75 percent, by volume, and the content of gravel ranges from 30 to 70 percent. The horizon has a few to 15 percent cobbles. Reaction is medium acid to mildly alkaline.

Some pedons have a BC horizon, which is generally 1 or 2 units higher in value than the Bt horizon.

The 2Cr horizon is weakly cemented sandstone interbedded with soft shale, sandy clay loam, or clay. It is mottled in shades of red, yellow, or gray.

Dilley Series

The Dilley series consists of shallow, well drained, loamy soils on uplands. These soils formed in loamy residuum over sandstone bedrock. Slopes range from 1 to 5 percent.

Typical pedon of Dilley fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 3.95 miles south on U.S. Highway 81, about 6.75 miles southeast on McKinley Road, 0.75 mile northeast along a fence line, 0.25 mile southeast on a farm road, and 350 feet northeast, in an area of rangeland:

A—0 to 6 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; few fine tubular pores; neutral; clear wavy boundary.

Bt—6 to 12 inches; yellowish red (5YR 4/6) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; few fine tubular pores; few faint clay films on faces of peds; few sandstone fragments as much as 1.5 inches in diameter; neutral; abrupt wavy boundary.

Cr—12 to 60 inches; yellowish brown (10YR 5/6), cemented, noncalcareous, fractured sandstone interbedded with thin seams of sandy ironstone as much as 0.5 inch thick; cracks filled with yellowish red fine sandy loam; few fine roots in the cracks.

The thickness of the solum, or the depth to strongly cemented or weakly cemented sandstone, is 10 to 20 inches. Reaction is slightly acid to mildly alkaline.

The A horizon is reddish brown, yellowish red, brown, or dark brown. It is 4 to 12 inches thick. The content of clay ranges from 12 to 25 percent. The content of coarse fragments ranges from 0 to 15 percent, by volume. The fragments are sandstone or siliceous gravel and cobbles.

The Bt horizon is red, reddish brown, or yellowish red. It is fine sandy loam, sandy clay loam, gravelly sandy clay loam, or gravelly sandy loam. Coarse fragments of sandstone or siliceous gravel and cobbles make up 0 to 30 percent of the volume.

The Cr horizon is weakly cemented or strongly cemented sandstone. In some pedons it has thin seams of sandy ironstone or loamy material. In other pedons the sandstone has thin coatings of calcium carbonate.

Divot Series

The Divot series consists of very deep, well drained, loamy soils on flood plains. These soils formed in calcareous, loamy and clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Divot silty clay loam, frequently flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, about 7.5 miles south and west on U.S. Highway 57, about 9.45 miles south on Leona River Road to the south side of the Leona River; 75 feet east of a road, in an area of rangeland:

A1—0 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure parting to weak fine granular; hard, friable; many fine roots; common fine tubular pores; few fine wormcasts; few fine, rounded nodules of calcium carbonate; few snail shell fragments; calcareous; mildly alkaline; gradual wavy boundary.

A2—14 to 24 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure parting to weak fine granular; very hard, firm; few fine roots; few fine tubular pores; few threads and soft masses of calcium carbonate; few snail shell fragments; about 7 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk1—24 to 34 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; very hard, firm; few fine roots; few fine tubular pores; few threads and films of calcium carbonate; few snail shell fragments; about 9 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk2—34 to 50 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; weak fine subangular blocky structure; very hard, firm; few fine roots; few fine tubular pores; few threads and films of calcium carbonate; about 11 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk3—50 to 65 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; weak fine subangular blocky structure; very hard, firm; few very fine roots; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate and other salts; about 8 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk4—65 to 80 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; weak fine subangular blocky structure; very hard, firm; few very fine roots; about 10 percent, by volume, threads, films, and soft masses of calcium carbonate and other salts; about 7 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the solum is 60 to more than 80 inches. The thickness of the mollic epipedon is 20 to 35 inches. During dry periods cracks 0.5 to 1.0 inch wide form at the surface. They extend to a depth of 20 to 30inches. The coefficient of linear extensibility (COLE) ranges from 0.07 to 0.12. The total content of clay in the 10- to 40-inch control section ranges from 35 to 50 percent, and the content of silicate clay ranges from 35 to 45 percent. The calcium carbonate equivalent in the control section ranges from 5 to 40 percent. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The Al and A2 horizons are grayish brown, dark grayish brown, very dark grayish brown, dark gray, very dark gray, brown, or dark brown. The A2 horizon is silty clay loam, silty clay, clay loam, or clay.

The Bk horizon is light brownish gray, grayish brown, very pale brown, pale brown, gray, brown, or light yellowish brown. It is clay loam, silty clay loam, silty clay, or clay. The content of visible accumulations of calcium carbonate is 1 to 10 percent, by volume. If it occurs, a content of more than 5 percent is at a depth of more than 40 inches.

Duval Series

The Duval series consists of deep, well drained, loamy and sandy soils on uplands. These soils formed in loamy material weathered from interbedded sandstone and siltstone (fig. 17). Slopes range from 0 to 5 percent.

Typical pedon of Duval very fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 1.3 miles west on Farm Road 140, about 14.3 miles south on Interstate Highway 35, about 1.0 mile north on an access road, 300 feet west of a right-of-way on a farm road, and 125 feet south, in an area of cropland:

Ap—0 to 7 inches; yellowish red (5YR 4/6) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, very friable; few fine roots; few fine tubular pores; few brown streaks and pockets of slightly sandier material; slightly acid; abrupt smooth boundary.

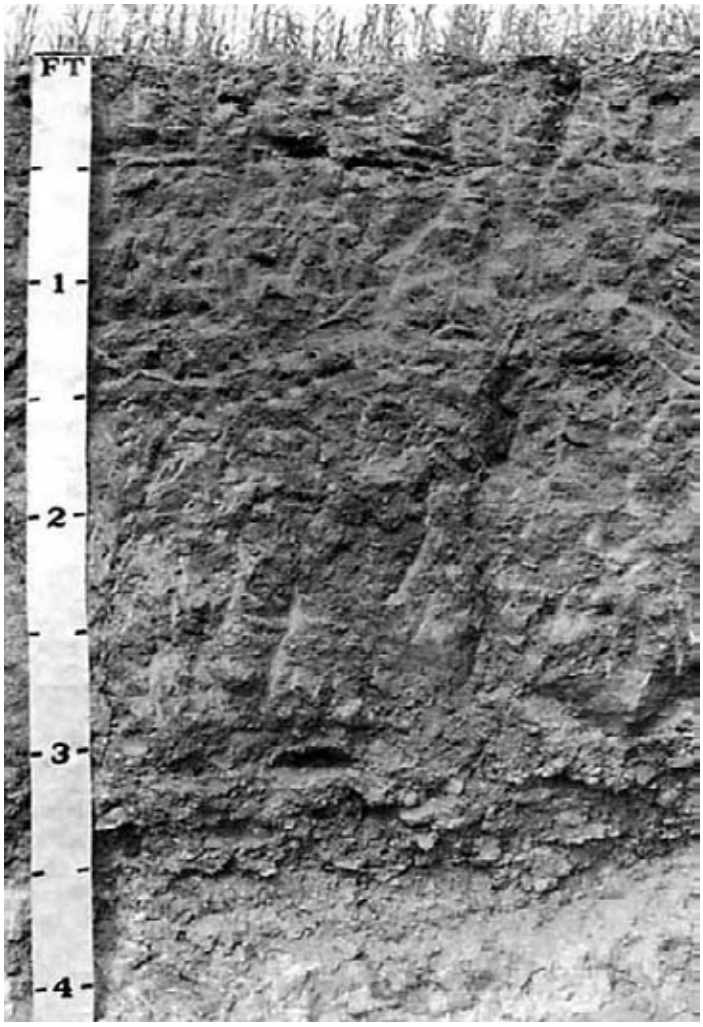

Figure 17.—Profile of a Duval loamy fine sand. This soil has fractured sandstone bedrock at a depth of 40 to 60 inches.

A—7 to 16 inches; yellowish red (5YR 4/6) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, very friable; few fine roots; few fine tubular pores; few brown streaks and pockets of slightly sandier material; slightly acid; clear smooth boundary.

Bt1—16 to 22 inches; yellowish red (5YR 4/6) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; few fine tubular pores; few faint clayfilms on faces of prisms; clay bridges between sand grains: few krotovinas; neutral; gradual wavy boundary.

Bt2—22 to 34 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; few fine tubular pores: few faint clay films on faces of prisms; clay bridges between sand grains; few krotovinas; few sandstone pebbles as much as 0.5 inch in diameter; few sandy ironstone pebbles as much as 0.25 inch in diameter; mildly alkaline; gradual wavy boundary.

Bt3—34 to 44 inches; red (2.5YR 4/8) sandy clay loam, dark red (2.5YR 3/6) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few very fine roots; few fine tubular pores; few faint clay films on faces of prisms; clay bridges between sand grains; few krotovinas; few sandstone pebbles as much as 0.5 inch in diameter; few sandy ironstone pebbles as much as 0.25 inch in diameter; mildly alkaline; gradual wavy boundary.

Bt4—44 to 52 inches; red (2.5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, friable; few very fine roots; about 15 percent, by volume, weakly cemented sandstone fragments 0.1 to 1.0 inch in diameter; few soft masses and nodules of calcium carbonate in the lower part; few sandy ironstone pebbles as much as 0.5 inch in diameter; clay bridges between sand grains; about 2 percent calcium carbonate equivalent; moderately alkaline; abrupt wavy boundary.

2Crk—52 to 72 inches; white (10YR 8/1), weakly cemented sandstone, which crushes to very fine sandy loam, light gray (10YR 7/1) moist; common fine and medium distinct yellowish brown (10YR 5/4), strong brown (7.5YR 5/6), reddish yellow (7.5YR 6/6), and yellowish red (5YR 5/6) mottles; sandstone is hard but can be extracted with an auger when moist; about 5 percent. by volume, yellowish red sandy clay loam in cracks in the upper part; common thin seams and small pockets of calcium carbonate; about 13 percent calcium carbonate equivalent; sandstone is noncalcareous; moderately alkaline.

The thickness of the solum and the depth to sandstone bedrock are 40 to 60 inches. Accumulations of calcium carbonate are below a depth of 35 inches. By weighted average, the total content of clay in the control section ranges from 18 to 30 percent.

The A horizon is reddish brown, yellowish red, brown, or light brown. It is very fine sandy loam or loamy fine sand. It is 8 to 20 inches thick. Reaction is slightly acid or neutral.

The Bt horizon is red, reddish brown, or yellowish red. The zone of maximum clay accumulation is reddish. This horizon is sandy clay loam, fine sandy loam, or very fine sandy loam. Reaction is slightly acid to moderately alkaline. Some pedons have a Bk horizon below the Bt horizon.

The Cr horizon is weakly cemented sandstone or weakly cemented sandstone interbedded with soft siltstone. Some pedons have a C horizon. This horizon is reddish to yellowish sandy clay loam, very fine sandy loam, or fine sandy loam containing fragments of sandstone.

Elmendorf Series

The Elmendorf series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Elmendorf clay loam, in a microvalley in an area of Elmendorf-Denhawken complex, 1 to 3 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 9.65 miles north on U.S. Highway 81, about 0.85 mile west on U.S. Highway 57, and 50 feet northwest of a fence, in an area of rangeland:

A—0 to 8 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm; common fine roots; common fine pores; few shell fragments on the surface; noncalcareous; mildly alkaline; clear wavy boundary.

BA—8 to 16 inches; black (10YR 2/1) clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, extremely firm; common fine roots; common fine tubular pores; calcareous; mildly alkaline; gradual wavy boundary.

Btk1—16 to 30 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine angular blocky structure; few fine roots, mainly on faces of peds; few fine tubular pores; common distinct clay films on faces of peds; few fine threads and films of calcium carbonate; about 10 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Btk2—30 to 42 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; common medium distinct brown (10YR 5/3) mottles; moderate fine subangular blocky structure; extremely hard, very firm; few fine roots; few fine tubular pores; common distinct clay films on faces of peds; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 15 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk—42 to 54 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; common medium distinct dark grayish brown (10YR 4/2) and few fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 21 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

BCkz—54 to 63 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; common medium distinct strong brown (7.5YR 5/6) and few medium distinct dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; very hard, very firm; few very fine roots; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; about 31 percent calcium carbonate equivalent; slightly saline; calcareous; moderately alkaline.

The thickness of the solum is 60 to 100 inches. During dry periods cracks as much as 2 inches wide form at the surface. They extend to a depth of more than 50 inches. The thickness of the mollic epipedon ranges from 20 to 55 inches, and the amplitude of its wavy lower boundary is about 15 to 30 inches. Electrical conductivity at 25 degrees C is less than 4 millimhos per centimeter in the A and Bt horizons. It increases to as much as 12 millimhos per centimeter in the BCk horizon in some pedons. The depth to an accumulation of visible calcium carbonates ranges from 16 to 54 inches.

The A and BA horizons are black, very dark gray, dark gray, very dark grayish brown, or dark grayish brown. The BA horizon is clay or clay loam. Both horizons are neutral to moderately alkaline.

In more than half of the horizontal distance of the pedon, the Btk horizon is black, very dark gray, very dark grayish brown, dark grayish brown, or dark gray. The rest of the Btk horizon and the Bk and BC horizons are pale brown, pale yellow, yellow, yellowish brown, light brown, brown, brownish yellow, olive yellow, light reddish brown, or light yellowish brown. The Btk horizon is clay loam or clay. The total content of clay in the upper 20 inches of this horizon ranges from 35 to 50 percent. The upper part of the Btk horizon has a few visible accumulations of calcium carbonate. In the lower part of this horizon, the content of these accumulations is as much as 10 percent, by volume. Some pedons have few or common visible accumulations of gypsum and other salts. Reaction is mildly alkaline or moderately alkaline.

The BC horizon is clay loam or clay. It has as much as 25 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts. Reaction is mildly alkaline or moderately alkaline.

The C horizon, if it occurs, is clay or soft shale interbedded with clay. It has a few to 30 percent, by volume, visible concentrations of calcium carbonate, gypsum, and other salts.

Falfurrias Series

The Falfurrias series consists of very deep, somewhat excessively drained, sandy soils on uplands. These soils formed in sandy eolian material (fig. 18). Slopes range from 0 to 5 percent.

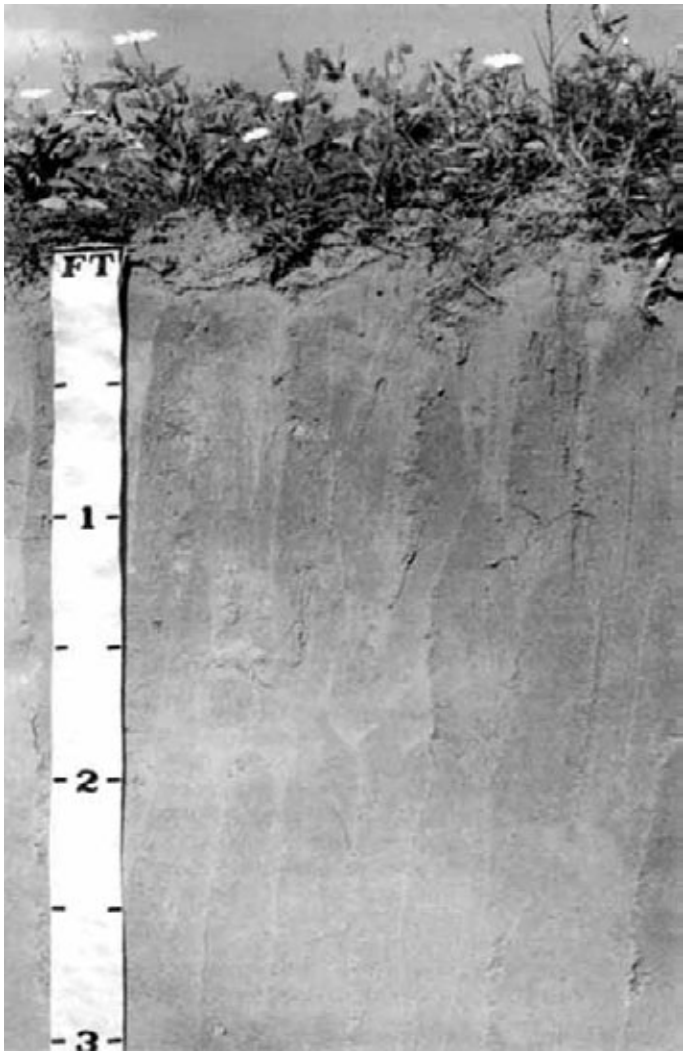

Figure 18.—Profile of Falfurrias sand, in an area of Ruiz-Falfurrias-Bobillo complex, gently undulating. This soil formed in sandy eolian material.

Typical pedon of Falfurrias sand, in an area of Ruiz-Falfurrias-Bobillo complex, gently undulating; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 16.75 miles west on Farm Road 140 to a gate; 6.4 miles northwest on a ranch road to a gate; 0.4 mile southeast along a fence line, and 20 feet northeast, in an area of rangeland:

A—0 to 30 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grained; loose; common very fine and fine roots; neutral; gradual wavy boundary.
C1—30 to 72 inches; reddish yellow (7.5YR 6/6) sand, strong brown (7.5YR 5/6) moist; single grained; loose; few very fine and fine roots; neutral; gradual wavy boundary.
C2—72 to 84 inches; pink (7.5YR 7/4) sand, brown (7.5YR 5/4) moist; single grained; loose; few very fine roots; neutral.

The combined thickness of the A and C horizons ranges from 80 to more than 100 inches. These horizons are sand or loamy sand. Some pedons have lamellae of sandy loam or loamy sand below a depth of 80 inches. The A horizon is brown, pale brown, or light brown. The C horizon is light brown, reddish yellow, or pink. Reaction is slightly acid or neutral throughout the profile.

Goldfinch Series

The Goldfinch series consists of shallow, well drained, very gravelly, loamy soils on uplands. These soils formed in very gravelly, loamy material weathered from interbedded sandstone and siltstone (fig. 19). Slopes range from 1 to 12 percent.

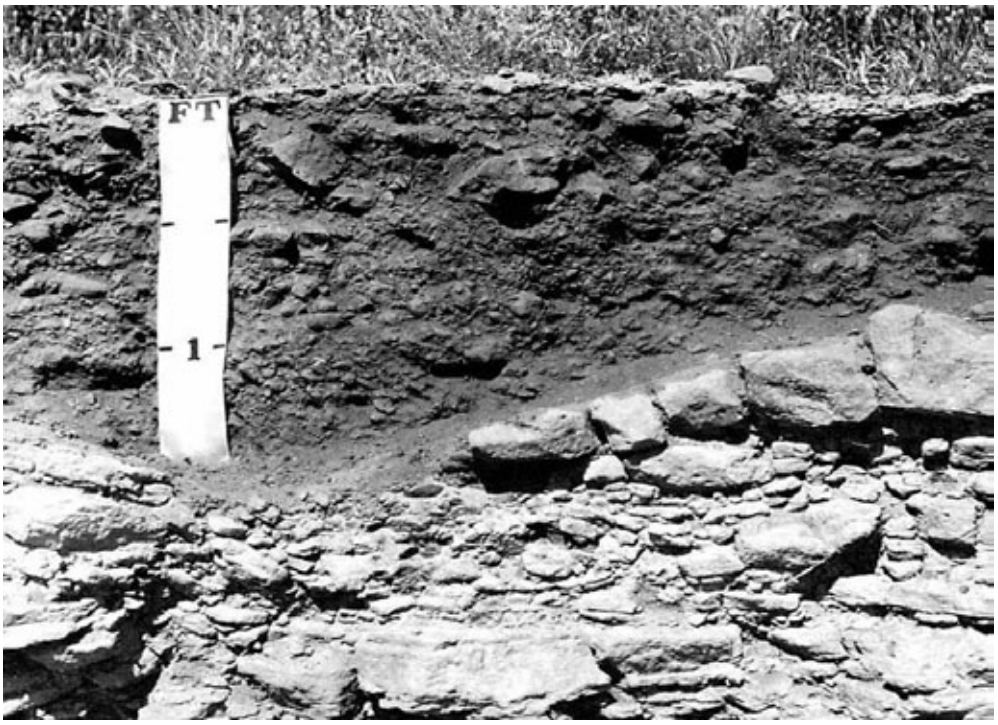

Figure 19.—Profile of a Goldfinch very gravelly sandy loam. This soil has fractured sandstone bedrock at a depth of 10 to 20 inches.

Typical pedon of Goldfinch very gravelly sandy loam, rolling; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 1.6 miles east on Farm Road 140, about 8.7 miles southeast on Keystone Road, and 50 feet south of a fence, in an area of rangeland:

A—0 to 8 inches; reddish brown (5YR 4/4) very gravelly sandy loam, dark reddish brown (5YR 3/4) moist; weak fine and medium granular structure; slightly volume, visible concentrations of calcium carbonate, hard, very friable; few fine and medium roots; about 55 percent, by volume, sandstone and ironstone fragments, of which 40 percent is pebbles and 15 percent is cobbles; slightly acid; clear wavy boundary.

Bt—8 to 16 inches; reddish brown (5YR 5/4) extremely gravelly sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; few fine roots; common fine tubular pores; common distinct clay films on faces of peds and on coarse fragments; about 70 percent, by volume, sandstone and ironstone fragments, of which 55 percent is pebbles and 15 percent is cobbles; neutral; abrupt wavy boundary.

Cr—16 to 48 inches; strong brown (7.5YR 5/8), weakly cemented sandstone; fractured at horizontal intervals of 4 to 6 inches between depths of 16 and 30 inches and coarsely fractured between depths of 30 and 48 inches; cracks filled with reddish brown (5YR 5/4) sandy clay loam in the upper part; noncalcareous; moderately alkaline.

The thickness of the solum, or the depth to sandstone, ranges from 10 to 20 inches. Cobbles and pebbles cover 10 to 85 percent of the surface. Reaction is medium acid to mildly alkaline in the solum.

The A horizon is reddish brown or yellowish red. It is 3 to 10 inches thick. The content of coarse fragments, mainly sandstone and ironstone, ranges from 35 to 70 percent, by volume. The content of pebbles ranges from 15 to 55 percent, and the content of cobbles ranges from 0 to 30 percent. Some pedons have as much as 2 percent stones.

The Bt horizon is reddish brown, yellowish red, red, or reddish yellow. It is extremely gravelly, very cobbly, or very gravelly sandy clay loam. The content of coarse fragments, mainly sandstone and ironstone, ranges from 35 to 75 percent, by volume. The content of pebbles ranges from 25 to 60 percent, and the content of cobbles ranges from 0 to 25 percent. Some pedons have as much as 2 percent stones.

Some pedons have a Crk horizon.

Hindes Series

The Hindes series consists of well drained, very gravelly, loamy soils on uplands. These soils are moderately deep over cemented caliche. They formed in calcareous, very gravelly, loamy ancient alluvium. Slopes range from 1 to 12 percent.

Typical pedon of Hindes very gravelly loam, in an area of Hindes-Yologo complex, rolling; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 5.0 miles northwest on Farm Road 140 and 25 feet north, in an area of rangeland:

A—0 to 9 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; few fine tubular pores; about 45 percent, by volume, siliceous gravel; neutral; clear wavy boundary.

Bt—9 to 18 inches; reddish brown (5YR 4/3) extremely gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine angular blocky structure; hard, friable; common fine roots; common distinct clay films on faces of peds and on coarse fragments; about 70 percent, by volume, siliceous gravel; neutral; gradual wavy boundary.

Btk—18 to 32 inches; reddish brown (2.5YR 4/4) extremely gravelly clay, dark reddish brown (2.5YR 3/4) moist; moderate fine angular blocky structure; hard, friable; few fine roots; many distinct clay films on faces of peds and on coarse fragments; about 75 percent, by volume, siliceous gravel; few films and threads of calcium carbonate in the lower part; noncalcareous matrix; neutral; abrupt wavy boundary.

Bk—32 to 60 inches; pink (7.5YR 8/4), weakly cemented caliche of clay loam, pink (7.5YR 7/4) moist; few fine and medium distinct reddish brown (5YR 5/4), strong brown (7.5YR 5/6), and yellowish red (5YR 5/6) mottles; massive; hard, friable (the upper 2 inches is slightly harder than the lower part); about 5 percent, by volume, siliceous gravel; calcareous; moderately alkaline.

The depth to a calcic horizon is 20 to 40 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon is very dark grayish brown, dark grayish brown, dark reddish brown, dark brown, reddish brown, or brown. It is 4 to 16 inches thick. The content of siliceous gravel ranges from 35 to 50 percent, by volume. Reaction is slightly acid to mildly alkaline.

The Bt horizon is brown, dark brown, or reddish brown. The content of siliceous gravel ranges from 35 to 75 percent, by volume. The fine-earth fraction is clay or clay loam in which the content of clay is 35 to 50 percent. Reaction is slightly acid to mildly alkaline.

The Bk horizon is weakly cemented, loamy caliche. Some pedons have a 2Bk horizon, which has seams of weakly consolidated sandstone interbedded with caliche.

Imogene Series

The Imogene series consists of very deep, moderately well drained, loamy soils that have a sodic subsoil. These soils are on flood plains. They formed in loamy old alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Imogene very fine sandy loam, occasionally flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 1.5 miles south on U.S. Highway 81, about 16.5 miles southeast on Farm Road 1582, and 100 feet southwest of a fence, in an area of rangeland:

A—0 to 5 inches; dark brown (10YR 4/3) very fine sandy loam, dark brown (10YR 3/3) moist; massive; very hard, friable; common fine and medium roots; few fine and medium tubular pores; slightly acid; abrupt wavy boundary.

Btn—5 to 12 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate coarse columnar structure parting to strong fine and medium angular blocky; extremely hard, extremely firm; common fine roots, mainly along faces of peds; many distinct dark brown clay films on faces of peds; light gray caps on the top of columns; neutral; clear wavy boundary.

Btkn—12 to 17 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; common distinct very dark grayish brown clay films on faces of peds; about 2 percent, by volume, threads, films, soft masses, and medium, rounded, weakly cemented nodules of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Btknz1—17 to 27 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common fine faint reddish yellow (7.5YR 6/6) and light gray (10YR 7/2) mottles; moderate fine subangular blocky structure; hard, firm; few fine roots; few fine tubular pores; common faint clay films on faces of peds; few distinct very dark grayish brown ferromanganese coatings on faces of peds; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; slightly saline; calcareous; mildly alkaline; gradual wavy boundary.

Btknz2—27 to 40 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; common medium distinct reddish yellow (7.5YR 6/6) and common medium faint light gray (2.5YR 7/2) mottles; weak fine subangular blocky structure; hard, friable; few fine roots; few faint clay films on faces of peds; few distinct very dark grayish brown ferromanganese coatings on faces of peds; slightly saline; calcareous; mildly alkaline; clear wavy boundary.

CBknyz—40 to 65 inches; light gray (2.5YR 7/2) sandy clay loam, light brownish gray (2.5YR 6/2) moist; common medium distinct brownish yellow (10YR 6/8) and brown (10YR 5/3) mottles; weak fine subangular blocky structure; slightly hard, very friable; few distinct ferromanganese coatings on faces of peds; few soft masses and films of calcium carbonate; few threads, films, and clusters of gypsum and other salt crystals; moderately saline; noncalcareous matrix; mildly alkaline; clear wavy boundary.

Cyz—65 to 74 inches; light gray (2.5YR 7/2) sandy clay loam, light brownish gray (2.5YR 6/2) moist; many medium distinct strong brown (7.5YR 5/8, 4/6) mottles; massive; very hard, firm; few distinct ferromanganese coatings; few films and clusters of gypsum and other salt crystals; moderately saline; noncalcareous; neutral.

The thickness of the solum is 38 to more than 60 inches. Electrical conductivity at 25 degrees C is 4 to 16 millimhos per centimeter in some part of the upper 40 inches. The exchangeable sodium percentage is 15 or more in some part of the upper 16 inches of the Bt horizon.

The A horizon is dark brown, dark grayish brown, dark brown, brown, or dark yellowish brown. It has value of 3 or less when moist. It is 3 to 12 inches thick. Reaction is slightly acid to mildly alkaline.

The upper part of the Bt horizon is dark brown, very dark gray, very dark grayish brown, or grayish brown. The lower part is brown, light yellowish brown, pale brown, or very pale brown. The Bt horizon is sandy clay, clay loam, or sandy clay loam. The content of clay ranges from 20 to 40 percent. The highest content is in the upper 20 inches of the horizon. By weighted average, the total content of clay in the control section ranges from 28 to 34 percent. Reaction is neutral to moderately alkaline.

The CB horizon is light gray, gray, grayish brown, light brownish gray, brown, pale brown, or very pale brown. It has a few to 5 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts. This horizon is sandy clay loam, clay loam, or loam. Reaction is neutral to moderately alkaline.

The C horizon is sandy clay loam, clay loam, or loam. In some pedons it is soft shale interbedded with weakly cemented sandstone or loamy material. It has a few to 20 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts.

Lacoste Series

The Lacoste series consists of well drained, loamy soils on uplands. These soils are shallow over a petrocalcic horizon. They formed in calcareous, gravelly, loamy ancient alluvium. Slopes range from 1 to 5 percent.

Typical pedon of Lacoste very fine sandy loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 31 and Farm Road 140 in Pearsall, 0.6 mile west on Farm Road 140, about 6.4 miles southwest on Farm Road 1581, about 1.0 mile southeast on Trevino Road, and 50 feet north of a fence, in an area of rangeland:

A1—0 to 4 inches; dark brown (7.5YR 4/4) very fine sandy loam, reddish brown (5YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; common fine tubular pores; few wormcasts; mildly alkaline; clear wavy boundary.

A2—4 to 10 inches; dark brown (7.5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; few fine tubular pores; few wormcasts; mildly alkaline; clear wavy boundary.

Bt—10 to 17 inches; yellowish red (5YR 5/6) fine sandy loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; few faint clay films on faces of peds and in pores; about 2 percent, by volume, sandstone pebbles; neutral; abrupt wavy boundary.

Bkm—17 to 19 inches; pinkish white (7.5YR 8/2), strongly cemented, gravelly caliche; about 15 percent, by volume, siliceous pebbles; calcareous; moderately alkaline; clear wavy boundary.

Bk—19 to 60 inches; white (10YR 8/2), weakly cemented, gravelly caliche; about 15 percent, by volume, siliceous pebbles; calcareous; moderately alkaline.

The depth to a petrocalcic horizon is 10 to 20 inches. Gravel covers 0 to 10 percent of the surface. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon is brown, dark brown, strong brown, or reddish brown. It is 4 to 11 inches thick. The content of siliceous pebbles ranges from 0 to 15 percent, by volume.

The Bt horizon is reddish brown, yellowish red, or red. It is fine sandy loam or sandy clay loam. The total content of clay is 15 to 25 percent. The content of siliceous pebbles ranges from 0 to 15 percent, by volume.

The Bkm horizon is strongly cemented or indurated caliche. The upper part is laminar in most pedons. The Bk horizon is weakly cemented or strongly cemented caliche. Coarse fragments of siliceous and limestone gravel make up 5 to 50 percent of the volume in the Bkm and Bk horizons.

Laparita Series

The Laparita series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in loamy and clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Laparita clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 9.55 miles east on Farm Road 140, about 2.05 miles north on McDonald Road, 3.85 miles north on Peck Bush Road, and 200 feet west of a fence, in an area of rangeland:

A—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; extremely hard, extremely firm; few fine roots; few fine tubular pores; slightly acid; clear wavy boundary.

Btz1—6 to 13 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong fine angular blocky structure; extremely hard, extremely firm; few fine roots; few fine tubular pores; many distinct clay films on faces of peds; few ironstone pebbles as much as 0.4 inch in diameter; slightly saline; mildly alkaline; clear wavy boundary.

Btz2—13 to 20 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; few medium distinct very dark grayish brown (10YR 3/2) mottles; strong fine angular blocky structure; extremely hard, extremely firm; few fine roots; common fine tubular pores; many distinct clay films on faces of peds; moderately saline; moderately alkaline; gradual wavy boundary.

Btkz—20 to 30 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; common medium faint light yellowish brown (10YR 6/4) and few medium distinct very dark grayish brown (10YR 3/2) mottles; moderate fine subangular blocky structure; very hard, very firm; few fine roots; few threads, films, and soft masses of gypsum and other salts; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; few faint clay films on vertical faces of peds; about 6 percent calcium carbonate equivalent; moderately saline; calcareous; mildly alkaline; clear wavy boundary.

BCkyz—30 to 56 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; few medium distinct very dark grayish brown (10YR 3/2) mottles; very hard, firm; few fine roots; weak fine subangular blocky structure; about 3 percent, by volume, threads, films, and soft masses of calcium carbonate; few threads, films, and clusters of gypsum and other salt crystals; few ironstone fragments as much as 0.8 inch in diameter; about 6 percent calcium carbonate equivalent; moderately saline; calcareous; moderately alkaline; gradual wavy boundary.

Ckyz—56 to 63 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; common fine faint yellow (10YR 7/8) mottles; massive; very hard, firm; common ironstone fragments as much as 1.6 inches in diameter; about 4 percent, by volume, threads, films, and soft masses of calcium carbonate; few threads, films, and clusters of gypsum and other salt crystals; about 6 percent calcium carbonate equivalent; moderately saline; calcareous; moderately alkaline.

The thickness of the solum is 40 to 60 inches. The coefficient of linear extensibility (COLE) ranges from 0.07 to 0.11. The exchangeable sodium percentage is less than 15. Electrical conductivity is less than 2 millimhos per centimeter in the A horizon and 4 to 12 millimhos per centimeter in the Bt and underlying horizons.

The A horizon is very dark gray, dark gray, or very dark grayish brown. It is 4 to 10 inches thick. Reaction is slightly acid or neutral,

The Bt and Btk horizons are very dark gray, dark gray, very dark grayish brown, dark brown, or brown. They are clay or clay loam. By weighted average, the total content of clay in the upper 20 inches of the Bt horizon is 35 to 45 percent. Reaction is neutral to

moderately alkaline in both horizons. The Btk horizon has a few to 5 percent, by volume, visible accumulations of calcium carbonate. In most pedons the lower part of this horizon has a few threads, films, and clusters of gypsum and other salt crystals.

The BC horizon is gray, light brownish gray, light yellowish brown, very pale brown, or pale brown. It has a few to 5 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts.

The C horizon is clay loam or clay. In some pedons it is interbedded with soft shale or siltstone. It has a few to 30 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts.

Miguel Series

The Miguel series consists of very deep, well drained, loamy soils on uplands. These soils formed in loamy and clayey residuum (fig. 20). Slopes range from 0 to 3 percent.

Typical pedon of Miguel very fine sandy loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 12.6 miles east on Farm Road 140, about 0.5 mile south along a fence line, and 75 feet east, in an area of rangeland:

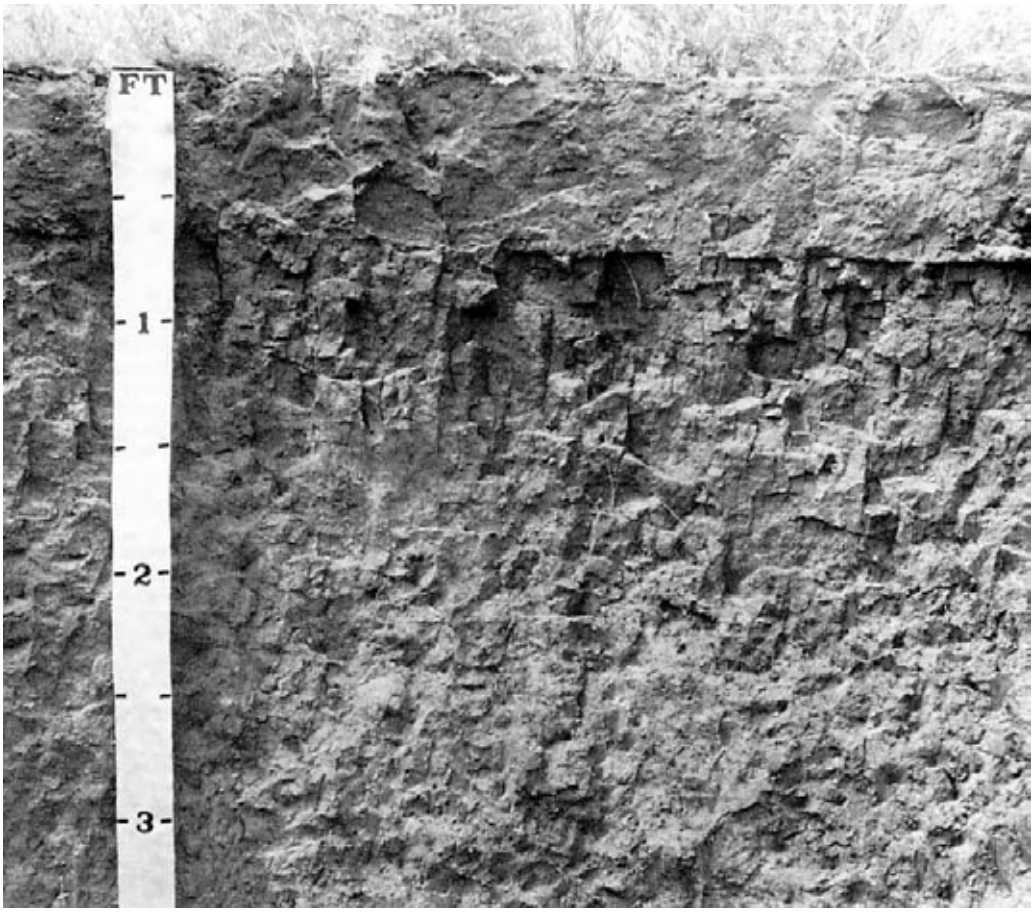

Figure 20.—Profile of a Miguel very fine sandy loam. An abrupt smooth boundary is between the surface layer and the subsoil at a depth of about 8 Inches. The upper part of the subsoil has angular blocky structure. The lower part has subangular blocky structure.

A—0 to 18 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky and weak very fine granular structure; slightly hard, very friable; common very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

Bt—18 to 26 inches; yellowish brown (10YR 5/4) sandy clay, dark yellowish brown (10YR 4/4) moist; common fine distinct brownish yellow (10YR 6/6), brown (10YR 5/3), and yellowish red (5YR 4/6) mottles; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; few very fine roots; many very fine tubular pores; many distinct clay films on faces of peds; clear smooth boundary.

Btk1—26 to 40 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; common fine distinct reddish yellow (7.5YR 6/6) and red (10R 4/8) mottles; moderate coarse prismatic structure parting to strong medium subangular blocky; hard, firm; few very fine roots; common distinct clay films on faces of peds; few threads of calcium carbonate in the lower part; mildly alkaline; gradual wavy boundary.

Btk2—40 to 60 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; many medium prominent very pale brown (10YR 7/3) and red (10R 4/8) mottles; moderate fine and medium subangular blocky structure; hard, friable; few very fine roots; common distinct clay films on faces of peds; about 2 percent, by volume, soft masses of calcium carbonate; moderately alkaline; diffuse wavy boundary.

Ck—60 to 66 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; hard, friable; about 1 percent, by volume, soft masses of calcium carbonate; common very pale brown masses of weakly cemented sandstone that slakes in water; few thin streaks of material from the Btk horizon; noncalcareous matrix; moderately alkaline.

The thickness of the solum is 40 to more than 60 inches. The depth to soft, powdery calcium carbonates ranges from about 28 to 40 inches.

The A horizon is reddish brown, brown, dark yellowish brown, or grayish brown. It is 6 to 20 inches thick. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, brown, or yellowish brown. It is mottled in shades of red, yellow, or brown. It is clay or sandy clay. The total content of clay is 35 to 50 percent in the upper 20 inches. Reaction is neutral to moderately alkaline.

The Btk and BCk horizons are strong brown, reddish yellow, or yellowish brown. They are mottled in shades of red, yellow, or brown. Accumulations of calcium carbonate make up 1 to 5 percent of the volume. These horizons are sandy clay loam or sandy clay. Reaction is mildly alkaline or moderately alkaline.

The C horizon is similar to the Bt horizon, but it is less clayey with increasing depth. The size and content of sandstone fragments also increase with increasing depth.

Montell Series

The Montell series consists of very deep, moderately well drained, clayey soils on stream terraces. These soils formed in clayey old alluvium. Slopes are 0 to 1 percent.

Typical pedon of Montell clay, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 11.1 miles northwest on Farm Road 140 to U.S. Highway 57 to a ranch gate; 1.55 miles north on a ranch road, then 150 feet east, in an area of rangeland:

A—0 to 10 inches; dark gray (10YR 4/1) clay, dark gray (10YR 4/1) moist; strong fine and medium subangular blocky structure; hard, firm; many very fine and fine roots; few very fine tubular pores; few snail shell fragments; about 10 percent calcium carbonate equivalent; calcareous; mildly alkaline; gradual wavy boundary.

AB—10 to 27 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; strong medium angular blocky structure; extremely hard, firm; common very fine and few very fine roots; few very fine tubular pores; common distinct stress surfaces; about 14 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

BAk—27 to 42 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; extremely hard, firm; few very fine roots; few very fine tubular pores; many coarse distinct gray (10YR 5/1) and pale brown (10YR 6/3) planar mottles; common distinct stress surfaces; common intersecting slickensides; about 2 percent, by volume, medium, rounded, soft masses and fine, rounded, weakly cemented nodules of calcium carbonate; about 14 percent calcium carbonate equivalent; very slightly saline; calcareous; moderately alkaline; gradual wavy boundary.

Bkz/A—42 to 60 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; many coarse distinct gray (10YR 5/1) and very pale brown (10YR 7/4) vertical streaks; moderate medium angular blocky structure; extremely hard, firm; few very fine pores; common distinct stress surfaces; common intersecting slickensides; about 2 percent, by volume, medium, rounded, soft masses and medium, rounded, weakly cemented nodules of calcium carbonate, mainly within the very pale brown mottles; about 14 percent calcium carbonate equivalent; slightly saline; calcareous; mildly alkaline; gradual wavy boundary.

Bkyz/A—60 to 74 inches; very pale brown (10YR 7/4) clay, very pale brown (10YR 7/4) moist; common coarse distinct gray (10YR 5/1) vertical streaks; weak coarse angular blocky structure; extremely hard, firm; common distinct stress surfaces; about 2 percent, by volume, medium, rounded, soft masses and medium, rounded, weakly cemented nodules of calcium carbonate; few medium clusters of gypsum crystals; about 15 percent calcium carbonate equivalent; slightly saline; calcareous; mildly alkaline.

The thickness of the solum is 60 to more than 80 inches. The calcium carbonate equivalent ranges from about 10 to 15 percent. Some pedons have gypsum and other salts below a depth of 40 inches. The texture is clay throughout the profile. The total content of clay is 40 to 60 percent. Reaction is mildly alkaline or moderately alkaline throughout the profile. Gilgai microrelief characterizes areas that have never been plowed. Microknolls are 6 to 12 feet in diameter and are 7 to 18 inches higher than microdepressions. Electrical conductivity is less than 4 millimhos per centimeter in the upper 30 inches and increases to 8 or more millimhos per centimeter in the underlying layers. The exchangeable sodium percentage is less than 15 in all horizons within 30 inches of the surface.

The A and AB horizons are gray or dark gray. The BA and B/A horizons are grayish brown, light brownish gray, brown, yellowish brown, pale brown, or very pale brown. They have streaks and mottles of material from the A horizon in most pedons. The depth to intersecting slickensides is 20 to 30 inches.

Monteola Series

The Monteola series consists of very deep, moderately well drained, saline, clayey soils on uplands. These soils formed in saline, calcareous, clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Monteola clay, saline, 1 to 3 percent slopes; from the intersection of Farm Road 140 and U.S. Highway 81 in Pearsall, 1.5 miles south on U.S. Highway 81, about 15.9 miles southeast on Farm Road 1582, about 1.7 miles south on Schorp Road, 1.95 miles northwest on a ranch road to a fence line, 0.4 mile southwest along the fence line, and 50 feet east, in an area of rangeland:

A—0 to 9 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to moderate fine subangular blocky; very hard, very firm; many fine and medium roots; few fine tubular pores; few siliceous pebbles as much as 0.4 inch in diameter; noncalcareous; mildly alkaline; gradual wavy boundary.

ABkyz—9 to 22 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong fine angular blocky structure; common wedge-shaped peds, the long axis of which is tilted 30 degrees from the horizontal; extremely hard, very firm; common fine roots; common distinct stress surfaces; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; few fine pores; slightly saline; noncalcareous matrix; mildly alkaline; gradual wavy boundary.

BAkyz—22 to 30 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; few medium distinct light yellowish brown (10YR 6/4) mottles; strong fine angular blocky structure; common wedge-shaped peds, the long axis of which is tilted 20 to 40 degrees from the horizontal; extremely hard, very firm; few fine roots; few slickensides; few fine pores; about 5 percent, by volume, threads, films, soft masses, and medium, rounded, weakly cemented nodules of calcium carbonate; moderately saline; noncalcareous matrix; mildly alkaline; gradual wavy boundary.

Bkyz/A—30 to 41 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; many coarse distinct very dark gray (10YR 3/1) vertical streaks; few fine distinct light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4) mottles; strong fine angular blocky structure; common slickensides; extremely hard, very firm; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; moderately saline; calcareous; mildly alkaline; clear wavy boundary.

Bkyz—41 to 51 inches; very pale brown (10YR 7/3) clay, light yellowish brown (10YR 6/4) moist; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; very hard, very firm; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 2 percent, by volume, threads, films, soft masses, and clusters of gypsum and other salt crystals; moderately saline; calcareous; mildly alkaline; gradual wavy boundary.

Ckyz1—51 to 63 inches; yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few fine distinct very pale brown (10YR 7/3), light brownish gray (2.5YR 6/2), and dark yellowish brown (10YR 4/6) mottles; massive; very hard, very firm; about 2 percent, by volume, threads, films, and soft masses of calcium carbonate; about 2 percent, by volume, threads, films, soft masses, and clusters of gypsum and other salt crystals; moderately saline; calcareous; mildly alkaline; gradual wavy boundary.

Ckyz2—63 to 72 inches; intermingled brownish yellow (10YR 6/8) clay and light brownish gray (2.5YR 6/2), soft shale fragments in a coarse distinct pattern, light brownish gray (2.5YR 6/2) and yellowish brown (10YR 5/8) moist; common medium distinct yellow (10YR 7/8) and yellowish brown (10YR 5/4) mottles; massive; extremely hard, very firm; common clusters of gypsum and other salt crystals; less than 2 percent, by volume, threads, films, and soft masses of calcium carbonate; moderately saline; calcareous; mildly alkaline.

The thickness of the solum is 40 to 80 inches and varies considerably within a few feet. The solum is thinnest on microknolls and ridges and thickest in microdepressions. Electrical conductivity is 0 to 4 millimhos per centimeter in the A horizon and increases to as much as 8 to 12 millimhos per centimeter in the underlying layers. By weighted average, the total content of clay in the 10- to 40-inch control section is 50 to 60 percent. During dry periods cracks extend from the surface to a depth of more than 40 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A, AB, and BA horizons are very dark gray or dark gray. Rounded siliceous gravel makes up 0 to 15 percent of the volume. The matrix is noncalcareous or calcareous in the A and AB horizons. The amplitude of the wavy boundary between the BA and B/A horizons ranges from 5 to about 14 inches.

The B/A and B horizons are dark grayish brown, grayish brown, brown, pale brown, very pale brown, dark brown, gray, light brownish gray, or brownish yellow. They have a few to 10 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts. Most pedons have streaks or planar mottles of soil material with colors similar to those of the A and AB horizons.

The C horizon is light gray, light yellowish brown, brownish yellow, or light brownish gray. It has 5 to 25 percent, by volume, visible accumulations of calcium carbonate, gypsum, and other salts.

Olmos Series

The Olmos series consists of well drained, very gravelly, loamy soils on uplands. These soils are very shallow or shallow over a petrocalcic horizon (fig. 21). They formed in calcareous, very gravelly, loamy sediments. Slopes range from 1 to 8 percent. Typical pedon of Olmos very gravelly loam, undulating; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 4.2 miles northwest on Farm Road 140 and 150 feet north to the edge of a caliche pit, in an area of rangeland:

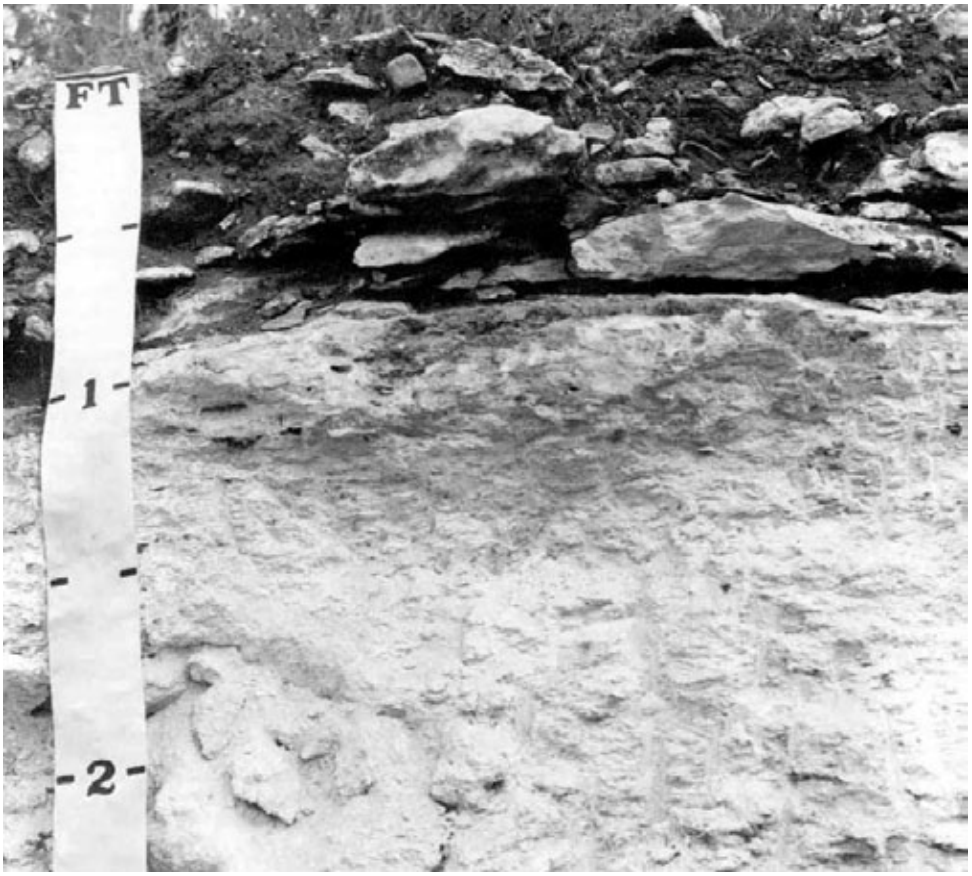

Figure 21.—Profile of an Olmos very gravelly loam. This soil has a petrocalcic horizon of strongly cemented caliche at a depth of 4 to 20 inches.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; many fine tubular pores; about 40 percent, by volume, strongly cemented caliche gravel; calcareous; mildly alkaline; clear wavy boundary.

A2—5 to 14 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; common fine roots; many fine tubular pores; about 55 percent, by volume, strongly cemented caliche fragments, of which 45 percent is gravel and 10 percent is cobbles 3 to 6 inches in diameter; calcareous; mildly alkaline; abrupt wavy boundary.

Bkm—14 to 18 inches; white (10YR 8/2), strongly cemented caliche; hardness of more than 3 on Mohs' scale; laminar in the upper 0.5 inch; calcareous; moderately alkaline; gradual wavy boundary.

Bk—18 to 60 inches; white (10YR 8/1), weakly cemented caliche; few fine distinct yellowish brown (10YR 5/6) mottles in the lower part; few siliceous and limestone pebbles.

The depth to a petrocalcic horizon is 4 to 20 inches. Coarse fragments cover 5 to 75 percent of the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is very dark grayish brown, dark gray, dark grayish brown, or dark brown. It is 35 to 85 percent, by volume, strongly cemented or indurated caliche fragments. In some pedons it has a few siliceous pebbles. The content of clay in the fine-earth fraction ranges from 12 to 27 percent.

The Bkm and Bk horizons are strongly cemented or indurated caliche in the upper ¼ inch to 5 inches and weakly cemented or strongly cemented caliche in the lower part. The Bk horizon has siliceous gravel throughout and has some limestone gravel in the lower part.

Poteet Series

The Poteet series consists of very deep, moderately well drained, loamy soils in drainageways on uplands. Soils formed in loamy sediments. Slopes are 0 to 1 percent.

Typical pedon of Poteet very fine sandy loam, occasionally flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 12.9 miles north on U.S. Highway 81 to Farm Road 462 in Moore; 8.25 miles east on Farm Road 462, about 3.25 miles north on Farm Road 472, about 4.25 miles southeast on Texas Highway 173 to Hayes Road; 0.2 mile northeast on Hayes Road and 30 feet northwest of a fence, in an area of rangeland:

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; many very fine to medium roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

A2—12 to 34 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

Bt1—34 to 39 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; common fine distinct dark yellowish brown (10YR 4/6) and dark gray (10YR 4/1) mottles; weak coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; common very fine and fine roots; many very fine and fine pores; many distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—39 to 48 inches; dark grayish brown (10YR 4/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; many medium distinct strong brown (7.5YR 5/6) and brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm; few very fine roots; many very fine and fine tubular pores; common distinct clay films on faces of peds; slightly acid; gradual wavy boundary.

Btk—48 to 58 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; many fine distinct yellowish red (5YR 5/6), reddish brown (5YR 4/4), and dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; hard, firm; few very fine roots; many very fine and fine tubular pores; few threads and films of calcium carbonate; few distinct ferromanganese coatings on faces of peds; distinct clay films on vertical faces of peds; neutral; gradual wavy boundary.

Btkc—58 to 62 inches; strong brown (7.5YR 4/6) sandy clay loam, strong brown (7.5YR 4/6) moist; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, firm; few very fine roots; common very fine tubular pores; about 1 percent, by volume, threads and films of calcium carbonate; common distinct clay films on vertical faces of peds; few medium, rounded, weakly cemented black ferromanganese nodules; neutral.

The thickness of the solum is 60 to 90 inches. The mollic epipedon is 20 to 40 inches thick. The depth to an accumulation of calcium carbonates is more than 36 inches.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. It is medium acid to mildly alkaline.

The Bt horizon is very dark grayish brown, dark grayish brown, grayish brown, dark brown, brown, dark yellowish brown, or yellowish brown. It has few to many faint to prominent mottles in shades of red, brown, yellow, or gray. It is sandy clay loam, clay loam, or sandy clay. The highest content of clay is in the upper part of the horizon. By weighted average, the total content of clay in the upper 20 inches of the horizon is 23 to 35 percent. Reaction is slightly acid to moderately alkaline.

The Btk horizon is grayish brown, brown, strong brown, light reddish brown, brownish yellow, yellowish brown, reddish yellow, or yellowish red. It is sandy clay loam or clay loam. It has a few to 5 percent, by volume, visible nodules and soft masses of calcium carbonate. Reaction is neutral to moderately alkaline.

The BC horizon, if it occurs, has value and chroma 1 or 2 units higher than the overlying horizons. It is sandy clay loam, clay loam, or fine sandy loam. It has a few to 5 percent, by volume, visible nodules and soft masses of calcium carbonate.

Poth Series

The Poth series consists of very deep, well drained, sandy soils on uplands. These soils formed in loamy material weathered from interbedded sandstone and shale. Slopes range from 0 to 3 percent.

Typical pedon of Poth loamy fine sand, 0 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 5.2 miles east on Farm Road 140, about 7.0 miles southeast and east on Goldfinch Road, 0.95 mile south on a ranch road, 0.45 mile east to a cattle guard, and 90 feet north, in an area of rangeland:

A1—0 to 12 inches; brown (7.5YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; many very fine and fine roots; common very fine tubular pores; slightly acid; clear smooth boundary.

A2—12 to 21 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many very fine roots; common very fine tubular pores; medium acid; gradual smooth boundary.

E—21 to 30 inches; light brown (7.5YR 6/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common very fine roots; common very fine tubular pores; medium acid; abrupt wavy boundary.

Bt—30 to 47 inches; dark yellowish brown (10YR 4/6) clay, dark yellowish brown (10YR 4/6) moist; common medium distinct yellowish red (5YR 4/6) and common

fine distinct brownish yellow (10YR 6/6) mottles; moderate coarse prismatic structure parting to strong medium angular blocky; extremely hard, very firm; few very fine and fine roots; many very fine and fine tubular pores; many distinct clay films on faces of peds; few distinct ferromanganese coatings on faces of peds; neutral; gradual wavy boundary.

Btk1—47 to 58 inches; yellowish brown (10YR 5/6) sandy clay, dark yellowish brown (10YR 4/6) moist; many medium distinct red (2.5YR 4/8) and dark brown (7.5YR 3/4) and few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium angular blocky structure; very hard, very firm; few very fine roots; many very fine and fine tubular pores; few soft masses of calcium carbonate; many distinct clay films on faces of peds; few fragments of brownish yellow, weakly cemented sandstone; mildly alkaline; abrupt wavy boundary.

Btk2—58 to 64 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; common medium distinct reddish yellow (5YR 6/8) mottles; moderate medium subangular blocky structure; hard, firm; few very fine roots; many very fine and fine tubular pores; few soft masses of calcium carbonate; few distinct clay films on vertical faces of peds; about 10 percent, by volume, brownish yellow, weakly cemented sandstone; mildly alkaline.

The thickness of the solum is 60 to more than 75 inches. Thin stone lines or fragments of sandstone and sandy ironstone are below a depth of about 47 inches in some pedons.

The A and E horizons are brown, light brown, pale brown, or yellowish brown. The combined thickness of these horizons is 20 to 40 inches. Reaction is medium acid to neutral.

The Bt horizon is reddish yellow, reddish brown, pale brown, brown, light brown, dark yellowish brown, or brownish yellow. It is mottled in shades of red, yellow, or brown. It is clay or sandy clay. The total content of clay is 35 to 52 percent. Reaction is slightly acid to mildly alkaline.

The Btk horizon is reddish yellow, yellowish red, strong brown, or yellowish brown. It is mottled in shades of red, yellow, or brown. This horizon is sandy clay loam or clay loam. Reaction is slightly acid to moderately alkaline.

Ramadero Series

The Ramadero series consists of very deep, well drained, loamy soils in drainageways on uplands. These soils formed in calcareous, loamy sediments. Slopes are 0 to 1 percent.

Typical pedon of Ramadero sandy clay loam, occasionally flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 17.0 miles south on U.S. Highway 81, about 1.9 miles east on Texas Highway 85, about 1.05 miles northeast on Proctor Road, and 50 feet northwest of a fence, in an area of cropland:

A—0 to 22 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common very fine to medium roots; common fine tubular pores; mildly alkaline; clear wavy boundary.

Bw1—22 to 32 inches; dark yellowish brown (10YR 4/4) sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common very fine to medium roots; common fine tubular pores; mildly alkaline; gradual wavy boundary.

Bw2—32 to 44 inches; dark yellowish brown (10YR 4/4) sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; common very fine to medium tubular pores; mildly alkaline; clear wavy boundary.

BCk—44 to 52 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; common very fine tubular pores; few films, threads, and soft masses

of calcium carbonate; about 10 percent, by volume, rounded siliceous pebbles that are as much as 1 inch in diameter and are coated with calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Ck—52 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; few fine roots; about 5 percent, by volume, threads, films, and soft masses of calcium carbonate; few medium and coarse, rounded, strongly cemented nodules of calcium carbonate; few siliceous and sandstone pebbles as much as 1 inch in diameter; calcareous; moderately alkaline.

The thickness of the solum is 40 to 60 inches. Reaction is neutral to moderately alkaline throughout the profile. By weighted average, the total content of clay in the 10- to 40-inch control section ranges from 25 to 34 percent. The content of organic carbon decreases irregularly with increasing depth.

The A horizon is very dark gray or very dark grayish brown. It is 20 to 35 inches thick. It is calcareous or noncalcareous.

The Bw and BCk horizons are brown, dark yellowish brown, or yellowish brown. They are sandy clay loam, clay loam, or loam. The matrix is calcareous or noncalcareous. These horizons have a few to 15 percent, by volume, visible accumulations of calcium carbonate. The content of siliceous pebbles ranges from 0 to 15 percent, by volume.

The C horizon is light yellowish brown, pale brown, very pale brown, or yellowish brown. It is sandy clay loam, clay loam, or loam.

Ruiz Series

The Ruiz series consists of very deep, somewhat excessively drained, sandy soils on uplands. These soils formed in sandy residuum reworked by the wind. Slopes range from 0 to 5 percent.

Typical pedon of Ruiz loamy sand, in an area of Ruiz-Falfurrias-Bobillo complex, gently undulating; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 16.75 miles west on Farm Road 140 to a gate; 6.4 miles north on a ranch road to a gate; 0.95 mile northeast on a ranch road, 1.2 miles southeast on a ranch road, 0.7 mile south on a ranch road, then 100 feet east of the road, in an area of rangeland:

A1—0 to 24 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; single grained; loose; common very fine to medium roots; neutral; gradual wavy boundary.

A2—24 to 48 inches; brown (10YR 5/3) loamy sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; common very fine and fine roots; neutral; clear wavy boundary,

E/Bt—48 to 84 inches; pink (7.5YR 7/4) loamy sand (E), brown (7.5YR 5/4) moist; single grained; loose; lamellae of reddish yellow (7.5YR 7/6) loamy sand (Bt), strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; many very fine and fine pores; lamellae are wavy, 0.2 to 0.4 inch thick, and 2 to 6 inches apart; clay bridges between sand grains in the lamellae; neutral.

The thickness of the solum is 80 to more than 100 inches. The depth to lamellae of loamy sand or sandy loam ranges from about 40 to 60 inches. The combined thickness of the lamellae is 2 to 6 inches within a depth of 80 inches.

The A horizon is light yellowish brown, brown, yellowish brown, pink, pale brown, light brown, or reddish yellow. Reaction is slightly acid or neutral.

The E horizon part of the E/Bt horizon is pink, very pale brown or reddish yellow. It is the same texture as the A horizon. The total content of clay ranges from 3 to 6 percent. Reaction is slightly acid or neutral.

The Bt part of the E/Bt horizon is strong brown, reddish yellow, yellowish red, reddish brown, or light red. It is sandy loam or loamy sand. The total content of clay is 9 to 19 percent. Individual lamellae are 0.1 to 1.0 inch thick. Reaction is slightly acid to mildly alkaline. Some pedons have a continuous Bt horizon of fine sandy loam or sandy clay loam at a depth of 80 to 100 inches.

Schattel Series

The Schattel series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, clayey and loamy material weathered from interbedded shale and siltstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Schattel clay loam, 1 to 8 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 14.2 miles east on Farm Road 140 to Farm Road 472; about 5.7 miles north on Farm Road 472 to a ranch road; 0.25 mile west on a ranch road, 0.5 mile north on a ranch road, 0.05 mile west on a ranch road, 100 feet north of the road, then 100 feet east, in an area of rangeland:

A—0 to 6 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine tubular pores; few fine threads of calcium carbonate; calcareous; mildly alkaline; clear wavy boundary.

Bk1—6 to 14 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; common fine tubular pores; about 2 percent, by volume, fine threads and soft masses of calcium carbonate; few ironstone pebbles; common fine and medium distinct dark grayish brown coatings on faces of peds; calcareous; mildly alkaline; gradual wavy boundary.

Bk2—14 to 26 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine tubular pores; about 5 percent, by volume, fine and medium threads, films, and soft masses of calcium carbonate; few fine and medium distinct grayish brown coatings on faces of peds; calcareous; moderately alkaline; clear wavy boundary.

Bkyz—26 to 44 inches; light gray (10YR 7/2) clay intermingled with white (10YR 8/1), soft shale fragments; pale brown (10YR 6/3) and light gray (10YR 7/1) moist; common medium distinct reddish yellow (7.5YR 6/8) and light brown (7.5YR 6/4) mottles; weak fine subangular blocky structure; very hard, very firm; about 2 percent, by volume, fine and medium films, threads, and soft masses of calcium carbonate; few medium clusters of gypsum crystals; slightly saline; calcareous; mildly alkaline; gradual wavy boundary.

Crkyz—44 to 63 inches; white (10YR 8/1), soft shale bedrock intermingled with clay, light gray (10YR 7/1) moist; common medium distinct reddish yellow (7.5YR 6/8) and light brown (7.5YR 6/4) mottles; massive; very hard, very firm; about 10 percent, by volume, fine and medium threads, films, and soft masses of calcium carbonate; common medium clusters of gypsum and other salt crystals; slightly saline; calcareous; mildly alkaline.

The thickness of the solum is 40 to 60 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile. Electrical conductivity at 25 degrees C is 0 to 4 millimhos per centimeter in the A horizon and increases to as much as 12 millimhos per centimeter in the Bkyz and Crkyz horizons.

The A horizon is very dark gray, very dark grayish brown, brown, grayish brown, or dark brown. Where moist values are less than 3.5, this horizon is less than 7 inches thick. The content of siliceous gravel ranges from 0 to 15 percent, by volume, and the content of

siliceous cobbles is less than 5 percent. The matrix is calcareous or noncalcareous.

The Bk horizon is reddish gray, reddish brown, brown, strong brown, yellowish brown, pale brown, light yellowish brown, or brownish yellow. It is clay or clay loam in which the content of clay is 35 to 55 percent. Coarse fragments make up as much as 15 percent of the volume. In some pedons this horizon has as much as 10 percent, by volume, threads, seams, and clusters of gypsum and other salt crystals.

The Bkyz and Crkyz horizons have shades of brown, white, gray, or yellow. They are clay or clay loam. They generally are interbedded with soft shale or siltstone. In some pedons, however, they are interbedded with thin layers of fractured, weakly cemented sandstone.

Sinton Series

The Sinton series consists of very deep, well drained loamy soils on flood plains. These soils formed in stratified, loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Sinton clay loam, frequently flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 1.5 miles south on U.S. Highway 81, about 15.9 miles southeast on Farm Road 1582, 2.6 miles northeast on Kothman Lane, 1.1 miles east on a private road from a gate, 1.1 miles north along a fence line, and 50 feet east into an area of rangeland along the north bank of San Miguel Creek:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm; many fine and medium roots; common fine tubular pores; few snail shell fragments; few fine, soft masses and rounded, weakly cemented nodules of calcium carbonate; common lenses of light yellowish brown loamy fine sand; noncalcareous matrix; mildly alkaline; gradual wavy boundary.

A2—8 to 34 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; common fine faint dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) and few medium distinct strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; very hard, firm; few fine roots; few fine tubular pores; noncalcareous; mildly alkaline; gradual wavy boundary.

C1—34 to 52 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; common fine distinct strong brown (7.5YR 4/6) and few fine faint light brownish gray (10YR 6/2) mottles; massive; hard, friable; few fine roots; few fine tubular pores; few thin lenses of loamy fine sand and fine sandy loam; calcareous; mildly alkaline; gradual wavy boundary.

C2—52 to 62 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; common fine distinct dark grayish brown (10YR 4/2) mottles; massive; very hard, friable; few fine roots; few fine tubular pores; common thin lenses of clay loam and fine sandy loam; calcareous; mildly alkaline.

The thickness of the solum is 20 to 40 inches. The content of organic carbon decreases irregularly with increasing depth. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is dark grayish brown, very dark grayish brown, or dark brown. In some pedons it has thin strata of loamy fine sand or fine sandy loam. It is calcareous or noncalcareous.

The C horizon is brown, dark brown, yellowish brown, or light yellowish brown. It is sandy clay loam, fine sandy loam, loam, or clay loam. It has few or common bedding planes and lenses of various textures.

Tiocano Series

The Tiocano series consists of very deep, somewhat poorly drained, clayey soils on playas. These soils formed in clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Tiocano clay; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 10.2 miles south on U.S. Highway 81 to the Frio River bridge; 0.1 mile west to the Interstate Highway 35 access road; 5 miles south on the Interstate Highway 35 access road to Loma Vista Road; 3.7 miles west on Loma Vista Road to a ranch entrance; 0.15 mile north on a ranch road, 0.35 mile west along a fence line to a fence corner, then 500 feet south, in an area of rangeland:

A1—0 to 14 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; very hard, very firm; few fine and coarse roots; few fine tubular pores; common prominent red and yellowish red clay coatings on faces of pods and in pores; neutral; clear wavy boundary.

A2—14 to 34 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; common wedge-shaped peds, the long axis of which is tilted 20 to 40 degrees from the horizontal; very hard, very firm; few fine and coarse roots; few fine tubular pores; common distinct stress surfaces; few thin sand coatings along cracks; few distinct red and yellowish red coatings on faces of peds; neutral; gradual wavy boundary.

Bk—34 to 52 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common coarse distinct dark gray (10YR 4/1) and light yellowish brown (2.5YR 6/4) mottles; weak fine and medium angular blocky structure; few intersecting slickensides; common wedge-shaped peds, the long axis of which is tilted 20 to 40 degrees from the horizontal; very hard, very firm; few fine and very fine roots; common distinct stress surfaces; few distinct sand coatings along vertical faces of cracks; few soft masses of calcium carbonate to 0.1 inch in diameter; mildly alkaline; gradual wavy boundary.

Ck—52 to 68 inches; light yellowish brown (2.5YR 6/4) day, grayish brown (2.5YR 5/2) moist; weak medium angular blocky structure; few intersecting slickensides; few distinct stress surfaces; very hard, very firm; few fine, soft masses of calcium carbonate; neutral.

The thickness of the solum is 40 to more than 60 inches. Reaction is neutral to moderately alkaline throughout the profile. By weighted average, the total content of clay is 40 to 60 percent in the 10- to 40-inch control section. During dry periods cracks 0.4 to 4.0 inches wide extend to a depth of 30 to 40 inches. Intersecting slickensides are in and below the B horizon in most pedons.

The A horizon is very dark gray or dark gray. The B horizon is dark gray or grayish brown. The Ck horizon is light yellowish brown, light brownish gray, or grayish brown.

Uvalde Series

The Uvalde series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in calcareous, loamy old alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Uvalde clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 11.1 miles northwest on Farm Road 140 to U.S. Highway 57; about 6.8 miles east on Highway 57 and 40 feet north, in an area of cropland:

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) clay loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable; few fine roots; few fine tubular pores; few fine, rounded, soft masses of calcium carbonate; about 6 percent calcium carbonate equivalent; calcareous; mildly alkaline; abrupt smooth boundary.

ABk—12 to 18 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; common very fine and fine tubular pores; few fine, soft masses of

calcium carbonate; about 13 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear wavy boundary.

Bk1—18 to 37 inches; dark yellowish brown (10YR 4/4) clay, dark brown (7.5YR 4/4) moist; strong fine and medium subangular blocky structure; hard, firm; few fine roots; common very fine and fine tubular pores; few fine and medium, soft masses of calcium carbonate; about 21 percent calcium carbonate equivalent; calcareous; mildly alkaline; gradual wavy boundary.

Bk2—37 to 44 inches; pink (7.5YR 7/4) clay, brown (7.5YR 5/4) moist; common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; very hard, very firm; few very fine pores; about 15 percent, by volume, threads, films, and coarse, rounded, soft masses of calcium carbonate; few medium, rounded, weakly cemented nodules of calcium carbonate surrounded by soft masses of calcium carbonate; about 32 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk3—44 to 56 inches; pink (7.5YR 7/4) clay, brown (7.5YR 5/4) moist; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm; about 25 percent, by volume, threads, films, and very coarse, rounded, soft masses of calcium carbonate; few medium, rounded, strongly cemented nodules of carbonate surrounded by soft masses of calcium carbonate; about 39 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual wavy boundary.

Bk4—56 to 62 inches; light brown (7.5YR 6/4) clay, strong brown (7.5YR 5/6) moist; few medium faint reddish yellow (7.5YR 6/6) mottles; weak medium subangular blocky structure; very hard, very firm; about 15 percent, by volume, threads, films, and very coarse, rounded, soft masses of calcium carbonate; few medium, rounded, strongly cemented nodules of calcium carbonate surrounded by soft masses of calcium carbonate; about 33 percent calcium carbonate equivalent; calcareous; mildly alkaline.

The solum is more than 80 inches thick. The calcium carbonate equivalent ranges from 5 to 25 percent in the A horizon, from 20 to 39 percent in the upper part of the Bk horizon, and from 30 to 75 percent in the lower part of the Bk horizon. By weighted average, the total content of clay in the 10- to 40-inch control section is 28 to 50 percent and the content of silicate clay is 22 to 35 percent. The content of sand coarser than very fine sand is 5 to 15 percent in the control section. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A and AB horizons are dark grayish brown, dark brown, or brown. The combined thickness of these horizons is 10 to 20 inches.

The Bk horizon is brown, yellowish brown, dark yellowish brown, pink, light brown, very pale brown or light yellowish brown. It has a few visible accumulations of calcium carbonate in the upper part. In the lower part the content of these accumulations is as much as 30 percent, by volume.

Valco Series

The Valco series consists of shallow, well drained, loamy soils on stream terraces. These soils formed in calcareous, loamy ancient alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Valco clay loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 16.3 miles northwest on Farm Road 140, about 0.2 mile south on a ranch road, and 100 feet north of a power line and road, in an area of rangeland:

A—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard,

friable; common fine roots; common fine and medium tubular pores; few wormcasts; few threads, films, and medium and coarse, rounded, weakly cemented nodules of calcium carbonate; about 2 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear smooth boundary.

Ak—8 to 18 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine roots; common fine and medium tubular pores; few wormcasts; few threads, films, and medium and coarse, rounded, weakly cemented nodules of calcium carbonate; about 6 percent calcium carbonate equivalent; few limestone pebbles; calcareous; mildly alkaline; clear smooth boundary.

Bkm—18 to 21 inches; white (10YR 8/1), strongly cemented caliche that is laminar in the upper 0.5 inch; few solution cavities and cracks that are filled with dark brown (10YR 4/3) clay loam; moderately alkaline; clear wavy boundary.

Bk—21 to 60 inches; white (10YR 8/2), weakly cemented caliche; few rounded limestone pebbles; moderately alkaline.

The depth to a petrocalcic horizon is 10 to 20 inches. Strongly cemented or indurated caliche and limestone gravel and cobbles cover 0 to about 10 percent of the surface. The total content of clay ranges from about 27 to 35 percent. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon is brown, dark grayish brown, dark brown, or very dark grayish brown. The content of strongly cemented or indurated caliche and limestone gravel and cobbles ranges from 0 to 15 percent, by volume.

The Ak horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. It is clay loam or gravelly clay loam. The content of limestone and strongly cemented or indurated caliche and limestone gravel and cobbles ranges from 0 to 30 percent, by volume.

The Bkm horizon is strongly cemented or indurated caliche that is laminar in the upper part in most pedons. The degree of cementation decreases with increasing depth. The Bk horizon has 0 to 50 percent, by volume, limestone gravel and cobbles.

Webb Series

The Webb series consists of very deep, well drained, loamy soils on uplands. These soils formed in loamy material weathered from interbedded sandstone and shale (fig. 22). Slopes range from 0 to 5 percent.

Typical pedon of Webb very fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 14.3 miles east on Farm Road 140, about 0.35 mile south on Farm Road 472, and 225 feet west of a fence, in an area of rangeland:

A—0 to 10 inches; dark brown (7.5YR 4/4) very fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common fine roots; few fine tubular pores; few krotovinas of lighter colored very fine sandy loam; slightly acid; abrupt smooth boundary.

Bt—10 to 19 inches; reddish brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to strong medium angular blocky; very hard, firm; many fine roots in the upper part and common fine roots in the lower part, mainly along faces of peds; few fine tubular pores; many distinct dark reddish brown clay films on faces of peds; few sandy ironstone pebbles near the upper boundary; slightly acid; gradual smooth boundary.

Btk1—19 to 26 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate prismatic structure parting to strong medium angular blocky; very hard, firm; common fine roots, mainly along faces of peds; few fine

pores; many distinct reddish brown clay films on faces of peds; few fine and medium, rounded, weakly cemented nodules of calcium carbonate; few fine, soft masses of weathered sandstone; noncalcareous matrix; neutral; clear wavy boundary.

Btk2—26 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; many distinct red clay films and clay bridges between sand grains on vertical faces of peds and common faint red clay films and clay bridges between sand grains on horizontal faces of peds; few distinct coatings of calcium carbonate on faces of peds; few fine and medium, rounded, weakly cemented nodules of calcium carbonate; few fine, soft masses of weathered sandstone; calcareous; moderately alkaline; gradual wavy boundary.

Btk3—38 to 50 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine tubular pores; common faint yellowish red clay films and clay bridges between sand grains, mainly on vertical faces of peds, and few faint clay films and clay bridges between sand grains on horizontal faces of peds; few fine, rounded, weakly cemented nodules of calcium carbonate that have distinct, soft coatings of calcium carbonate; few fine, soft masses of weathered sandstone; very slightly saline; noncalcareous matrix; mildly alkaline; gradual wavy boundary.

Btyz1—50 to 65 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; common medium distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; few fine and medium tubular pores; common faint clay films and clay bridges between sand grains on vertical faces of prisms and few faint clay films and clay bridges between sand grains on horizontal faces of prisms; few fine, soft masses of weathered sandstone; few distinct black ferromanganese coatings on vertical faces of peds; about 5 percent, by volume, threads, films, and clusters of gypsum and other salt crystals, mainly on faces of prisms; slightly saline; mildly alkaline; gradual wavy boundary.

Btyz2—65 to 72 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; common medium distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few fine roots along faces of peds; few very fine tubular pores; common faint clay films and clay bridges between sand grains on vertical faces of prisms and few faint clay films and clay bridges between sand grains on horizontal faces of prisms; common soft masses of weathered sandstone; few threads, films, and clusters of gypsum and other salt crystals, mainly on faces of prisms; slightly saline; neutral; clear irregular boundary.

2Crz—72 to 80 inches; white (5YR 8/2), weakly cemented sandstone that crushes to sandy clay loam; light gray (5YR 7/2) moist; horizontal bands of weak red (10YR 4/4) and reddish yellow (7.5YR 6/8) material; massive; hard, friable; few fine roots in the upper part; slightly saline; neutral.

The thickness of the solum is 60 to 90 inches. Electrical conductivity at 25 degrees C is 0 to 2 millimhos per centimeter in the upper 30 inches and 0 to 8 millimhos below a depth of 30 inches.

The A horizon is yellowish red, reddish brown, dark brown, or brown. It is 7 to 18 inches thick. Reaction is medium acid to neutral. Some pedons have an AB or BA horizon, which is very fine sandy loam or sandy clay loam.

The Bt, Btk, and Btyz horizons are red, reddish brown, reddish yellow, yellowish red, or strong brown. The higher chromas are in the lower part of the B horizon. This horizon is sandy clay, clay, or clay loam in the upper part and sandy clay loam, very fine sandy loam, or fine sandy loam in the lower part. By weighted average, the total content of clay in the upper 20 inches of the Bt horizon ranges from 35 to 45 percent.

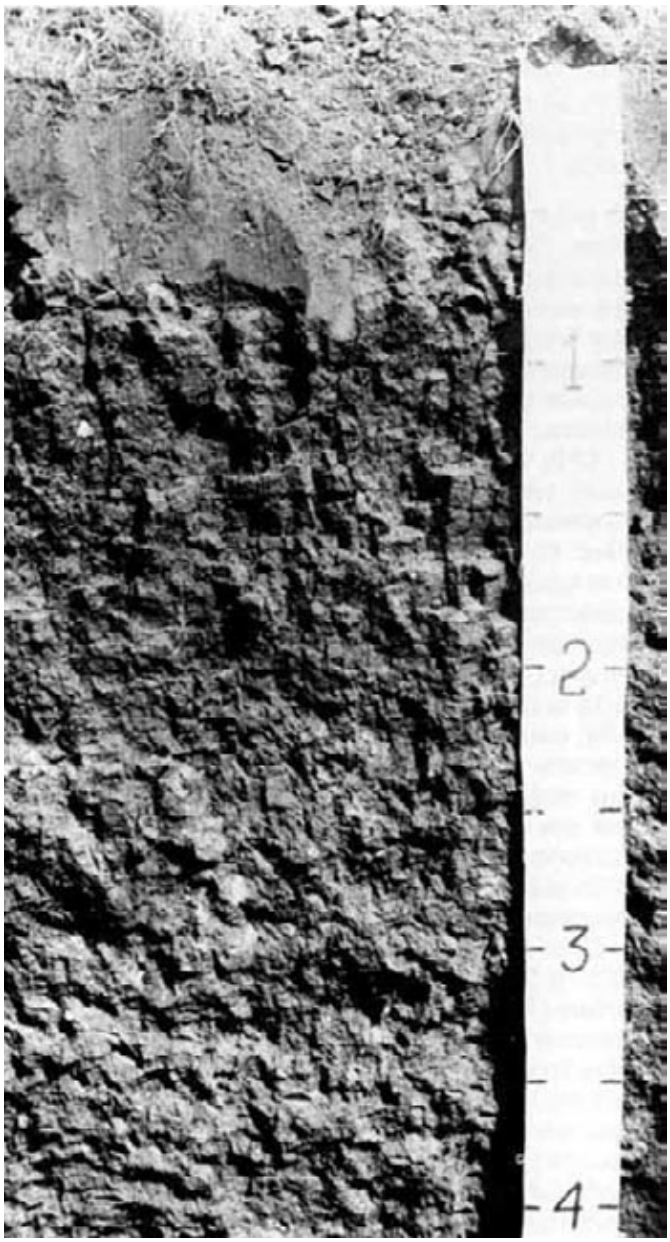

Figure 22.—Profile of a Webb very fine sandy loam. Soil structure is strong medium angular blocky between depths of 10 and 26 inches and moderate medium subangular blocky between depths of 26 and 50 inches. Depth is marked in feet.

The B horizon is slightly acid to moderately alkaline.
The 2Cr horizon is reddish yellow, brownish yellow, yellowish red, light yellowish brown, pink, reddish brown, or white, weakly cemented sandstone, fine sandy loam, very fine sandy loam, or sandy clay loam.

Wilco Series

The Wilco series consists of very deep, well drained, sandy soils on uplands. These soils formed in loamy and clayey material weathered from interbedded sandstone and shale. Slopes range from 0 to 3 percent.

Typical pedon of Wilco loamy fine sand, 0 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 12.9 miles north on Highway 81 to Farm Road 462 in Moore; 8.25 miles east on Farm Road 462 to Farm Road 472 in Bigfoot; 1 mile north on Farm Road 472, about 0.8 mile west on Weiser Lane, and 125 feet north, in an area of cropland:

Ap—0 to 7 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; soft, very friable; few fine roots; slightly acid; abrupt smooth boundary.
A—7 to 16 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable; few fine roots; few fine tubular pores; neutral; abrupt wavy boundary.
Bt1—16 to 21 inches; light yellowish brown (10YR 6/4) sandy clay, brown (10YR 5/3) moist; many medium distinct red (2.5YR 4/6) and yellowish red (5YR 5/6) mottles; moderate fine and medium angular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; common distinct clay films on faces of peds; strongly acid; gradual wavy boundary.
Bt2—21 to 29 inches; light yellowish brown (10YR 6/4) sandy clay, yellowish brown (10YR 5/4) moist; many medium distinct red (2.5YR 4/6), yellowish red (5YR 5/6), and reddish yellow (7.5YR 6/6) mottles; moderate fine and medium angular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; common clay films on faces of peds; strongly acid; gradual wavy boundary.
Bt3—29 to 42 inches; light yellowish brown (10YR 6/4) sandy clay, yellowish brown (10YR 5/4) moist; common medium faint reddish yellow (7.5YR 6/6) and strong brown (7.5YR 5/8) mottles; weak fine angular blocky structure; very hard, firm; few fine tubular pores; few patchy clay films on faces of peds; medium acid; gradual wavy boundary.
BC—42 to 56 inches; strong brown (7.5YR 5/6) sandy clay loam, brown (7.5YR 5/4) moist; common medium faint reddish yellow (7.5YR 6/8) mottles; weak fine subangular blocky structure; hard, firm; common fine tubular pores; slightly acid; gradual wavy boundary.
C—56 to 72 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, friable; few fine, soft masses of calcium carbonate; noncalcareous matrix; neutral.

The thickness of the solum is 40 to 72 inches. The depth to soft, powdery calcium carbonates or nodules of calcium carbonate ranges from 40 to 70 inches.

The Ap and A horizons are brown, pale brown, light yellowish brown, dark brown, pale brown, reddish brown, yellowish red, yellowish brown, or light brown. The combined thickness of these horizons is 10 to 20 inches. Reaction is medium acid to neutral.

The Bt and BC horizons are pale brown, dark yellowish brown, light yellowish brown, very pale brown, yellowish red, reddish yellow, red, brown, strong brown, or yellowish brown. They have common or many, medium or coarse, faint to prominent mottles in shades of red, yellow, or brown. The upper 20 inches of the Bt horizon is sandy clay, clay, or clay loam. The total content of clay is 35 to 48 percent. The Bt1 and Bt2 horizons are strongly acid to mildly alkaline. The Bt3 horizon is sandy clay loam or sandy clay. It is slightly acid to mildly alkaline. The BC horizon is fine sandy loam or sandy clay loam. It is neutral to moderately alkaline.

The C horizon has the same colors as the Bt and BC horizons. It is fine sandy loam or sandy clay loam. Reaction is neutral to moderately alkaline.

Winterhaven Series

The Winterhaven series consists of very deep, well drained, loamy soils on flood plains. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Winterhaven silty clay loam, frequently flooded; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 7.9 miles west on Farm Road 140, about 1,500 feet north to a fence corner north of the Frio River, and 50 feet east of the fence corner, in an area of rangeland:

A—0 to 11 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to moderate very fine subangular blocky; slightly hard, very friable; many fine and medium and few coarse roots; common fine tubular pores; few snail shell fragments; about 56 percent calcium carbonate equivalent; calcareous; mildly alkaline; clear smooth boundary.

Bw—11 to 16 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common fine roots; few fine tubular pores; few snail shell fragments; about 57 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear wavy boundary.

Bk—16 to 32 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few fine tubular pores; few fine threads and films of calcium carbonate; about 56 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.

Ck—32 to 62 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; few fine roots; many distinct bedding planes; few fine threads and films of calcium carbonate; about 58 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The thickness of the solum is 25 to 40 inches. The depth to stratified material ranges from 16 to 40 inches. The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 65 percent. The total content of clay in the control section is 22 to 39 percent. The content of silicate clay is 18 to about 30 percent, and the content of carbonate clay is 4 to 11 percent.

The A horizon is light brownish gray, grayish brown, or brown. Reaction is mildly alkaline or moderately alkaline.

The Bw and Bk horizons are grayish brown, brown, or pale brown. They are silty clay loam or silt loam. Reaction is mildly alkaline or moderately alkaline. Some pedons do not have a Bk horizon.

The Ck horizon is very pale brown, pale brown, or light yellowish brown. In some pedons it does not have films, threads, or soft masses of calcium carbonate. It has thin strata of silty clay loam, silt loam or loam, mainly less than 0.2 inch thick. The strata are the same color as the rest of the horizon or are slightly darker.

Yologo Series

The Yologo series consists of well drained, very gravelly, loamy soils on uplands. These soils are very shallow or shallow over a petrocalcic horizon. They formed in calcareous, very gravelly, loamy ancient alluvium. Slopes range from 1 to 8 percent.

Typical pedon of Yologo very gravelly loam, in an area of Hindes-Yologo complex, rolling; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 5.0 miles northwest on Farm Road 140 and 25 feet north, in an area of rangeland:

A—0 to 6 inches; dark brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; common fine roots; few fine tubular pores; few wormcasts; estimated 45 percent, by volume, siliceous gravel; mildly alkaline; clear smooth boundary.

Bt—6 to 14 inches; reddish brown (5YR 4/3) extremely gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine angular blocky structure; hard, friable; many fine roots; few fine tubular pores; common distinct clay films on faces of peds and

on coarse fragments; about 75 percent, by volume, siliceous gravel; mildly alkaline; abrupt wavy boundary.

Bkm—14 to 16 inches; pink (7.5YR 8/4), strongly cemented caliche; hardness of 2.5 on Mohs' scale; about 8 percent, by volume, siliceous gravel; a laminar cap 0.2 to 1.0 inch thick; calcareous; moderately alkaline; clear wavy boundary.

Bk—16 to 60 inches; white (10YR 8/1), weakly cemented caliche of silty clay loam; hard, friable; few fine and medium faint pink (7.5YR 8/4) mottles in streaks and pockets; about 2 percent, by volume, siliceous and limestone gravel; the limestone pebbles are mainly in the lower part and are cupped on the upper surfaces; calcareous; moderately alkaline.

The depth to a petrocalcic horizon is 7 to 20 inches. Reaction is slightly acid to mildly alkaline above the petrocalcic horizon.

The A horizon is dark grayish brown, reddish brown, dark brown, or brown. It is 2 to 14 inches thick. The content of siliceous gravel ranges from 15 to 60 percent, by volume.

The Bt horizon is dark brown or reddish brown. The fine-earth fraction is clay loam or sandy clay loam in which the content of clay is 20 to 35 percent. The content of siliceous gravel ranges from 35 to 80 percent, by volume.

The Bkm horizon is strongly cemented and laminar caliche 0.25 inch to 6.0 inches thick. The Bk horizon is weakly cemented caliche. In some pedons it has weathered limestone gravel in the lower part.

Zavco Series

The Zavco series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, clayey and loamy material weathered from interbedded shale and siltstone. Slopes range from 0 to 3 percent.

Typical pedon of Zavco sandy clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 140 in Pearsall, 1.5 miles south on U.S. Highway 81, about 21.0 miles southeast on Farm Road 1582, 1.25 miles southwest on Williams Road to a ranch entrance; 0.55 mile northwest along a fence line and 60 feet southwest of the fence, in an area of cropland:

A—0 to 10 inches; dark brown (7.5YR 3/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, friable; common fine roots; few fine and medium tubular pores; neutral; clear smooth boundary.

AB—10 to 16 inches; dark brown (7.5YR 3/2) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; few fine and medium tubular pores; mildly alkaline; clear smooth boundary.

Bt—16 to 25 inches; yellowish red (5YR 5/6) sandy clay, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine roots; common fine tubular pores; many distinct dark reddish brown clay films on faces of peds; few distinct black coatings on faces of peds; moderately alkaline; gradual wavy boundary.

Btk—25 to 38 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; few fine roots; few fine tubular pores; common distinct reddish brown clay films on faces of peds; few distinct black coatings on faces of peds; few fine threads and films and few fine, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

BCk—38 to 58 inches; reddish yellow (5YR 6/6) sandy clay, yellowish red (5YR 5/6) distinct red (2.5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; few fine tubular pores; about 20 percent, by volume, fine threads and coarse, soft masses of calcium

carbonate; calcareous; moderately alkaline; clear wavy boundary.
Ck—58 to 72 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; few fine distinct reddish yellow (5YR 6/6) mottles; massive; very hard, firm; few very fine roots; about 10 percent, by volume, medium and coarse, soft masses of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum is 40 to 80 inches. The depth to an accumulation of soft, powdery calcium carbonates ranges from 10 to 28 inches.

The A and AB horizons are dark brown, brown, very dark grayish brown, reddish brown, dark reddish brown, dark reddish gray, or dark grayish brown. The combined thickness of these horizons is 10 to 20 inches. Reaction is slightly acid to mildly alkaline. Some pedons do not have an AB horizon.

The Bt and Btk horizons are yellowish red, reddish brown, strong brown, or brown. They are sandy clay, clay, or clay loam. The total content of clay is 35 to 45 percent. Reaction is neutral to moderately alkaline.

The BCk and Ck horizons are reddish yellow, light yellowish brown, yellowish brown, brownish yellow, light brown, or pink. The BCk horizon is sandy clay loam or clay loam. The Ck horizon is mainly clay loam or sandy clay loam, but it is interbedded with weakly cemented sandstone or soft shale in some pedons. Visible calcium carbonates and other salts make up as much as 30 percent of the volume in these horizons. Reaction is mildly alkaline or moderately alkaline. Electrical conductivity at 25 degrees C is 0 to 8 millimhos per centimeter.

Formation of the Soils

In this section the factors of soil formation are related to the soils in Frio County. Also, soil horizons and surface geology are described.

Factors of Soil Formation

Soil forms through the action and interaction of five major factors. These factors are climate, living organisms, relief, time, and parent material. The kind of soil that forms in a given area is determined by these factors, although isolating the effect of any one factor is difficult in some areas.

Climate

Frio County has a subhumid climate characterized by mild, dry winters and hot summers. Low rainfall, a high evaporation rate, temperature, and wind are some of the climatic factors that influence soil formation.

Because the pattern of rainfall varies, the soils in the county are alternately wet and dry. Clayey soils, such as Montell, Monteola, or Tiocano, crack when they dry. Animals, rainfall, and wind deposit surface soil in the cracks. During periods of rainfall, water fills the cracks, wetting the soil thoroughly. As it becomes wet, the soil swells and the cracks close. These processes result in deep soil development and gilgai microrelief.

Water moving through the soil can carry clay particles downward in suspension from the surface layer. The clay particles are deposited in the subsoil as the waterflow ceases. As the clay accumulates, permeability is restricted. The restricted permeability, in turn, accelerates the deposition of clay. Some soils, such as Amphion, Duval, and Poth, have accumulations of clay in the subsoil.

Rainfall leaches minerals from the upper layers and deposits them in the lower layers. As a result, Brystal, Caid, Webb, Zavco, and many other soils have a layer in which calcium carbonate has accumulated. Campbellton, Imogene, and Laparita are examples of soils that have an accumulation of soluble salts in the subsoil. Poteet and other soils have an accumulation of ferromanganese oxide compounds in the lower part of the subsoil.

The accumulation of organic matter is affected by temperature and moisture. Low rainfall and high temperatures generally limit plant growth and the accumulation of organic matter in the soils of the county. Soils on flood plains and in depressions have more moisture than the soils on the surrounding uplands. As a result, the amount of vegetation and the content of organic matter are higher. In areas where there is more vegetation, temperatures near the surface of the soil are lower and the organic matter decomposes at a slower rate.

Wind has affected the formation of soils in the county. Many of the sandy soils that have been used as cropland have gained or lost soil material because of past wind erosion. Antosa, Bobillo, Poth, and Comitas soils are examples. Sand dunes are along fences and accumulations of soil material are in swales throughout areas of these soils.

Living Organisms

Plants, animals, earthworms, insects, and microorganisms are important factors in the formation of soils. They affect the amount of organic matter and nitrogen in the soil and can result in gains or losses in plant nutrients and changes in soil structure and porosity.

Vegetation, predominantly grasses and brush, has played a major role in soil formation in Frio County. Decayed plant roots add organic matter to the soils and leave channels and pores that provide passageways for the intake of air and water. Deep-rooting brush plants bring nutrients from the subsoil to the surface.

Earthworms, insects, and burrowing animals mix the soil material and create channels for the downward movement of air and water and the penetration of plant roots. Actinomycetes, bacteria, and fungi aid in the formation of humus by breaking down primary forms of organic matter and releasing plant nutrients. As a result, they improve soil tilth and fertility.

Human activities have greatly affected the soils in Frio County. In the past some of the rangeland in the county was overstocked with livestock and native wildlife and was thus overgrazed. In the overgrazed areas, the better grasses, brush, and forbs decreased in abundance and were replaced by the less desirable grasses, brush, and forbs. Overgrazing by livestock and other animals increases the extent of bare areas and compaction and thus increases the runoff rate and the hazard of erosion.

Farming has resulted in excessive water and wind erosion in many areas. Compaction of the soil by farm equipment has restricted the movement of air and water and the penetration of plant roots in many of the soils used as cropland.

Relief

Relief affects soil formation through its influence on drainage, erosion, and the plant cover. If other factors of soil formation are equal, the degree of profile development in a soil depends on the amount of water that enters the soil.

Generally, Amphion and other nearly level or gently undulating soils absorb more rainfall, have a greater degree of profile development, are less susceptible to water erosion, and have a lower runoff rate than Schattel and other gently undulating or undulating soils. The steeper soils may erode away nearly as fast as they form. On nearly level slopes, which are more stable than the steeper slopes, the rate of soil formation generally exceeds soil loss through erosion and a deeper soil profile develops.

Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. Hundreds to thousands of years are usually required for the formation of well defined, genetic horizons. Genetically, the soils in Frio County range from very young to old. Differences in the ages of the soils are evident in their profiles.

Winterhaven soils are very young. They formed in slightly altered alluvial sediments on recent flood plains.

The older soils in the county generally are nearly level or gently undulating and are on stable uplands that are actually ancient stream terraces. Lacoste soils are old. Calcium carbonate was leached from the upper part of these soils and accumulated as a layer of cemented caliche. Also, clay was translocated from the surface layer to the subsoil.

Parent Material

Parent material is the unconsolidated organic and mineral material in which a soil forms. The type of parent material determines the physical and chemical limits of the soil. For example, Antosa, Bobillo, and other sandy soils in the northern part of Frio County have coarser sand grains than Duval, Poth, and other soils in the central part of the county. The parent material of the Antosa and Bobillo soils weathered from coarser grained sandstone than the parent material of the Duval and Poth soils.

Bigfoot, Bookout, Caid, Divot, Uvalde, and Winterhaven soils formed in calcareous alluvium along the Frio and Leona Rivers. The alluvium contained calcium carbonate. All of these soils are calcareous throughout.

Soil Horizons

The soil-forming factors produce a succession of layers, or horizons, in the soil profile. The horizons differ in one or more properties, such as thickness, color, texture, structure, consistence, porosity, and reaction.

Most profiles have three major horizons. These are the A, B, and C horizons. Several processes are involved in the formation of these horizons. In Frio County the main processes are the leaching of calcium carbonate and other salts and bases, the accumulation of organic matter, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of horizons.

The A horizon is the surface layer. It is the horizon that has the maximum accumulation of organic matter. The soils in Frio County range from low to high in organic matter content. Various dissolved or suspended materials, such as calcium carbonate, organic matter, salts, iron, and clay, may have been leached from the A horizon to the B horizon.

The B horizon lies directly below the A horizon. It is the horizon that has the maximum accumulation of dissolved or suspended material, or it is an altered horizon that has distinct structure. The Bk horizon is a layer that has an accumulation of carbonates, commonly calcium carbonate. The Bt horizon has a significant accumulation of silicate clay. Subsoil layers that have a distinct structure and show little evidence of the accumulation of dissolved or suspended material are designated as Bw horizons. Bigfoot and Winterhaven soils have Bw and Bk horizons. Brystal and Duval soils have a Bt horizon.

The C horizon is relatively little affected by soil-forming processes. It consists mainly of unconsolidated sediments or soft rock.

The Cr horizon is weathered or soft bedrock, such as weakly cemented sandstone. Dilley and Duval soils have a Cr horizon.

Some young soils have no B horizon, and some shallow soils that formed directly over bedrock do not have a C horizon.

Surface Geology

Mary L.W. Jackson, geologist, Bureau of Economic Geology, Austin, Texas, helped prepare this section.

In this section the major geological formations that crop out in Frio County are described in relation to the soils in the county. Absolute relationships between geologic outcrops and the soils they underlie, however, are not possible because of displacement and mixing of surface sediments since exposure of the outcrop. The geologic names and locations generally follow the latest geological maps of the region (12, 13).

All of the geological formations that crop out in the county are from the Cenozoic Era. Sediments deposited during the Tertiary Period consist of Eocene deposits, which are as old as 54 million years. Sediments deposited during the Quaternary Period consist of Pleistocene and Holocene deposits, which are as old as 2 million years (5). Uvalde Gravel was deposited between the late Pliocene Epoch (Tertiary Period) and the early Pleistocene Epoch (Quaternary Period) (4) and thus may range in age from 1 to 10 million years (5).

The major geological formations are described in order of age from the oldest to the youngest in the following paragraphs. The map units mentioned in association with each geological formation refer to the general soil map units commonly underlain by that formation.

Carrizo Sand crops out discontinuously in an area directly south of the northern edge of the county (12, 13). This formation is distinguished from the underlying and overlying formations by generally larger sized sand grains, in many places as much as 2 millimeters in diameter; by sandier, thicker, conspicuously crossbedded strata; and by

mottles of red and buff colors in the exposures. It is mostly a continental deposit laid down by streams that dropped their loads on a flat coastal plain and built up a broad alluvial apron all along the coast (7). Carrizo Sand is made up mainly of sandstone that is coarse grained to fine grained and generally is loosely cemented, massive, crossbedded, and well sorted but may have local spherical concretions of sand cemented by iron. It may have shale that is interbedded with thin sandstone beds. It is about 200 feet thick (12, 13).

Carrizo Sand underlies the Antosa-Bobillo general soil map unit east of Interstate Highway 35 and the Ruiz-Bobillo-Falfurrias general soil map unit west of Interstate Highway 35.

Carrizo Sand forms an aquifer that underlies the entire county and is the major source of irrigation and drinking water. The aquifer is recharged through the outcrop areas in northern Frio County and southern Medina County.

The Reklaw Formation crops out discontinuously as a thin band that runs east to west across the northern edge of the county, directly south of the Carrizo Sand. It is distinguished from the underlying and overlying formations by a higher content of clay in its section and by finer grained, more glauconitic sand, the grain size of which rarely exceeds 0.6 millimeter in diameter. The sediments of this formation were deposited in shallow water along a flat or gently inclined coastal plain. During the period of deposition, much less sand was washed into the sea and marine waters advanced landward, working over and burying the Carrizo sand with finer textured sediments (7). The Reklaw Formation is made of clay and some sandstone. The clay is calcareous and varicolored and contains gypsum crystals (selenite) along with some sandy clay and sandstone. The sandstone is crossbedded with some thin beds of ironstone and fissile shale. The formation is 200 to 800 feet thick (12, 13).

The Reklaw Formation underlies part of the Duval-Webb general soil map unit west of Interstate Highway 35 and part of the Poth-Miguel-Wilco and Duval-Goldfinch-Dilley general soil map units in the northeast corner of the county. Most of the soils overlying this formation have a sandy surface layer consisting of reworked or transported sediments derived from other formations.

Queen City Sand crops out nearly continuously in the northeastern quadrant of the county. It extends from an area roughly south of Farm Road 462 and east of the Frio River near Frio Town to the Atascosa County line (12, 13). It is largely a continental, fluviatile deposit laid down by meandering and shifting rivers on a flat coastal plain (7). The formation is made up of sandstone and siltstone and thin interbeds of clay. The sandstone is fine grained or medium grained, noncalcareous, massive, crossbedded, and light gray to olive green (12, 13). The sandstone strata in this formation are not easily distinguished from the underlying or overlying formations. Extensive outcrops of the siltstone members of this formation are in an area south of Farm Road 462, north of Farm Road 140, and east of San Miguel Creek. These sediments are in part gypsiferous and medium gray to brown and may have thin layers of sandstone and clay (7). The deposits are 500 to 650 feet thick (12, 13).

Queen City Sand underlies areas of the Duval-Webb, Zavco-Elmendorf-Campbellton, Duval, Duval-Goldfinch-Dilley, Poth-Miguel-Wilco, and Ruiz-Bobillo-Falfurrias general soil map units in the northeastern quadrant of the county. The siltstone members are more extensive in areas of the Zavco-Elmendorf-Campbellton general soil map unit than in areas of the other map units.

The Weches Formation crops out as a thin band that stretches northeast from an area north of Derby to the Atascosa County line directly north of Farm Road 140. As a result of faulting, some Weches Formation outcrops also are directly north and west of Pearsall and at Melon (12, 13). The formation consists of sandstone and some interbedded clay. The sandstone is mostly glauconite, a mineral that has a high content of iron. It is called greensand because of its pale green to yellowish brown color (7). This characteristic and an abundance of marine fossils distinguish the formation from the underlying and

overlying formations. The Weches Formation is interbedded with glauconitic clay. It is approximately 30 feet thick (12, 13). The sediments of the Weches Formation were deposited in moderately shallow, clear marine waters. Later, the seas deepened and little sediment of any kind was deposited. As a result, the iron-rich glauconite grains that formed the greensand and glauconitic clays precipitated (7). Because of the high content of iron, the outcrop weathers to hardened ironstone layers that are resistant to erosion. Therefore, this formation crops out on the summit and shoulder slopes of sandstone-capped hills and ridges.

The Weches Formation underlies the Duval-Goldfinch-Dilley general soil map unit and areas of the Duval-Webb, Duval, and Poth-Miguel-Wilco general soil map units in the central and eastern parts of the county.

Sparta Sand crops out as a thin band between Derby and Goldfinch. Because of some downfaulting, a small remnant is north and east of Pearsall. Sparta Sand is distinguished by a loose, unconsolidated makeup and by the absence of the ironstone and greensand of the Weches Formation. The number of marine fossils is much fewer than the number in the underlying and overlying deposits. The sediments of the Sparta Sand Formation are mostly continental in origin and are on beaches, on coastal plains, and in areas of fluviatile deposits (7). Sparta Sand is made up of quartz sandstone that is very fine grained or fine grained and is light gray to very pale orange and grayish brown. It is 150 to 250 feet thick (12, 13).

Sparta Sand underlies areas of the Duval-Goldfinch-Dilley, Duval, Duval-Webb, and Poth-Miguel-Wilco general soil map units in the central and eastern parts of the county. It serves as an aquifer in places (7).

The Cook Mountain Formation crops out in the southeastern quadrant of the county, east of the Frio River and south of the outcrops of Sparta Sand (12, 13). Its strata are distinguished from the overlying and underlying formations because of a rich abundance of large marine fossils. The sediments of the Cook Mountain Formation show evidence of much variation in deposition. During periods of deposition, water levels changed from very shallow to deep and back to shallow. Deposition occurred in both exposed and inundated areas (7). The Cook Mountain Formation is made up of clay and sandstone. The clay is silty, brown to brownish gray or gray, and high in content of gypsum. The sandstone is calcareous, very fine grained, and gray to yellowish brown. This formation is 200 to 350 feet thick (12, 13).

The Cook Mountain Formation underlies areas of the Duval-Webb, Zavco-Elmendorf-Campbellton, Duval, and Webb-Zavco general soil map units in the southeast corner of the county.

The Laredo Formation crops out mainly in the southwestern quadrant of the county, south of the Leona River and west of the Frio River. It is distinguished from the adjacent Cook Mountain Formation by thicker sandstone strata. In most ways, its formation was very similar to that of the Cook Mountain Formation. The Laredo Formation is made up of very fine grained or fine grained, red and brown sandstone. It has some clay, which weathers to orange-yellow. The formation is 600 to 700 feet thick (12, 13).

The Laredo Formation underlies the Duval-Webb and Duval general soil map units.

Uvalde Gravel consists of discontinuous deposits in scattered areas throughout Frio County (12, 13). It is distinguished from the underlying sediments by a large percentage of gravel. It was deposited on exposed strata of various ages by ancient rivers. Because of erosion-resistant qualities, these gravel beds are now in areas of topographic highs, such as Pilot Knob, rather than in the present river valleys (4). According to one source, Uvalde Gravel deposits are made up almost entirely of siliceous cobbles and pebbles derived from Lower Cretaceous Formations (7). A more recent study of the pebbles indicates that the headwaters of all the drainage from the Southern Rocky Mountains were captured by the Pecos River of the Pleistocene Epoch (4). This river removed the sediments of the Ogallala Formation from an area approximately 510 miles wide and 300 miles long. All of this sandy and gravelly material must have been carried to the Gulf of Mexico or deposited along the way. The coarsest textured material was deposited in

upland river valleys. These gravelly valley deposits resisted erosion and persist today as fills. It is possible that the Uvalde Gravel deposits in Frio County were derived from a combination of sources. The deposits are made up of well rounded siliceous and limestone pebbles and cobbles and some silicified, or petrified, wood. A thick accumulation of calcium carbonate underlies the surface gravel in many areas. The gravel is 1 to 30 feet thick (12, 13).

Uvalde Gravel underlies the Hindes-Yologo-Olmos general soil map unit. It is an important source of gravel and caliche used locally as road building and foundation material.

Fluviatile terrace deposits are mainly on terraces along the major rivers and creeks in the county. They are distinguished from the adjacent formations by a level, benchlike topography and by unconsolidated sediments. They were laid down unconformably on strata of various ages by streams during the Pleistocene Epoch. The deposits are made up of clay, sand, silt, and gravel (12, 13). They are probably less than 100 feet thick. The thickness varies.

The Fluviatile terrace deposits underlie the Uvalde-Caid-Montell general soil map unit. The latest geological maps of the county erroneously indicate that they also underlie the Winterhaven-Bigfoot general soil map unit. This map unit is underlain by alluvium.

Alluvial deposits are in and adjacent to the major rivers and creeks and many of the smaller creeks and drainageways. They also are in depressions and on alluvial plains (12, 13). Alluvium is distinguished from the adjacent formations by its location on the bottom of river or stream valleys and by a generally level topography. It was deposited during the flooding of past and present streams. The sediments are made up of clay, silt, sand, and gravel. The source of the sediments varies and includes strata within the county and on the Edward's Plateau. These deposits are probably less than 100 feet thick. The thickness varies.

Alluvium underlies the Winterhaven-Bigfoot and Bigfoot-Divot general soil map units along the major rivers and creeks.

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Glossary

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. Soil having so high a degree of alkalinity 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 gravel, sand, silt, clay, or various mixtures of these, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cationexchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard or soft, thick beds just beneath the solum, or it is exposed at the surface by erosion. Some layers are laminar and indurated or strongly cemented. Fragments of caliche may be gravel, cobbles, or stones in the soil or on the soil surface.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). 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 in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (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.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons.

Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium is in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—layey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying 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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising prominently above the surrounding lower lands and having a well defined outline; generally considered to be less than 300 meters from base to summit.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an 0, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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 plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

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.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

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.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Knoll. A small, rounded hill.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments that are 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

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.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint*, *distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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 the soil may not adequately filter effluent from a waste disposal system.

Pebble. See Gravel.

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 1C square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Playa. The usually dry, nearly level lake plain that occupies the lowest parts of closed depressions. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not be characterized by a high water table and saline conditions.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The pH values in this survey were determined by the 1:1 water method unless otherwise indicated. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridge. A long, narrow elevation of the land surface. It generally is sharp crested and forms an extended upland between valleys.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sediment. Solid, clastic material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice, or mass wasting and has come to rest on the Earth's surface either above or below sea level.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The erosional slope on the side of a ridge or broad divide that leads down to a drainageway or valley floor. A side slope may include one or more geomorphic components of a hillslope as well as nose slopes and head slopes.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slope shape. The shape of the land surface at right angles to contours of equal elevation.

Slope wash. Soil and rock material moved down a slope predominantly by the action of gravity assisted by running water that is not confined to channels.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the dissected remnants of an abandoned flood plain, streambed, or valley floor produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind 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 and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Summit. The top of a hill, mountain, or rolling plain.

Surface layer. Technically, the A horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited in stream valleys by heavily loaded streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

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

The Tables in this soil survey contain information that affects land use planning in this survey area. Current data tables may be available within the Web Soil Survey.

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Pearsall, Texas)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	64.5	39.5	52.0	88	18	179	1.11	0.16	1.81	2	0.0
February	69.1	42.6	55.9	89	22	215	1.30	.44	2.01	3	.3
March	78.0	50.5	64.3	96	30	449	.82	.08	1.35	2	.0
April	84.9	59.4	72.2	101	39	666	2.21	.62	3.48	4	.0
May	89.0	65.2	77.1	101	50	840	3.71	1.09	5.82	5	.0
June	94.6	70.2	82.4	104	59	972	2.87	.60	4.66	3	.0
July	97.5	71.4	84.5	106	66	1,070	1.45	.07	2.43	3	.0
August	97.0	71.4	84.2	105	65	1,060	2.80	.27	4.70	3	.0
September	92.0	68.2	80.1	103	53	903	3.11	.61	5.03	4	.0
October	84.7	59.4	72.1	97	38	685	2.99	.47	4.91	3	.0
November	74.9	49.7	62.3	91	27	380	1.49	.23	2.46	3	.1
December	67.6	42.5	55.1	86	23	194	1.12	.21	1.81	3	.0
Yearly:											
Average	82.8	57.5	70.2	---	---	---	---	---	---	---	---
Extreme	---	---	---	107	17	---	---	---	---	---	---
Total	---	---	---	---	---	7,613	24.98	16.54	32.13	38	.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Pearsall, 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--	Feb. 17	Mar. 8	Mar. 12
2 years in 10 later than--	Feb. 9	Feb. 28	Mar. 6
5 years in 10 later than--	Jan. 22	Feb. 13	Feb. 22
First freezing temperature in fall:			
1 year in 10 earlier than--	Dec. 5	Nov. 27	Nov. 13
2 years in 10 earlier than--	Dec. 15	Dec. 4	Nov. 19
5 years in 10 earlier than--	Jan. 3	Dec. 19	Dec. 1

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Pearsall, 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	308	280	255
8 years in 10	318	290	264
5 years in 10	343	309	282
2 years in 10	>365	328	299
1 year in 10	>365	338	308

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AmA	Amphion sandy clay loam, 0 to 1 percent slopes	11,370	1.6
AmB	Amphion sandy clay loam, 1 to 3 percent slopes	8,110	1.1
An	Amphion sandy clay loam, occasionally flooded	5,860	0.8
ATC	Antosa-Bobillo complex, gently undulating	3,250	0.4
Bb	Bigfoot silty clay, occasionally flooded	10,890	1.5
Bf	Bigfoot silty clay, frequently flooded	7,910	1.1
BoB	Bookout clay loam, 1 to 3 percent slopes	1,750	0.2
BoC	Bookout clay loam, 3 to 5 percent slopes	480	0.1
BrA	Brystal very fine sandy loam, 0 to 1 percent slopes	2,680	0.4
BrB	Brystal very fine sandy loam, 1 to 3 percent slopes	24,450	3.4
CaA	Caid very fine sandy loam, 0 to 1 percent slopes	2,380	0.3
CaB	Caid very fine sandy loam, 1 to 3 percent slopes	6,900	1.0
CdA	Caid sandy clay loam, 0 to 1 percent slopes	10,630	1.5
CdB	Caid sandy clay loam, 1 to 3 percent slopes	11,200	1.5
CmA	Campbellton clay loam, 0 to 1 percent slopes	1,010	0.1
CmB	Campbellton clay loam, 1 to 3 percent slopes	8,990	1.2
CoB	Comitas loamy fine sand, 0 to 3 percent slopes	6,390	0.9
DED	Devine very gravelly sandy loam, rolling	3,260	0.4
DfC	Dilley fine sandy loam, 1 to 5 percent slopes	13,040	1.8
Do	Divot silty clay loam, occasionally flooded	6,360	0.9
Dt	Divot silty clay loam, frequently flooded	6,110	0.8
DuC	Duval loamy fine sand, 0 to 5 percent slopes	52,680	7.3
DvA	Duval very fine sandy loam, 0 to 1 percent slopes	21,720	3.0
DvB	Duval very fine sandy loam, 1 to 3 percent slopes	105,690	14.6
DvC	Duval very fine sandy loam, 3 to 5 percent slopes	7,940	1.1
EdA	Elmendorf-Denhawken complex, 0 to 1 percent slopes	6,420	0.9
EdB	Elmendorf-Denhawken complex, 1 to 3 percent slopes	11,740	1.6
GFD	Goldfinch very gravelly sandy loam, rolling	6,170	0.9
HYD	Hindes-Yologo complex, rolling	61,190	8.4
Im	Imogene very fine sandy loam, occasionally flooded	9,140	1.3
LaC	Lacoste very fine sandy loam, 1 to 5 percent slopes	10,920	1.5
LpA	Laparita clay loam, 0 to 1 percent slopes	3,330	0.5
MgA	Miguel very fine sandy loam, 0 to 1 percent slopes	6,700	0.9
MgB	Miguel very fine sandy loam, 1 to 3 percent slopes	11,200	1.5
MoA	Montell clay, 0 to 1 percent slopes	10,550	1.5
MtA	Monteola clay, saline, 0 to 1 percent slopes	1,420	0.2
MtB	Monteola clay, saline, 1 to 3 percent slopes	1,970	0.3
OMD	Olmos very gravelly loam, undulating	10,820	1.5
Pa	Pits	220	*
Pe	Poteet very fine sandy loam, occasionally flooded	25,950	3.6
PoB	Poth loamy fine sand, 0 to 3 percent slopes	18,860	2.6
Ra	Ramadero sandy clay loam, occasionally flooded	3,130	0.4
RBC	Ruiz-Falfurrias-Bobillo complex, gently undulating	3,250	0.4
ShD	Schattel clay loam, 1 to 8 percent slopes	8,110	1.1
Sn	Sinton clay loam, frequently flooded	970	0.1
Tc	Tiocano clay	2,490	0.3
UvA	Uvalde clay loam, 0 to 1 percent slopes	23,700	3.3
UvB	Uvalde clay loam, 1 to 3 percent slopes	9,180	1.3
VaB	Valco clay loam, 0 to 3 percent slopes	3,960	0.5
WeA	Webb very fine sandy loam, 0 to 1 percent slopes	12,940	1.8
WeB	Webb very fine sandy loam, 1 to 3 percent slopes	51,390	7.1
WeC	Webb very fine sandy loam, 3 to 5 percent slopes	840	0.1
WoB	Wilco loamy fine sand, 0 to 3 percent slopes	7,240	1.0
Wr	Winterhaven silty clay loam, occasionally flooded	14,160	2.0
Wv	Winterhaven silty clay loam, frequently flooded	2,180	0.3
ZaA	Zavco sandy clay loam, 0 to 1 percent slopes	18,740	2.6
ZaB	Zavco sandy clay loam, 1 to 3 percent slopes	25,074	3.5
	Total	725,004	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AmA	Amphion sandy clay loam, 0 to 1 percent slopes
AmB	Amphion sandy clay loam, 1 to 3 percent slopes
An	Amphion sandy clay loam, occasionally flooded
Bb	Bigfoot silty clay, occasionally flooded (where irrigated)
BoB	Bookout clay loam, 1 to 3 percent slopes (where irrigated)
BoC	Bookout clay loam, 3 to 5 percent slopes (where irrigated)
BrA	Brystal very fine sandy loam, 0 to 1 percent slopes
BrB	Brystal very fine sandy loam, 1 to 3 percent slopes
CaA	Caid very fine sandy loam, 0 to 1 percent slopes
CaB	Caid very fine sandy loam, 1 to 3 percent slopes
CdA	Caid sandy clay loam, 0 to 1 percent slopes
CdB	Caid sandy clay loam, 1 to 3 percent slopes
CmA	Campbellton clay loam, 0 to 1 percent slopes (where irrigated)
CmB	Campbellton clay loam, 1 to 3 percent slopes (where irrigated)
Do	Divot silty clay loam, occasionally flooded
DuC	Duval loamy fine sand, 0 to 5 percent slopes (where irrigated)
DvA	Duval very fine sandy loam, 0 to 1 percent slopes
DvB	Duval very fine sandy loam, 1 to 3 percent slopes
DvC	Duval very fine sandy loam, 3 to 5 percent slopes
EdA	Elmendorf-Denhawken complex, 0 to 1 percent slopes
EdB	Elmendorf-Denhawken complex, 1 to 3 percent slopes
MoA	Montell clay, 0 to 1 percent slopes (where irrigated)
Pe	Poteet very fine sandy loam, occasionally flooded
PoB	Poth loamy fine sand, 0 to 3 percent slopes (where irrigated)
Ra	Ramadero sandy clay loam, occasionally flooded
UvA	Uvalde clay loam, 0 to 1 percent slopes
UvB	Uvalde clay loam, 1 to 3 percent slopes
WeA	Webb very fine sandy loam, 0 to 1 percent slopes
WeB	Webb very fine sandy loam, 1 to 3 percent slopes
WeC	Webb very fine sandy loam, 3 to 5 percent slopes
WoB	Wilco loamy fine sand, 0 to 3 percent slopes (where irrigated)
Wr	Winterhaven silty clay loam, occasionally flooded (where irrigated)
ZaA	Zavco sandy clay loam, 0 to 1 percent slopes
ZaB	Zavco sandy clay loam, 1 to 3 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Grain sorghum		Cotton lint		Peanuts		Corn		Wheat		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Bu	Bu	AUM*	AUM*
AmA---Amphion	IIc	I	55	125	---	---	---	---	40	100	---	---	3.5	14
AmB---Amphion	IIe	IIe	50	100	---	---	---	---	35	90	---	---	3.0	14
An---Amphion	IIIw	IIIw	55	125	---	---	---	---	40	100	---	---	3.5	14
ATC**---Antosa-Bobillo	IVe	IVe	---	---	---	---	1,000	3,000	---	---	---	---	2.5	12
Bb---Bigfoot	IIw	IIw	---	---	---	---	---	---	---	---	---	---	4.5	12
Bf---Bigfoot	Vw	---	---	---	---	---	---	---	---	---	---	---	5.0	---
BoB---Bookout	IIIe	IIe	25	90	---	800	---	---	---	80	25	---	3.0	12
BoC---Bookout	IVe	IIIe	20	85	---	700	---	---	---	70	20	---	2.0	10
BrA---Brystal	IIIc	I	35	90	---	---	---	---	---	90	---	---	3.0	14
BrB---Brystal	IIIe	IIe	30	85	---	---	---	---	---	85	---	---	2.5	12
CaA---Caid	IIIc	I	35	110	---	1,000	---	---	---	95	30	55	3.0	14
CaB---Caid	IIIe	IIe	30	100	---	900	---	---	---	90	25	50	2.5	12
CdA---Caid	IIIc	I	35	110	---	1,000	---	---	---	95	30	55	3.0	14
CdB---Caid	IIIe	IIe	30	100	---	900	---	---	---	90	25	50	2.5	12
CmA---Campbellton	IIc	I	45	110	400	1,000	---	---	35	90	30	---	3.5	14
CmB---Campbellton	IIe	IIe	40	100	350	800	---	---	30	80	25	---	3.0	12
CoB---Comitas	IVe	IIIe	35	80	200	500	500	3,000	40	95	---	---	3.0	12
DED---Devine	VIs	VIs	---	---	---	---	---	---	---	---	---	---	2.5	---
DfC---Dilley	VIe	IVe	---	55	---	---	---	---	---	---	---	---	2.0	8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability		Grain sorghum		Cotton lint		Peanuts		Corn		Wheat		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Bu	Bu	AUM*	AUM*
Do---------- Divot	IIw	IIw	55	110	---	---	---	---	---	---	---	---	4.5	12
Dt---------- Divot	Vw	---	---	---	---	---	---	---	---	---	---	---	5.0	---
DuC---------- Duval	IIIe	IIIe	35	85	200	800	900	3,500	45	95	22	50	2.0	10
DvA---------- Duval	IIIc	I	45	105	250	1,000	1,000	4,000	55	95	30	55	3.0	14
DvB---------- Duval	IIIe	IIe	40	100	200	900	900	3,500	50	90	25	50	2.5	12
DvC---------- Duval	IIIe	IIIe	35	95	150	750	800	3,000	45	85	20	---	2.0	10
EdA**---------- Elmendorf-Denhawken	IIs	IIs	57	120	409	918	---	---	42	107	37	---	3.3	12
EdB**---------- Elmendorf-Denhawken	IIIe	IIIe	46	109	358	816	---	---	36	96	31	---	2.8	11
GFD---------- Goldfinch	VIIs	VIIs	---	---	---	---	---	---	---	---	---	---	1.5	---
HYD**---------- Hindes-Yologo	VIIs	---	---	---	---	---	---	---	---	---	---	---	---	---
Im---------- Imogene	IVs	IIIs	25	60	---	---	---	---	---	---	---	---	3.0	10
LaC---------- Lacoste	IVe	IIIe	25	50	---	---	---	---	---	---	---	---	3.5	7
LpA---------- Laparita	IIIc	IIs	35	75	---	---	---	---	---	---	---	---	3.5	12
MgA---------- Miguel	IIIs	IIIs	35	85	225	725	900	3,400	40	95	25	50	3.5	12
MgB---------- Miguel	IIIe	IIIe	30	75	200	600	800	3,000	35	90	22	50	3.0	12
MoA---------- Montell	IVs	IIIs	---	100	---	---	---	---	---	90	---	---	3.0	12
MtA---------- Monteola	IIIs	IIIs	40	90	300	750	---	---	---	---	---	---	3.0	12
MtB---------- Monteola	IVe	IVe	35	75	250	500	---	---	---	---	---	---	2.5	10
OMD---------- Olmos	VIIs	---	---	---	---	---	---	---	---	---	---	---	---	---
Pa**---------- Pits	VIIIs	---	---	---	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability		Grain sorghum		Cotton lint		Peanuts		Corn		Wheat		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Bu	Bu	AUM*	AUM*
Pe Poteet	IIw	IIw	50	100	500	1,000	---	---	35	100	30	55	5.0	14
PoB Poth	IIIe	IIIe	35	90	250	500	1,000	3,500	25	95	22	50	6.0	10
Ra Ramadero	IIw	IIw	60	135	500	1,000	---	---	---	---	---	---	8.0	15
RBC** Ruiz-Falfurrias-Bobillo	VIe	IVe	---	---	---	---	---	---	---	---	---	---	---	10
ShD Schattel	VIe	---	---	---	---	---	---	---	---	---	---	---	1.5	---
Sn Sinton	Vw	---	---	---	---	---	---	---	---	---	---	---	6.0	---
Tc Tiocano	VIw	VIw	---	---	---	---	---	---	---	---	---	---	4.0	---
UvA Uvalde	IIIc	I	40	125	---	1,250	---	---	50	110	30	60	3.0	16
UvB Uvalde	IIIe	IIe	35	110	---	1,000	---	---	45	100	25	55	3.0	14
VaB Valco	IVe	IIIe	---	80	---	650	---	---	---	65	---	35	2.0	10
WeA Webb	IIIc	I	40	90	250	900	1,000	3,500	35	100	25	50	3.0	14
WeB Webb	IIIe	IIe	35	85	225	800	850	3,300	30	90	20	45	2.5	12
WeC Webb	IIIe	IIIe	30	80	200	750	700	3,200	25	85	18	40	2.5	12
WoB Wilco	IIIe	IIIe	40	90	250	750	1,250	3,600	30	95	22	50	6.0	14
Wr Winterhaven	IIIc	IIs	35	105	---	1,250	---	---	---	110	30	60	3.0	14
Wv Winterhaven	Vw	---	---	---	---	---	---	---	---	---	---	---	3.0	---
ZaA Zavco	IIIc	I	35	100	---	1,000	---	---	---	100	25	55	2.5	12
ZaB Zavco	IIIe	IIe	30	90	---	750	---	---	---	90	20	50	2.0	10

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
AmA, AmB---- Amphion	Clay Loam----	5,100	4,200	2,800
An---- Amphion	Ramadero----	5,800	4,200	3,000
ATC*:				
Antosa----	Sandy----	4,500	3,500	2,000
Bobillo----	Sandy----	4,500	3,500	2,000
Bb, Bf---- Bigfoot	Clayey Bottomland----	6,000	4,800	2,500
BoB, BoC---- Bookout	Clay Loam----	3,800	3,000	2,000
BrA, BrB---- Brystal	Sandy Loam----	4,000	3,500	2,200
CaA, CaB---- Caid	Gray Sandy Loam----	3,500	3,000	2,000
CdA, CdB---- Caid	Clay Loam----	3,800	3,200	2,000
CmA, CmB---- Campbellton	Saline Clay Loam----	3,600	2,700	1,800
CoB---- Comitas	Loamy Sand----	4,500	3,500	2,000
DED---- Devine	Gravelly Ridge----	3,000	2,200	1,000
DfC---- Dilley	Shallow Sandy Loam----	3,500	2,200	1,000
Do, Dt---- Divot	Loamy Bottomland----	7,000	6,000	4,000
DuC---- Duval	Loamy Sand----	4,300	3,900	2,000
DvA, DvB, DvC---- Duval	Sandy Loam----	4,200	3,600	2,100
EdA*, EdB*:				
Elmendorf----	Clay Loam----	4,000	3,300	2,200
Denhawken----	Clay Loam----	4,000	3,300	2,200
GFD---- Goldfinch	Gravelly Ridge----	3,000	2,000	1,000
HYD*:				
Hindes----	Gravelly Ridge----	3,200	1,900	1,100

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
HYD*:				
Yologo	Gravelly Ridge	2,600	1,800	1,100
Im	Tight Sandy Loam	3,700	3,000	1,600
Imogene				
LaC	Shallow Sandy Loam	3,300	2,500	1,400
Lacoste				
LpA	Claypan Prairie	3,000	2,500	1,500
Laparita				
MgA, MgB	Tight Sandy Loam	3,600	3,100	1,800
Miguel				
MoA	Clay Flat	4,500	3,300	1,600
Montell				
MtA, MtB	Saline Clay	4,000	3,000	1,500
Monteola				
OMD	Shallow Ridge	2,700	1,800	1,000
Olmos				
Pe	Loamy Bottomland	6,500	5,000	3,800
Poteet				
PoB	Loamy Sand	4,000	3,500	2,000
Poth				
Ra	Ramadero	6,000	5,000	2,500
Ramadero				
RBC*:				
Ruiz	Sandy	4,200	3,500	2,400
Falfurrias	Sand Hill	4,500	3,500	1,500
Bobillo	Sandy	4,500	3,500	2,000
ShD	Saline Clay Loam	3,000	2,000	1,500
Schattel				
Sn	Loamy Bottomland	7,000	6,000	4,000
Sinton				
Tc	Lakebed	5,300	4,300	3,100
Tiocano				
UvA, UvB	Clay Loam	4,500	3,300	2,100
Uvalde				
VaB	Shallow	3,000	1,900	1,300
Valco				
WeA, WeB, WeC	Tight Sandy Loam	3,900	3,100	2,200
Webb				
WoB	Loamy Sand	4,000	3,500	2,000
Wilco				

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Wr, Wv Winterhaven	Loamy Bottomland	6,600	4,800	2,500
ZaA, ZaB Zavco	Clay Loam	3,800	3,000	2,100

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AmA---------- Amphion	Slight	Slight	Slight	Slight	Slight.
AmB---------- Amphion	Slight	Slight	Moderate: slope.	Slight	Slight.
An---------- Amphion	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
ATC*: Antosa----------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
Bobillo----------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Bb---------- Bigfoot	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.	Severe: too clayey, excess lime.
Bf---------- Bigfoot	Severe: flooding.	Moderate: flooding, too clayey.	Severe: flooding.	Moderate: too clayey, flooding.	Severe: flooding, too clayey, excess lime.
BoB, BoC---------- Bookout	Slight	Slight	Moderate: slope.	Slight	Slight.
BrA---------- Brystal	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
BrB---------- Brystal	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
CaA---------- Caid	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
CaB---------- Caid	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
CdA---------- Caid	Slight	Slight	Slight	Slight	Slight.
CdB---------- Caid	Slight	Slight	Moderate: slope.	Slight	Slight.
CmA---------- Campbellton	Slight	Slight	Slight	Slight	Slight.
CmB---------- Campbellton	Slight	Slight	Moderate: slope.	Slight	Slight.
CoB---------- Comitas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
DED---------- Devine	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, droughty.
DfC---------- Dilley	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones, depth to rock.	Slight----------	Severe: droughty, depth to rock.
Do---------- Divot	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
Dt---------- Divot	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
DuC---------- Duval	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty, too sandy.
DvA---------- Duval	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
DvB, DvC---------- Duval	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
EdA*:					
Elmendorf----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight----------	Slight.
Denhawken----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight----------	Slight.
EdB*:					
Elmendorf----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
Denhawken----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
GFD---------- Goldfinch	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: small stones.	Severe: small stones, droughty, depth to rock.
HYD*:					
Hindes----------	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight----------	Severe: small stones.
Yologo----------	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.	Severe: small stones, cemented pan.
Im---------- Imogene	Severe: flooding, percs slowly, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight----------	Severe: excess sodium.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LaC Lacoste	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: cemented pan.
LpA Laparita	Slight	Slight	Slight	Slight	Severe: droughty.
MgA Miguel	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
MgB Miguel	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
MoA Montell	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey, excess sodium.
MtA Monteola	Moderate: percs slowly, too clayey, excess salt.	Moderate: too clayey, excess salt.	Moderate: excess salt, too clayey.	Moderate: too clayey.	Severe: too clayey.
MtB Monteola	Moderate: percs slowly, too clayey, excess salt.	Moderate: too clayey, excess salt.	Moderate: slope, excess salt, too clayey.	Moderate: too clayey.	Severe: too clayey.
OMD Olmos	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.	Severe: small stones, droughty, cemented pan.
Pa* Pits	Variable	Variable	Variable	Variable	Poor: droughty, slope, thin layer.
Pe Poteet	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
PoB Poth	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
Ra Ramadero	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
RBC*:					
Ruiz	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Severe: droughty.
Falfurrias	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Bobillo	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Severe: droughty.
ShD Schattel	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Sn Sinton	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Tc Tiocano	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, too clayey.
UvA Uvalde	Slight	Slight	Slight	Slight	Slight.
UvB Uvalde	Slight	Slight	Moderate: slope.	Slight	Slight.
VaB Valco	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: cemented pan.
WeA Webb	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
WeB, WeC Webb	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
WoB Wilco	Slight	Slight	Slight	Slight	Moderate: too sandy.
Wr Winterhaven	Severe: flooding.	Slight	Moderate: flooding.	Slight	Severe: excess lime.
Wv Winterhaven	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding, excess lime.
ZaA Zavco	Slight	Slight	Slight	Slight	Slight.
ZaB Zavco	Slight	Slight	Moderate: slope.	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AmA, AmB, An--- Amphion	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
ATC*:									
Antosa---	Fair	Fair	Fair	Good	Very poor	Poor	Fair	Very poor	Fair.
Bobillo---	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
Bb--- Bigfoot	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Bf--- Bigfoot	Very poor	Poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
BoB, BoC--- Bookout	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
BrA, BrB--- Brystal	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair.
CaA, CaB, CdA, CdB- Caid	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
CmA, CmB--- Campbellton	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
CoB--- Comitas	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
DED--- Devine	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
DfC--- Dilley	Fair	Poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor.
Do--- Divot	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Dt--- Divot	Very poor	Poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
DuC, DvA, DvB, DvC- Duval	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair.
EdA*:									
Elmendorf---	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Denhawken---	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
EdB*:									
Elmendorf---	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Denhawken---	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
GFD--- Goldfinch	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
HYD*:									
Hindes	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Yologo	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Im Imogene	Poor	Poor	Poor	Poor	Very poor	Poor	Poor	Very poor	Poor.
LaC Lacoste	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
LpA Laparita	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
MgA, MgB Miguel	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
MoA Montell	Poor	Poor	Fair	Fair	Very poor	Poor	Poor	Very poor	Fair.
MtA, MtB Monteola	Poor	Fair	Fair	Fair	Very poor	Poor	Fair	Very poor	Fair.
OMD Olmos	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Pa* Pits	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Pe Poteet	Fair	Good	Good	Good	Very poor	Poor	Fair	Very poor	Good.
PoB Poth	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Ra Ramadero	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
RBC*:									
Ruiz	Very poor	Very poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
Falfurrias	Very poor	Very poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
Bobillo	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
ShD Schattel	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Sn Sinton	Very poor	Poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
Tc Tiocano	Poor	Poor	Poor	Fair	Good	Good	Poor	Good	Poor.
UvA, UvB Uvalde	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
VaB Valco	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
WeA, WeB, WeC---Webb	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair.
WoB---Wilco	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Wr---Winterhaven	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Wv---Winterhaven	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
ZaA, ZaB---Zavco	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AmA, AmB Amphion	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
An Amphion	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
ATC*:						
Antosa	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Severe: droughty.
Bobillo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Bb Bigfoot	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: too clayey, excess lime.
Bf Bigfoot	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding, too clayey, excess lime.
BoB Bookout	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BoC Bookout	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
BrA, BrB Brystal	Slight	Slight	Slight	Slight	Slight	Slight.
CaA, CaB, CdA, CdB Caid	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CmA, CmB Campbellton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CoB Comitas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
DED Devine	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Slight	Severe: small stones, droughty.
DfC Dilley	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: droughty, depth to rock.
Do Divot	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Dt Divot	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding.
DuC Duval	Slight	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
DvA, DvB Duval	Slight	Slight	Slight	Slight	Slight	Slight.
DvC Duval	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
EdA*, EdB*:						
Elmendorf	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Denhawken	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
GFD Goldfinch	Severe: depth to rock.	Moderate: depth to rock, large stones.	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Moderate: depth to rock, large stones.	Severe: small stones, droughty, depth to rock.
HYD*:						
Hindes	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Slight	Severe: small stones.
Yologo	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: slope, cemented pan.	Moderate: cemented pan.	Severe: small stones, cemented pan.
Im Imogene	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: excess sodium.
LaC Lacoste	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.
LpA Laparita	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: droughty.
MgA, MgB Miguel	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
MoA Montell	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey, excess sodium.
MtA, MtB Monteola	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: droughty, too clayey.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OMD---------- Olmos	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Moderate: slope, cemented pan, large stones.	Moderate: cemented pan, large stones.	Severe: small stones, droughty, cemented pan.
Pa*---------- Pits	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Poor: droughty, slope, thin layer.
Pe---------- Poteet	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
PoB---------- Poth	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
Ra---------- Ramadero	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
RBC*:						
Ruiz----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
Falfurrias-------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
Bobillo----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
ShD---------- Schattel	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
Sn---------- Sinton	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Tc---------- Tiocano	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
UvA, UvB---------- Uvalde	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
VaB---------- Valco	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.
WeA, WeB---------- Webb	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
WeC---------- Webb	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
WoB---------- Wilco	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: too sandy.
Wr---------- Winterhaven	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: excess lime.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Wv---------- Winterhaven	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding, excess lime.
ZaA, ZaB---------- Zavco	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AmA---------- Amphion	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
AmB---------- Amphion	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
An---------- Amphion	Severe: flooding, percs slowly.	Slight----------	Severe: flooding.	Severe: flooding.	Poor: too clayey, hard to pack.
ATC*:					
Antosa----------	Severe: percs slowly, poor filter.	Severe: seepage.	Slight----------	Severe: seepage.	Good.
Bobillo----------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Bb, Bf---------- Bigfoot	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack, excess lime.
BoB, BoC---------- Bookout	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
BrA---------- Brystal	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
BrB---------- Brystal	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
CaA---------- Caid	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
CaB---------- Caid	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
CdA---------- Caid	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
CdB---------- Caid	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
CmA---------- Campbellton	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CmB---------- Campbellton	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
CoB---------- Comitas	Slight----------	Severe: seepage.	Slight----------	Slight----------	Good.
DED---------- Devine	Severe: percs slowly, poor filter.	Severe: seepage.	Slight----------	Severe: seepage.	Poor: seepage, small stones.
DfC---------- Dilley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Poor: depth to rock, thin layer.
Do, Dt---------- Divot	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
DuC---------- Duval	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight----------	Fair: depth to rock, thin layer.
DvA---------- Duval	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight----------	Fair: depth to rock, thin layer.
DvB, DvC---------- Duval	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight----------	Fair: depth to rock, thin layer.
EdA*:					
Elmendorf----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Denhawken----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
EdB*:					
Elmendorf----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Denhawken----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
GFD---------- Goldfinch	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Slight----------	Poor: depth to rock, small stones, thin layer.
HYD*:					
Hindes----------	Severe: percs slowly.	Moderate: slope.	Slight----------	Slight----------	Poor: small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HYD*:					
Yologo	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan, too clayey.	Slight	Poor: cemented pan, small stones.
Im Imogene	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, excess sodium, excess salt.	Severe: flooding.	Poor: excess salt, excess sodium.
LaC Lacoste	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan, thin layer.
LpA Laparita	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MgA Miguel	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
MgB Miguel	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
MoA Montell	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MtA Monteola	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MtB Monteola	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
OMD Olmos	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Poor: cemented pan, small stones.
Pa* Pits	Variable	Variable	Variable	Variable	Poor: slope, thin layer.
Pe Poteet	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
PoB Poth	Severe: percs slowly.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Fair: too sandy.
Ra Ramadero	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
RBC*:					
Ruiz	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Severe: seepage.
Falfurrias	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RBC*:					
Bobillo	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
ShD Schattel	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: hard to pack.
Sn Sinton	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Tc Tiocano	Severe: ponding, wetness, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
UvA Uvalde	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
UvB Uvalde	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
VaB Valco	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: cemented pan, thin layer.
WeA Webb	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
WeB, WeC Webb	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
WoB Wilco	Severe: percs slowly.	Slight	Slight	Slight	Fair: too clayey.
Wr, Wv Winterhaven	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack, excess lime.
ZaA Zavco	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Poor: hard to pack.
ZaB Zavco	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Poor: hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "fair," "poor," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AmA, AmB, An Amphion	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ATC*:				
Antosa	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Bobillo	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Bb, Bf Bigfoot	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess lime.
BoB, BoC Bookout	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
BrA, BrB Brystal	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CaA, CaB, CdA, CdB Caid	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CmA, CmB Campbellton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CoB Comitas	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
DED Devine	Good	Improbable: excess fines.	Probable	Poor: small stones, area reclaim.
DfC Dilley	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Do, Dt Divot	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DuC, DvA, DvB, DvC Duval	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
EdA*, EdB*:				
Elmendorf	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Denhawken	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GFD---------- Goldfinch	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, thin layer.
HYD*:				
Hindes----------	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Yologo----------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, small stones, thin layer.
Im---------- Imogene	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
LaC---------- Lacoste	Poor: cemented pan, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, thin layer.
LpA---------- Laparita	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
MgA, MgB---------- Miguel	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MoA---------- Montell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MtA, MtB---------- Monteola	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
OMD---------- Olmos	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, small stones.
Pa*---------- Pits	Poor: thin layer.	Variable----------	Variable----------	Poor: thin layer, slope.
Pe---------- Poteet	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
PoB---------- Poth	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Ra---------- Ramadero	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
RBC*:				
Ruiz----------	Good----------	Probable----------	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RBC*:				
Falfurrias	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Bobillo	Good	Probable	Improbable: too sandy.	Fair: too sandy.
ShD Schattel	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Sn Sinton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Tc Tiocano	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
UvA, UvB Uvalde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
VaB Valco	Poor: cemented pan, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, thin layer.
WeA, WeB, WeC Webb	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WoB Wilco	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Wr, Wv Winterhaven	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess lime.
ZaA, ZaB Zavco	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
AmA, AmB Amphion	Slight	Moderate: hard to pack.	Favorable	Favorable	Favorable.
An Amphion	Slight	Moderate: hard to pack.	Flooding	Favorable	Favorable.
ATC*:					
Antosa	Severe: seepage.	Slight	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Bobillo	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Bb, Bf Bigfoot	Slight	Severe: hard to pack.	Slow intake, flooding, excess lime.	Favorable	Excess lime.
BoB Bookout	Moderate: seepage.	Slight	Favorable	Favorable	Favorable.
BoC Bookout	Moderate: seepage, slope.	Slight	Slope	Favorable	Favorable.
BrA, BrB Brystal	Moderate: seepage.	Moderate: piping.	Soil blowing	Soil blowing	Favorable.
CaA, CaB Caid	Moderate: seepage.	Slight	Soil blowing	Soil blowing	Too arid.
CdA, CdB Caid	Moderate: seepage.	Slight	Favorable	Favorable	Too arid.
CmA, CmB Campbellton	Moderate: seepage.	Moderate: hard to pack, excess salt.	Excess salt	Favorable	Favorable.
CoB Comitas	Severe: seepage.	Severe: piping.	Droughty, fast intake, soil blowing.	Soil blowing	Too arid, droughty.
DED Devine	Severe: seepage.	Severe: seepage.	Slope, droughty.	Favorable	Droughty.
DfC Dilley	Severe: depth to rock.	Severe: thin layer.	Droughty, soil blowing, depth to rock.	Depth to rock, soil blowing.	Too arid, droughty, depth to rock.
Do, Dt Divot	Slight	Moderate: hard to pack.	Flooding	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
DuC---------- Duval	Moderate: seepage, depth to rock.	Moderate: thin layer.	Fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DvA, DvB---------- Duval	Moderate: seepage, depth to rock.	Moderate: thin layer.	Soil blowing-----	Soil blowing-----	Favorable.
DvC---------- Duval	Moderate: seepage, depth to rock, slope.	Moderate: thin layer.	Slope, soil blowing.	Soil blowing-----	Favorable.
EdA*, EdB*:					
Elmendorf--------	Slight----------	Moderate: hard to pack.	Percs slowly-----	Percs slowly-----	Percs slowly.
Denhawken--------	Slight----------	Severe: hard to pack.	Percs slowly-----	Percs slowly-----	Percs slowly.
GFD---------- Goldfinch	Severe: depth to rock.	Severe: large stones, thin layer.	Slope, droughty, depth to rock.	Large stones, depth to rock.	Too arid, large stones, droughty.
HYD*:					
Hindes----------	Severe: seepage.	Moderate: thin layer, large stones.	Slope, droughty.	Large stones-----	Large stones, droughty.
Yologo----------	Severe: cemented pan, seepage.	Severe: thin layer.	Slope, droughty, cemented pan.	Cemented pan-----	Droughty, cemented pan.
Im---------- Imogene	Slight----------	Severe: excess sodium, excess salt.	Droughty, percs slowly, excess salt.	Erodes easily, soil blowing, percs slowly.	Excess sodium, erodes easily, droughty.
LaC---------- Lacoste	Severe: cemented pan.	Severe: thin layer.	Slope, soil blowing, cemented pan.	Cemented pan, soil blowing.	Droughty, cemented pan.
LpA---------- Laparita	Slight----------	Moderate: hard to pack, excess salt.	Droughty, excess salt.	Favorable--------	Droughty.
MgA, MgB---------- Miguel	Slight----------	Slight----------	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
MoA---------- Montell	Slight----------	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Percs slowly-----	Droughty, percs slowly, excess sodium.
MtA, MtB---------- Monteola	Slight----------	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Excess salt, erodes easily, droughty.
OMD---------- Olmos	Severe: cemented pan, seepage.	Moderate: large stones.	Slope, large stones, droughty.	Large stones, cemented pan.	Large stones, droughty, cemented pan.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Pa* Pits	Variable	Variable	Variable	Variable	Variable.
Pe Poteet	Moderate: seepage.	Slight	Soil blowing, flooding.	Soil blowing	Favorable.
PoB Poth	Severe: seepage.	Severe: piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, percs slowly.
Ra Ramadero	Moderate: seepage.	Moderate: piping.	Flooding	Favorable	Favorable.
RBC*:					
Ruiz	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Falfurrias	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Bobillo	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
ShD Schattel	Slight	Severe: hard to pack.	Slope, droughty, percs slowly.	Percs slowly	Percs slowly, droughty, rooting depth.
Sn Sinton	Severe: seepage.	Severe: piping.	Flooding	Favorable	Favorable.
Tc Tiocano	Slight	Severe: hard to pack, ponding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
UvA, UvB Uvalde	Moderate: seepage.	Slight	Favorable	Favorable	Too arid.
VaB Valco	Severe: cemented pan, seepage.	Severe: thin layer.	Droughty, cemented pan.	Cemented pan	Droughty, cemented pan.
WeA, WeB Webb	Moderate: seepage.	Moderate: piping.	Erodes easily, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
WeC Webb	Moderate: seepage, slope.	Moderate: piping.	Erodes easily, soil blowing.	Erodes easily, soil blowing, percs slowly.	Erodes easily.
WoB Wilco	Moderate: seepage.	Moderate: piping.	Fast intake, soil blowing.	Too sandy, soil blowing.	Percs slowly.
Wr, Wv Winterhaven	Moderate: seepage.	Severe: hard to pack.	Erodes easily, flooding, excess lime.	Erodes easily	Erodes easily, excess lime.
ZaA, ZaB Zavco	Moderate: seepage.	Moderate: hard to pack.	Favorable	Favorable	Too arid.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
AmA, AmB---------- Amphion	0-20	Sandy clay loam, clay loam.	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	25-40	8-20
	20-36	Clay, clay loam	CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	50-95	34-57	20-32
	36-63	Sandy loam, clay, sandy clay loam.	CL	A-6, A-7-6	0	90-100	90-100	80-100	50-95	30-50	11-27
An---------- Amphion	0-20	Sandy clay loam	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	25-40	8-20
	20-36	Clay, clay loam	CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	50-95	34-57	20-32
	36-63	Clay loam, clay, sandy clay loam.	CL	A-6, A-7-6	0	90-100	90-100	80-100	50-95	30-50	11-27
ATC*:											
Antosa----------	0-26	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	90-100	50-75	5-30	<25	NP-5
	26-54	Sandy clay, sandy clay loam.	SC	A-2-6, A-6, A-7-6	0	95-100	90-100	80-100	20-50	25-43	11-27
	54-72	Sandy clay loam, sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	0-5	90-100	85-100	80-100	18-48	18-35	7-22
Bobillo----------	0-52	Sand, loamy sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-75	5-30	<25	NP-3
	52-74	Sandy clay loam, sandy loam.	SC	A-2-6, A-6	0-5	90-100	85-100	80-100	20-50	25-40	11-25
Bb, Bf---------- Bigfoot	0-9	Silty clay-------	CH	A-7-6	0	100	100	95-100	90-100	51-62	24-34
	9-63	Silty clay, clay	CH, MH	A-7-6, A-7-5	0	100	100	95-100	90-100	51-65	22-35
BoB, BoC---------- Bookout	0-16	Clay loam--------	CL	A-6, A-7-6	0	90-100	85-100	75-100	60-90	31-48	13-25
	16-62	Clay loam, clay	CL	A-6, A-7-6	0	90-100	85-100	75-100	70-95	31-48	15-25
BrA, BrB---------- Brystal	0-10	Very fine sandy loam.	CL, CL-ML, ML, SC	A-4, A-6	0	80-100	75-100	70-100	36-65	<30	NP-12
	10-30	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, CL	A-4, A-6, A-2-4, A-2-6	0	80-100	75-100	70-100	30-65	27-40	8-20
	30-64	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, SM-SC, CL	A-2-4, A-2-6, A-4, A-6	0	80-100	75-100	60-100	30-85	20-40	7-23
CaA, CaB---------- Caid	0-11	Very fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	85-100	50-70	<36	NP-18
	11-32	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-100	40-80	30-45	15-30
	32-72	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	90-100	90-100	80-100	45-90	30-50	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
CdA, CdB--------- Caid	0-17 17-38 38-72	Sandy clay loam Sandy clay loam, clay loam. Sandy clay loam, clay loam.	SC, CL SC, CL SC, CL	A-6, A-4 A-6, A-7-6 A-6, A-7-6	0 0 0	95-100 95-100 90-100	95-100 95-100 90-100	90-100 80-100 80-100	36-60 40-80 45-90	20-35 30-45 30-50	8-18 15-30 15-30
CmA, CmB--------- Campbellton	0-12 12-48 48-60	Clay loam-------- Clay loam, clay Clay loam, loam, clay.	CL CL, CH CL	A-6 A-7-6 A-6, A-7-6	0 0 0	98-100 98-100 98-100	95-100 95-100 95-100	80-95 85-98 80-95	60-80 70-90 60-80	30-40 41-55 30-45	11-20 20-30 11-22
CoB--------- Comitas	0-30 30-80	Loamy fine sand Fine sandy loam, sandy clay loam.	SM, SM-SC SM, SC, SM-SC	A-2-4 A-2-4, A-2-6, A-4, A-6	0 0	95-100 95-100	95-100 90-100	85-100 80-100	15-25 23-50	<25 <34	NP-4 NP-14
DED--------- Devine	0-38 38-62	Very gravelly sandy loam. Extremely gravelly sandy clay, extremely gravelly clay, very gravelly clay, very gravelly sandy clay.	GM, GP-GM GC	A-1 A-2	0-5 5-10	20-55 20-55	10-50 15-45	10-40 15-40	8-25 15-35	<25 35-50	NP-3 18-30
DfC--------- Dilley	0-6 6-12 12-60	Fine sandy loam Fine sandy loam, sandy clay loam, gravelly sandy loam, gravelly sandy clay loam. Unweathered bedrock.	SM, SM-SC SC, SM-SC, GC ---	A-2-4, A-4 A-4, A-6 ---	0-10 0-10 ---	75-100 65-100 ---	70-100 60-100 ---	70-85 60-85 ---	25-40 36-50 ---	<25 20-30 ---	NP-7 7-15 ---
Do, Dt--------- Divot	0-72	Silty clay loam, clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	75-100	75-100	70-95	40-55	19-30
DuC--------- Duval	0-18 18-36 36-44 44-62	Loamy fine sand Sandy clay loam, fine sandy loam, very fine sandy loam. Sandy clay loam, fine sandy loam, very fine sandy loam. Weathered bedrock	SM, SM-SC SC SC, SM-SC ---	A-2-4 A-4, A-6 A-2-4, A-2-6, A-4, A-6 ---	0 0 0 ---	80-100 80-100 80-100 ---	75-100 75-100 70-100 ---	75-100 75-100 60-95 ---	15-30 36-50 25-50 ---	<25 26-40 20-35 ---	NP-7 9-19 4-15 ---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
DvA, DvB, DvC---- Duval	0-16	Very fine sandy loam.	ML, CL-ML, CL, SM-SC	A-4	0	80-100	75-100	75-100	36-65	<30	NP-10
	16-44	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC	A-4, A-6	0	80-100	75-100	75-100	36-50	26-40	9-19
	44-52	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0	80-100	70-100	60-95	25-50	20-35	4-15
	52-72	Weathered bedrock	---	---	---	---	---	---	---	---	---
EdA*, EdB*:											
Elmendorf-------	0-8	Clay loam--------	CL	A-6, A-7	0-2	95-100	90-100	90-100	65-90	30-50	15-28
	8-42	Clay loam, clay	CH, CL	A-7	0-2	95-100	90-100	90-100	70-95	45-65	25-40
	42-63	Clay loam, clay	CH, CL	A-7	0-2	95-100	90-100	90-100	70-95	45-60	25-36
Denhawken-------	0-6	Clay loam--------	CL, CH	A-6, A-7	0-2	95-100	90-100	90-100	60-90	35-55	16-33
	6-39	Clay loam, clay	CH, CL	A-7	0-2	95-100	90-100	85-100	60-90	40-60	20-38
	39-52	Clay loam, clay	CH, CL	A-7	0-2	95-100	90-100	85-100	70-95	48-68	25-43
	52-63	Clay loam, clay	CH, CL	A-7	0-2	95-100	90-100	85-100	70-95	48-68	25-43
GFD---------- Goldfinch	0-8	Very gravelly sandy loam.	GC, GM, SM, SC	A-2, A-1, A-4	0-40	35-75	25-70	15-60	10-40	<30	NP-10
	8-16	Extremely gravelly sandy clay loam, very gravelly sandy clay loam, very cobbly sandy clay loam.	SC, GC, GP-GC, SP-SC	A-2-6, A-2-7	0-50	30-70	20-60	15-55	5-35	25-43	11-21
	16-48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HYD*:											
Hindes----------	0-9	Very gravelly loam.	GC, SC	A-2-6, A-4, A-6, A-2-4	0-20	35-95	35-50	35-50	30-50	<30	8-15
	9-32	Extremely gravelly clay, very gravelly clay loam, very gravelly clay.	GC, SC	A-2-7, A-7-6	0-20	20-70	20-50	20-45	15-45	41-52	20-28
	32-60	Variable---------	---	---	---	---	---	---	---	---	---
Yologo----------	0-6	Very gravelly loam.	GC, SC	A-2-4, A-2-6	0-5	35-70	25-50	20-50	15-35	25-35	8-15
	6-14	Very gravelly clay loam, very gravelly sandy clay loam, extremely gravelly clay loam.	GC, SC	A-2-6	0-10	20-65	15-50	14-50	13-35	30-40	11-20
	14-16	Indurated material.	---	---	---	---	---	---	---	---	---
	16-60	Variable---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
Im	0-5	Very fine sandy loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	100	95-100	70-95	40-70	<30	NP-15
Imogene	5-12	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-6, A-7-6	0	100	95-100	80-100	45-75	26-48	11-24
	12-40	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	90-100	75-95	40-70	26-43	11-25
	40-74	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	85-100	75-95	40-70	26-37	11-21
LaC	0-10	Very fine sandy loam.	ML, CL-ML, CL	A-4	0-5	80-100	80-100	65-100	36-70	<28	NP-10
Lacoste	10-17	Sandy clay loam, fine sandy loam.	SC, CL	A-2-4, A-2-6, A-4, A-6	0-5	80-100	75-100	65-90	30-55	25-35	8-15
	17-60	Cemented material	---	---	---	---	---	---	---	---	---
LpA	0-6	Clay loam--------	CL	A-4, A-6	0	98-100	95-100	80-95	50-80	25-40	8-20
Laparita	6-30	Clay, clay loam	CL, CH	A-7-6	0	98-100	95-100	85-95	60-90	41-55	20-30
	30-63	Clay, clay loam	CL, CH	A-6, A-7-6	0	98-100	95-100	80-95	55-80	35-55	18-28
MgA, MgB	0-18	Very fine sandy loam.	CL, CL-ML, ML, SM	A-4	0	90-100	90-100	85-100	36-66	<28	NP-10
Miguel	18-40	Sandy clay, clay	CL, SC, CH	A-7-6	0	95-100	95-100	90-100	45-70	41-55	20-32
	40-66	Sandy clay loam, sandy clay.	CL, SC	A-6, A-7-6	0	95-100	90-100	90-100	36-70	30-50	15-28
MoA	0-10	Clay----------	CH	A-7-6	0	80-100	75-100	75-100	75-100	51-70	29-46
Montell	10-42	Clay----------	CH	A-7-6	0	80-100	75-100	75-100	75-100	51-70	29-46
	42-74	Clay----------	CH	A-7-6	0	80-100	75-100	75-100	70-100	51-73	29-49
MtA, MtB	0-9	Clay----------	CH	A-7-6	0-3	80-100	80-100	80-100	75-90	51-75	30-50
Monteola	9-30	Clay----------	CH	A-7-6	0-3	90-100	80-100	75-100	75-96	56-80	33-54
	30-72	Clay----------	CH	A-7-6	0-3	90-100	80-100	75-100	75-96	56-80	33-54
OMD	0-14	Very gravelly loam.	GC, GM-GC, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0-30	35-75	25-55	25-55	20-50	25-35	7-15
Olmos	14-18	Cemented material	---	---	---	---	---	---	---	---	---
	18-60	Variable---------	---	---	---	---	---	---	---	---	---
Pa*	0-80	Variable---------	---	---	---	---	---	---	---	---	---
Pits											
Pe	0-34	Very fine sandy loam.	ML, CL-ML, CL, SM	A-4	0	90-100	90-100	85-100	36-65	<29	NP-10
Poteet	34-58	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-6, A-7-6	0	95-100	95-100	90-100	40-55	32-45	15-23
	58-62	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-6, A-7-6	0	95-100	90-100	85-100	36-55	30-43	14-22

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
PoB---------- Poth	0-30	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	95-100	60-100	20-40	<25	NP-7
	30-58	Sandy clay, clay	CL, SC, CH	A-7	0	90-100	90-100	70-100	45-60	41-59	20-34
	58-64	Sandy clay loam, clay loam.	CL, SC	A-4, A-6, A-7	0	85-100	80-100	65-100	36-57	25-50	8-27
Ra---------- Ramadero	0-22	Sandy clay loam	CL, SC	A-6, A-4	0	100	100	85-100	45-65	27-39	9-19
	22-60	Sandy clay loam, clay loam, loam.	CL, SC	A-6, A-7-6	0	100	95-100	90-100	45-65	32-42	13-21
RBC*:											
Ruiz----------	0-48	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-75	5-35	<25	NP-3
	48-80	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-75	5-35	<25	NP-3
Falfurrias------	0-80	Sand, loamy sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-75	5-30	<25	NP-4
Bobillo---------	0-52	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-75	5-30	<25	NP-3
	52-74	Sandy clay loam, sandy loam.	SC	A-2-6, A-6	0-5	90-100	85-100	80-100	20-50	25-40	11-25
ShD---------- Schattel	0-6	Clay loam--------	CL	A-6, A-7-6	0-5	80-100	75-100	70-100	55-80	36-48	16-25
	6-44	Clay, clay loam	CL, CH	A-7-6	0	80-100	75-100	70-100	65-95	43-62	21-36
	44-63	Clay, clay loam	CL, CH	A-7-6	0	90-100	85-100	65-100	60-95	48-70	27-48
Sn---------- Sinton	0-34	Clay loam--------	CL	A-4, A-6	0	100	95-100	85-100	50-80	27-40	9-20
	34-62	Stratified loamy fine sand to clay loam.	SM, SC, ML, CL	A-2-4, A-2-6, A-4, A-6	0	100	90-100	50-100	20-52	<30	NP-14
Tc---------- Tiocano	0-68	Clay----------	CH	A-7-6	0	100	100	95-100	85-100	56-76	33-49
UvA, UvB--------- Uvalde	0-18	Clay loam--------	CL	A-6, A-7	0-2	95-100	95-100	90-98	80-95	38-49	20-30
	18-62	Clay loam, silty clay loam.	CL	A-6, A-7	0-2	95-100	95-100	90-98	80-95	38-49	20-30
VaB---------- Valco	0-18	Clay loam, gravelly clay loam.	CL	A-6, A-7-6	0-2	90-100	85-100	70-95	51-75	34-43	14-21
	18-21	Cemented material	---	---	---	---	---	---	---	---	---
	21-60	Variable---------	---	---	---	---	---	---	---	---	---
WeA, WeB, WeC---- Webb	0-10	Very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-2	90-100	90-100	85-100	30-65	<30	NP-10
	10-19	Sandy clay, clay, clay loam.	CL	A-6, A-7-6	0-2	95-100	90-100	90-100	51-80	37-50	20-30
	19-72	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, CL	A-6, A-7-6	0-2	95-100	90-100	90-100	45-80	30-50	12-28
	72-80	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
WoB----------	0-16	Loamy fine sand	SM, SM-SC	A-2-4	0-2	95-100	95-100	80-100	13-30	<26	NP-7
Wilco	16-29	Sandy clay, clay, clay loam.	CL, CH, SC	A-7-6, A-6	0-2	95-100	95-100	80-100	48-65	38-55	18-31
	29-42	Sandy clay loam, sandy clay.	CL, SC	A-6, A-7-6	0-2	95-100	95-100	80-100	36-60	39-48	17-25
	42-72	Fine sandy loam, sandy clay loam.	CL, SC	A-2-6, A-6, A-2-7, A-7	0-2	90-100	90-100	80-100	30-60	28-45	11-25
Wr, Wv----------	0-11	Silty clay loam	CL, ML, MH, CH	A-6, A-7-6	0	100	100	95-100	80-100	38-59	10-30
Winterhaven	11-32	Silty clay loam, silt loam.	CL, ML, MH, CH	A-6, A-7-6	0	98-100	95-100	95-100	85-100	38-59	10-30
	32-60	Stratified silt loam to clay loam.	CL, ML, MH, CH	A-6, A-7-6	0	98-100	95-100	90-100	75-100	38-59	10-30
ZaA, ZaB----------	0-16	Sandy clay loam	SC, CL	A-4, A-6	0	95-100	95-100	80-100	40-65	25-40	8-22
Zavco	16-58	Sandy clay, clay, clay loam.	SC, CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	45-75	38-58	18-35
	58-72	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	85-100	80-100	70-100	45-65	34-45	15-25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
AmA, AmB	0-20	20-34	1.35-1.55	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	0.32	5	5	1-3
Amphion	20-36	35-50	1.40-1.60	0.2-0.6	0.13-0.17	6.6-8.4	<2	Moderate	0.32			
	36-63	30-50	1.40-1.60	0.2-0.6	0.12-0.17	7.4-8.4	<4	Moderate	0.28			
An	0-20	20-34	1.35-1.55	0.6-2.0	0.15-0.20	6.6-8.4	<2	Moderate	0.32	5	5	1-3
Amphion	20-36	35-50	1.40-1.60	0.2-0.6	0.13-0.17	6.6-8.4	<2	Moderate	0.32			
	36-63	30-50	1.40-1.55	0.2-0.6	0.09-0.17	7.4-8.4	<4	Moderate	0.28			
ATC*:												
Antosa	0-26	2-10	1.50-1.65	6.0-20.0	0.02-0.10	5.6-7.3	<2	Low	0.15	5	1	<1
	26-54	28-40	1.45-1.70	0.2-0.6	0.12-0.17	5.6-7.3	<2	Moderate	0.32			
	54-72	18-34	1.45-1.70	0.2-0.6	0.11-0.16	6.6-8.4	<2	Moderate	0.32			
Bobillo	0-52	2-10	1.50-1.65	6.0-20.0	0.02-0.10	5.6-7.3	<2	Low	0.15	5	1	<1
	52-74	15-32	1.40-1.65	0.6-2.0	0.11-0.17	6.1-7.8	<2	Moderate	0.32			
Bb, Bf	0-9	40-55	1.10-1.40	0.2-0.6	0.14-0.18	7.4-8.4	<2	High	0.32	5	4	1-4
Bigfoot	9-63	40-55	1.25-1.45	0.2-0.6	0.12-0.18	7.4-8.4	<2	Moderate	0.32			
BoB, BoC	0-16	28-40	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	0.32	5	4L	<1
Bookout	16-62	32-50	1.35-1.55	0.6-2.0	0.12-0.20	7.4-8.4	<2	Moderate	0.28			
BrA, BrB	0-10	7-19	1.40-1.70	0.6-2.0	0.13-0.18	6.6-7.8	<2	Low	0.32	5	3	<1
Brystal	10-30	18-32	1.45-1.70	0.6-2.0	0.11-0.19	6.6-8.4	<2	Low	0.32			
	30-64	15-32	1.50-1.75	0.6-2.0	0.11-0.19	7.4-8.4	<2	Low	0.32			
CaA, CaB	0-11	8-18	1.40-1.60	0.6-2.0	0.13-0.20	7.4-8.4	<2	Low	0.28	5	3	1-2
Caid	11-32	27-35	1.30-1.55	0.6-2.0	0.12-0.20	7.4-8.4	<2	Moderate	0.24			
	32-72	24-33	1.30-1.60	0.6-2.0	0.11-0.18	7.9-8.4	<2	Moderate	0.24			
CdA, CdB	0-17	20-29	1.40-1.60	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low	0.24	5	5	1-3
Caid	17-38	27-35	1.30-1.55	0.6-2.0	0.12-0.20	7.4-8.4	<2	Moderate	0.24			
	38-72	24-33	1.30-1.60	0.6-2.0	0.11-0.18	7.9-8.4	<2	Moderate	0.24			
CmA, CmB	0-12	27-30	1.40-1.65	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	0.32	5	5	1-3
Campbellton	12-48	35-48	1.45-1.70	0.2-0.6	0.09-0.18	7.4-8.4	2-8	Moderate	0.32			
	48-60	15-34	1.35-1.65	0.6-2.0	0.04-0.14	7.4-8.4	4-16	Moderate	0.32			
CoB	0-30	2-12	1.50-1.70	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low	0.17	5	2	<1
Comitas	30-80	6-24	1.45-1.70	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low	0.24			
DED	0-38	15-20	1.40-1.65	6.0-20	0.03-0.11	5.6-7.3	<2	Low	0.10	5	8	<2
Devine	38-62	35-50	1.35-1.60	0.2-0.6	0.03-0.12	5.6-7.8	<2	Low	0.10			
DfC	0-6	10-17	1.40-1.70	0.6-2.0	0.07-0.14	6.1-7.8	<2	Low	0.24	1	3	<1
Dilley	6-12	12-25	1.45-1.70	0.6-2.0	0.08-0.16	6.1-7.8	<2	Low	0.20			
	12-60	---	---	---	---	---	---	---	---			
Do, Dt	0-72	35-50	1.35-1.60	0.2-0.6	0.14-0.20	7.4-8.4	<2	High	0.32	5	4	1-4
Divot												
DuC	0-18	6-11	1.45-1.70	2.0-6.0	0.07-0.11	6.1-7.3	<2	Low	0.20	4	2	<1
Duval	18-36	18-34	1.45-1.70	0.6-2.0	0.11-0.18	6.1-7.8	<2	Low	0.32			
	36-44	16-32	1.45-1.70	0.6-2.0	0.11-0.18	6.1-8.4	<2	Low	0.32			
	44-62	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
DvA, DvB, DvC----	0-16	8-18	1.40-1.70	0.6-2.0	0.12-0.18	6.1-7.3	<2	Low-------	0.32	4	3	<1
Duval	16-44	18-34	1.45-1.70	0.6-2.0	0.11-0.18	6.1-7.8	<2	Low-------	0.32			
	44-52	16-32	1.45-1.70	0.6-2.0	0.11-0.19	6.1-8.4	<2	Low-------	0.32			
	52-72	---	---	---	---	---	---	----------	----			
EdA*, EdB*:												
Elmendorf-------	0-8	20-34	1.35-1.55	0.2-0.6	0.15-0.20	6.1-8.4	<2	Moderate	0.32	5	6	1-3
	8-42	35-50	1.30-1.60	<0.06	0.15-0.20	6.6-8.4	<2	High------	0.32			
	42-63	30-45	1.30-1.60	<0.06	0.04-0.18	7.4-8.4	2-16	High------	0.32			
Denhawken-------	0-6	30-45	1.20-1.50	0.2-0.6	0.13-0.18	7.4-8.4	<2	Moderate	0.32	5	6	1-3
	6-39	35-50	1.25-1.50	<0.06	0.14-0.18	7.9-8.4	<2	High------	0.32			
	39-52	35-55	1.35-1.60	<0.06	0.14-0.18	7.9-8.4	<4	High------	0.32			
	52-63	35-50	1.35-1.60	<0.06	0.04-0.15	7.9-8.4	2-16	High------	0.32			
GFD--------------	0-8	5-20	1.35-1.60	0.6-2.0	0.03-0.09	5.6-7.8	<2	Low-------	0.10	1	8	<1
Goldfinch	8-16	20-35	1.30-1.60	0.6-2.0	0.03-0.10	5.6-7.8	<2	Low-------	0.10			
	16-48	---	---	---	---	---	---	----------	----			
HYD*:												
Hindes----------	0-9	18-27	1.40-1.65	0.6-2.0	0.06-0.13	6.1-7.8	<2	Low-------	0.10	3	8	1-3
	9-32	35-55	1.25-1.45	0.2-0.6	0.02-0.13	6.1-7.8	<2	Low-------	0.10			
	32-60	---	---	---	---	---	---	----------	----			
Yologo----------	0-6	16-27	1.35-1.55	0.6-2.0	0.05-0.12	6.1-7.8	<2	Low-------	0.10	1	8	1-3
	6-14	20-35	1.35-1.60	0.6-2.0	0.05-0.10	6.1-7.8	<2	Low-------	0.10			
	14-16	---	---	---	---	---	---	----------	----			
	16-60	---	---	---	---	---	---	----------	----			
Im---------------	0-5	10-18	1.45-1.65	0.6-2.0	0.10-0.20	6.1-7.8	<4	Low-------	0.43	3	3	<1
Imogene	5-12	20-40	1.45-1.70	<0.06	0.05-0.12	6.6-8.4	4-16	Moderate	0.43			
	12-40	20-34	1.40-1.65	0.06-0.2	0.05-0.11	6.6-8.4	>8	Moderate	0.43			
	40-74	15-34	1.40-1.65	0.06-0.2	0.04-0.10	6.6-8.4	>8	Moderate	0.43			
LaC--------------	0-10	5-19	1.50-1.70	0.6-2.0	0.13-0.20	6.6-8.4	<2	Low-------	0.32	1	3	<1
Lacoste	10-17	15-25	1.35-1.60	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low-------	0.28			
	17-60	---	---	---	---	---	---	----------	----			
LpA--------------	0-6	27-32	1.40-1.70	0.6-2.0	0.12-0.20	6.1-7.3	<2	Moderate	0.32	5	6	1-3
Laparita	6-30	35-47	1.35-1.60	0.2-0.6	0.03-0.15	6.6-8.4	4-16	High------	0.32			
	30-63	35-45	1.35-1.65	0.2-0.6	0.03-0.10	7.9-8.4	8-16	High------	0.32			
MgA, MgB---------	0-18	10-20	1.50-1.70	0.6-2.0	0.13-0.20	6.1-7.3	<2	Low-------	0.43	5	3	<1
Miguel	18-40	35-50	1.35-1.65	<0.06	0.14-0.18	6.6-8.4	<2	Moderate	0.32			
	40-66	30-45	1.35-1.65	0.06-0.2	0.11-0.17	7.4-8.4	<2	Moderate	0.32			
MoA--------------	0-10	40-55	1.35-1.60	<0.06	0.10-0.18	7.4-8.4	<4	Very high	0.32	5	4	1-3
Montell	10-42	40-55	1.35-1.60	<0.06	0.06-0.16	7.4-8.4	<4	Very high	0.32			
	42-74	40-60	1.50-1.80	<0.06	0.02-0.10	7.4-8.4	4-16	Very high	0.32			
MtA, MtB---------	0-9	40-55	1.40-1.55	<0.06	0.06-0.15	7.4-8.4	<4	Very high	0.32	5	4	1-3
Monteola	9-30	40-60	1.40-1.70	<0.06	0.02-0.15	7.4-8.4	4-16	Very high	0.37			
	30-72	40-60	1.40-1.70	<0.06	0.02-0.12	7.4-8.4	4-16	Very high	0.37			
OMD--------------	0-14	12-27	1.35-1.60	0.6-2.0	0.05-0.10	7.4-8.4	<2	Low-------	0.10	1	8	1-4
Olmos	14-18	---	---	---	---	---	---	----------	----			
	18-60	---	---	---	---	---	---	----------	----			
Pa*--------------	0-80	---	---	---	0.01-0.10	6.6-8.4	<8	Low-------	0.10	1	8	---
Pits												

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Pe	0-34	10-20	1.40-1.65	0.6-2.0	0.12-0.20	5.6-7.8	<2	Low	0.32	5	3	1-3
Poteet	34-58	23-40	1.45-1.70	0.2-0.6	0.12-0.20	6.1-8.4	<2	Moderate	0.32			
	58-62	16-32	1.35-1.65	0.2-0.6	0.10-0.20	6.6-8.4	<2	Moderate	0.32			
PoB	0-30	2-12	1.50-1.70	2.0-6.0	0.07-0.11	5.6-7.3	<2	Low	0.20	5	2	<1
Poth	30-58	35-52	1.35-1.65	0.06-0.2	0.12-0.19	6.1-7.8	<2	Moderate	0.32			
	58-64	24-34	1.35-1.65	0.6-2.0	0.10-0.16	6.1-8.4	<2	Low	0.32			
Ra	0-22	20-34	1.45-1.60	0.6-2.0	0.14-0.19	6.6-8.4	<2	Moderate	0.28	5	5	1-4
Ramadero	22-60	25-34	1.45-1.65	0.6-2.0	0.15-0.20	6.6-8.4	<4	Moderate	0.32			
RBC*:												
Ruiz	0-48	3-5	1.50-1.65	6.0-20.0	0.02-0.09	6.1-7.3	<2	Low	0.15	5	1	<1
	48-80	3-7	1.50-1.70	6.0-20.0	0.09-0.10	6.1-7.8	<2	Low	0.15			
Falfurrias	0-80	1-9	1.50-1.65	6.0-20	0.02-0.08	6.1-7.3	<2	Low	0.15	5	1	<1
Bobillo	0-52	2-10	1.50-1.65	6.0-20.0	0.02-0.10	5.6-7.3	<2	Low	0.15	5	1	<1
	52-74	15-32	1.40-1.65	0.6-2.0	0.11-0.17	6.1-7.8	<2	Moderate	0.32			
ShD	0-6	27-40	1.15-1.35	0.6-2.0	0.11-0.18	7.4-8.4	<4	Moderate	0.32	2	6	5-2
Schattel	6-44	35-55	1.30-1.55	0.2-0.6	0.08-0.15	7.4-8.4	<8	High	0.32			
	44-63	35-60	1.65-1.80	0.06-0.2	0.03-0.08	7.4-8.4	4-16	High	0.37			
Sn	0-34	20-35	1.35-1.60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.28	5	5	1-3
Sinton	34-62	10-35	1.40-1.65	2.0-6.0	0.07-0.15	7.4-8.4	<2	Low	0.20			
Tc	0-68	40-60	1.35-1.60	<0.06	0.12-0.18	6.6-8.4	<4	Very high	0.32	5	4	1-3
Tiocano												
UvA, UvB	0-18	28-39	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	0.28	5	4L	1-3
Uvalde	18-62	28-50	1.25-1.55	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	0.28			
VaB	0-18	27-35	1.40-1.55	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	0.28	1	4L	1-3
Valco	18-21	---	---	---	---	---	---	---	---			
	21-60	---	---	---	---	---	---	---	---			
WeA, WeB, WeC	0-10	8-18	1.40-1.60	0.6-2.0	0.12-0.17	5.6-7.3	<2	Low	0.37	5	3	<1
Webb	10-19	35-45	1.40-1.60	0.2-0.6	0.15-0.20	6.1-7.3	<2	Moderate	0.32			
	19-72	18-35	1.30-1.60	0.6-2.0	0.10-0.18	6.6-8.4	<8	Moderate	0.32			
	72-80	---	---	---	---	---	---	---	---			
WoB	0-16	2-12	1.50-1.70	2.0-6.0	0.07-0.10	5.6-7.3	<2	Low	0.20	5	2	<1
Wilco	16-29	35-48	1.35-1.60	0.06-0.2	0.15-0.18	5.1-7.8	<2	Moderate	0.32			
	29-42	30-42	1.45-1.65	0.2-0.6	0.10-0.15	5.6-7.8	<2	Moderate	0.32			
	42-72	18-30	1.45-1.70	0.2-0.6	0.10-0.14	6.6-8.4	<2	Moderate	0.32			
Wr, Wv	0-11	22-38	1.10-1.40	0.6-2.0	0.14-0.20	7.4-8.4	<2	Moderate	0.43	5	4L	1-4
Winterhaven	11-32	22-39	1.20-1.45	0.6-2.0	0.13-0.20	7.4-8.4	<2	Moderate	0.43			
	32-60	22-39	1.30-1.55	0.6-2.0	0.12-0.20	7.4-8.4	<2	Moderate	0.43			
ZaA, ZaB	0-16	24-32	1.40-1.60	0.6-2.0	0.12-0.20	6.1-7.8	<2	Low	0.17	5	5	1-3
Zavco	16-58	35-45	1.40-1.60	0.2-0.6	0.12-0.18	6.6-8.4	<2	Moderate	0.20			
	58-72	24-45	1.35-1.55	0.6-2.0	0.06-0.15	7.4-8.4	<8	Moderate	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and terms such as "very brief" 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			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
AmA, AmB---------- Amphion	C	None--------	---	---	>60	---	---	---	High-----	Low.
An---------- Amphion	C	Occasional	Very brief	May-Sep	>60	---	---	---	High-----	Low.
ATC*:										
Antosa----------	B	None--------	---	---	>60	---	---	---	Moderate	Low.
Bobillo----------	B	None--------	---	---	>60	---	---	---	Moderate	Low.
Bb---------- Bigfoot	C	Occasional	Very brief	May-Sep	>60	---	---	---	High-----	Low.
Bf---------- Bigfoot	C	Frequent----	Very brief to brief.	May-Sep	>60	---	---	---	High-----	Low.
BoB, BoC---------- Bookout	C	None--------	---	---	>60	---	---	---	High-----	Low.
BrA, BrB---------- Brystal	B	None--------	---	---	>60	---	---	---	High-----	Low.
CaA, CaB, CdA, CdB---------- Caid	B	None--------	---	---	>60	---	---	---	High-----	Low.
CmA, CmB---------- Campbellton	C	None--------	---	---	>60	---	---	---	High-----	Low.
CoB---------- Comitas	A	None--------	---	---	>60	---	---	---	Low------	Low.
DED---------- Devine	C	None--------	---	---	>60	---	---	---	Moderate	Low.
DfC---------- Dilley	C	None--------	---	---	10-20	Soft	---	---	Low------	Low.
Do---------- Divot	C	Occasional	Very brief to brief.	May-Sep	>60	---	---	---	High-----	Low.
Dt---------- Divot	C	Frequent----	Very brief	May-Sep	>60	---	---	---	High-----	Low.
DuC, DvA, DvB, DvC---------- Duval	B	None--------	---	---	40-60	Soft	---	---	High-----	Low.
EdA*, EdB*:										
Elmendorf--------	D	None--------	---	---	>60	---	---	---	High-----	Low.
Denhawken--------	D	None--------	---	---	>60	---	---	---	High-----	Low.
GFD---------- Goldfinch	C	None--------	---	---	10-20	Soft	---	---	Moderate	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
HYD*:										
Hindes	C	None	---	---	>60	---	---	---	Moderate	Low.
Yologo	D	None	---	---	>60	---	7-20	Thin	Moderate	Low.
Im	C	Occasional	Very brief	May-Sep	>60	---	---	---	High	Moderate.
Imogene										
LaC	C	None	---	---	>60	---	10-20	Thin	Moderate	Low.
Lacoste										
LpA	C	None	---	---	>60	---	---	---	High	Low.
Laparita										
MgA, MgB	D	None	---	---	>60	---	---	---	High	Low.
Miguel										
MoA	D	None	---	---	>60	---	---	---	High	Moderate.
Montell										
MtA, MtB	D	None	---	---	>60	---	---	---	High	Low.
Monteola										
OMD	C	None	---	---	>60	---	10-20	Thin	High	Low.
Olmos										
Pa*	D	None	---	---	>60	---	---	---	High	Low.
Pits										
Pe	C	Occasional	Very brief	May-Sep	>60	---	---	---	High	Low.
Poteet										
PoB	C	None	---	---	>60	---	---	---	High	Low.
Poth										
Ra	B	Occasional	Very brief	May-Sep	>60	---	---	---	High	Low.
Ramadero										
RBC*:										
Ruiz	A	None	---	---	>60	---	---	---	Low	Low.
Falfurrias	A	None	---	---	>60	---	---	---	Low	Low.
Bobillo	B	None	---	---	>60	---	---	---	Moderate	Low.
ShD	C	None	---	---	>60	---	---	---	High	Low.
Schattel										
Sn	B	Frequent	Very brief	May-Sep	>60	---	---	---	Moderate	Low.
Sinton										
Tc**	D	None	---	---	>60	---	---	---	High	Low.
Tiocano										
UvA, UvB	B	None	---	---	>60	---	---	---	High	Low.
Uvalde										
VaB	C	None	---	---	>60	---	8-20	Thin	Moderate	Low.
Valco										

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					In		In			
WeA, WeB, WeC----- Webb	C	None--------	---	---	>60	---	---	---	High-----	Low.
WoB---------- Wilco	C	None--------	---	---	>60	---	---	---	High-----	Moderate.
Wr---------- Winterhaven	B	Occasional	Very brief	May-Sep	>60	---	---	---	Moderate	Low.
Wv---------- Winterhaven	B	Frequent----	Very brief to brief.	May-Sep	>60	---	---	---	Moderate	Low.
ZaA, ZaB---------- Zavco	C	None--------	---	---	>60	---	---	---	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

** This soil has a perched water table during the period September through May. The water table is 2 feet above to 6 feet below the surface.

TABLE 17.--CHEMICAL AND OTHER PROPERTIES OF SELECTED SOILS

(TR means trace)

Soil name and sample number	Depth	Horizon	Gypsum	Calcite	Dolomite	CO_3 as $CaCO_3$	Organic carbon	Cation-exchange capacity	pH H_2O (1:1)	pH $CaCl_2$ 0.01M (1:2)	Electrical conductivity	Exchangeable sodium
	In		Pct < 2 mm					Meq/100g			mmhos/cm	Pct
Bigfoot:[1, 2]												
(S83TX163-4)	44-49	Bk	---	37.6	2.9	40.7	1.61	---	---	---	---	---
Duval:[1, 3]												
(S79TX163-1)	0-7	Ap	---	---	---	---	0.36	6.3	6.5	5.8	---	---
	7-16	A	---	---	---	---	0.30	6.3	6.5	5.8	---	---
	16-22	Bt1	---	---	---	---	0.36	10.2	6.9	6.1	---	---
	22-34	Bt2	---	---	---	---	0.32	13.1	7.4	6.8	---	---
	34-44	Bt3	---	---	---	TR	0.30	14.6	7.7	7.3	---	---
	44-52	Bt4	---	---	---	2.0	0.27	14.0	7.9	7.5	---	---
	52-72	2Crk	---	---	---	13.0	0.11	8.0	8.1	7.9	---	---
Webb:[1, 2]												
(S82TX163-1)	0-10	A	---	---	---	---	0.67	8.2	6.1	---	0.2	1
	10-19	Bt	---	0.2	0.3	0.5	0.55	22.5	6.2	---	0.4	4
	19-26	Btk1	---	---	---	---	0.44	20.4	7.0	---	1.0	6
	26-38	Btk2	---	1.5	0.2	1.7	0.30	20.4	8.0	---	1.9	9
	38-50	Btk3	0.5	0.5	0.2	0.7	0.12	19.7	7.8	---	3.6	10
	50-65	Btyz1	4.5	---	---	---	0.10	18.8	7.4	---	6.0	8
	65-72	Btyz2	2.3	---	---	---	0.13	20.5	7.2	---	6.4	9
	72-80	2Crz	1.4	---	---	---	0.16	25.5	7.0	---	6.8	11
Winterhaven:[2]												
(S83TX163-1)	0-20	A	---	39.0	3.5	42.8	2.16	---	---	---	---	---

[1] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[2] Data determined by Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

[3] Data determined by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

TABLE 18.--PHYSICAL PROPERTIES OF SELECTED SOILS

(Dashes indicate that analyses were not made. COLE means coefficient of linear extensibility. TR means trace)

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2.0-1.0 mm)	Sand: Coarse (1.0-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2.0-0.05 mm)	Silt: Fine (0.02-0.002 mm)	Silt: Total (0.05-0.002 mm)	Clay: Fine (< 0.0002 mm)	Clay: Total (< 0.002 mm)	Clay: Carbonate (< 0.002 mm)	Coarse fraction (0.1-75.0 mm)	1/3 bar water content	COLE	Bulk density: 1/3 bar	Bulk density: Air-dry
	In		Pct (wt)											Pct (wt)	Pct (wt)	cm/cm	g/cc	g/cc
Campbellton:[1]																		
(S82TX163-3)	33-48	Btkz	0.3	0.4	0.4	13.1	14.8	29.0	---	30.4	---	40.6	7	---	---	---	---	---
Duval:[1, 2, 3]																		
(S79TX163-1)	0-7	Ap	TR	0.4	1.2	11.2	65.3	78.1	3.3	9.3	---	12.6	---	13	---	---	---	---
	7-16	A	0.3	0.3	1.2	11.1	65.7	78.6	3.7	9.2	---	12.2	---	13	---	---	---	---
	16-22	Bt1	0.2	0.3	1.2	9.5	59.3	70.5	4.1	9.0	---	20.5	---	11	---	---	---	---
	22-34	Bt2	1.2	0.5	0.9	8.4	54.8	65.8	4.5	9.1	---	25.1	---	17	---	---	---	---
	34-44	Bt3	0.8	0.5	0.9	7.3	54.3	63.8	4.9	9.9	---	26.3	---	16	---	---	---	---
	44-52	Bt4	0.2	0.5	0.7	5.7	58.4	65.5	5.8	9.3	---	25.2	1	17	---	---	---	---
	52-72	2Crk	2.0	2.5	1.9	3.3	67.4	77.1	11.4	14.7	---	8.2	3	51	---	---	---	---
Webb:[1, 3]																		
(S82TX163-1)	0-10	A	0.0	0.0	0.9	25.8	49.1	75.8	4.2	11.1	7.0	13.1	---	---	19.2	0.022	1.49	1.59
	10-19	Bt	0.3	0.2	0.7	17.3	33.8	52.3	4.1	8.3	32.7	39.4	---	---	25.6	0.078	1.46	1.83
	19-26	Btk1	0.1	0.2	0.7	19.2	38.3	58.5	3.6	8.4	25.8	33.1	---	---	23.9	0.065	1.55	1.87
	26-38	Btk2	0.6	0.5	0.7	17.3	39.8	58.9	3.0	9.2	22.8	31.9	---	---	23.1	0.061	1.48	1.77
	38-50	Btk3	0.2	0.3	0.8	19.3	40.0	60.6	3.0	8.3	20.5	31.1	---	---	23.8	0.055	1.50	1.76
	50-65	Btyz1	0.1	0.2	1.0	20.7	42.2	64.2	3.1	5.3	21.0	30.5	---	---	23.6	0.050	1.53	1.77
	65-72	Btyz2	0.2	0.1	0.6	17.9	43.3	62.1	3.6	6.8	19.6	31.1	---	---	27.8	0.060	1.37	1.63
	72-80	2Crz	0.1	0.1	0.2	8.7	50.4	59.5	6.5	9.1	14.5	31.4	---	---	31.7	0.055	1.33	1.56
Winterhaven:[1]																		
(S82TX163-1)	30-60	C	0.0	0.0	0.0	0.4	2.9	3.3	---	63.7	---	33.0	8	---	---	---	---	---

[1] Data determined by Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.
[2] Data determined by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.
[3] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit[1]	Plasticity index[1]	Specific gravity	Shrinkage		
			Percentage passing sieve--					Percentage smaller than--								
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		g/cc	Pct	Pct	
Bookout:[2]																
(THD81TX163-1)																
A---------- 8-16	A-7-6(19)	CL	100	100	100	98	77	69	43	27	44	25	2.63	17.0	12.8	1.88
Bk1---------- 16-32	A-6(14)	CL	100	100	100	98	75	67	40	22	39	21	2.68	16.0	11.5	1.91
Bk3---------- 44-62	A-6(13)	CL	100	100	99	97	73	63	36	22	36	20	2.66	15.0	10.6	1.92
Brystal:[2]																
(THD81TX163-2)																
A---------- 0-10	A-6(3)	CL	100	100	100	99	52	36	16	11	30	11	2.66	20.0	5.1	1.73
Btk3---------- 22-30	A-6(7)	CL	100	99	98	95	57	43	20	14	37	18	2.70	18.0	8.8	1.77
Btk5---------- 40-64	A-6(13)	CL	100	99	95	90	82	48	25	17	32	18	2.69	16.0	8.8	1.94
Caid:[3]																
(THD81TX163-3)																
A---------- 0-15	A-6(9)	CL	100	100	100	100	68	48	20	13	35	16	2.64	20.0	7.5	1.75
Btk1---------- 25-38	A-7-6(16)	CL	100	100	100	99	75	61	26	18	43	23	2.67	19.0	11.0	1.79
Btk3---------- 56-80	A-7-6(26)	CL	100	100	100	100	89	79	54	38	47	30	2.68	16.0	14.5	1.94
Duval:[4]																
(THD81TX163-5)																
A1---------- 0-10	A-2-4(0)	SM	100	100	99	99	24	16	7	6	23	2	2.65	19.0	1.4	1.63
Bt2---------- 34-47	A-6(2)	SC	100	99	98	97	45	33	21	15	30	13	2.67	20.0	5.1	1.75
Bt3---------- 47-55	A-6(4)	SC	100	98	93	91	50	35	22	14	33	14	2.68	19.0	7.1	1.95
Schattel:[2]																
(THD81TX163-7)																
A---------- 0-6	A-6(12)	CL	100	98	96	94	68	53	26	18	40	20	2.63	16.0	11.3	1.87
Bk2---------- 14-26	A-7-6(22)	CL	100	99	99	97	83	73	44	32	48	28	2.70	18.0	13.7	1.84
Crkyz-------- 44-63	A-7-6(38)	CH	100	100	100	97	88	87	---	---	69	48	2.75	20.0	19.4	1.85
Webb:[2]																
(THD82TX163-1)																
A---------- 0-10	A-2-4(0)	SM	100	100	100	99	32	28	7	5	26	4	2.61	19.0	3.6	1.62
Bt---------- 10-19	A-7-6(10)	CL	100	100	100	99	53	43	31	24	45	26	2.66	18.0	12.8	1.82
Btk2---------- 26-38	A-7-6(7)	SC	100	99	97	96	47	36	24	18	44	23	2.69	21.0	10.8	1.72
Wilco:[2]																
(THD81TX163-8)																
Ap---------- 0-7	A-2-4(0)	SM	100	100	100	99	23	13	7	5	19	3	2.64	18.0	1.2	1.73
Bt2---------- 21-29	A-6(6)	SC	100	100	100	99	49	45	39	34	38	21	2.64	16.0	10.7	1.84
BC---------- 42-56	A-2-6(0)	SC	100	100	100	100	33	31	24	20	30	11	2.64	19.0	5.3	1.71

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit[1]	Plasticity index[1]	Specific gravity	Shrinkage		
	AASHTO	Unified	Percentage passing sieve--					Percentage smaller than--						Limit	Linear	Ratio
			3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm						
											Pct		g/cc	Pct	Pct	
Winterhaven:[5] (THD81TX163-9)																
A2---------- 2-12	A-7-6(24)	CH	100	100	100	100	96	89	53	32	52	25	2.61	23.0	12.2	1.65
Bw---------- 12-30	A-7-6(22)	CL	100	100	100	100	99	94	50	28	43	21	2.68	21.0	9.8	1.77
C---------- 30-60	A-7-6(23)	CL	100	100	100	100	98	90	53	34	44	23	2.69	20.0	11.3	1.79
Zavco:[6] (THD81TX163-4)																
A---------- 0-10	A-4(2)	CL	100	100	100	99	54	36	14	8	27	9	2.61	20.0	4.3	1.77
Bt2---------- 22-36	A-6(11)	CL	100	99	98	97	64	52	22	15	39	21	2.68	17.0	10.6	1.81
BCk---------- 48-72	A-6(9)	CL	100	96	89	84	61	48	34	23	37	20	2.69	16.0	10.5	1.87

[1] Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods, except that soil was added to water.

[2] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[3] From the junction of U.S. 81 and Farm Road 140, 5.7 miles west on Farm Road 140, 5.7 miles west on U.S. 57, 10 miles south on a county road, 125 feet east.

[4] From the junction of Farm Road 1582 and U.S. 85, 1.6 miles east on U.S. 85, 0.3 mile north on a county road, 50 feet east.

[5] From the junction of U.S. 81 and Farm Road 140, 6.7 miles west on Farm Road 140, 100 feet south.

[6] From the junction of U.S. 81 and Farm Road 140, 0.6 mile west on Farm Road 140, 13.9 miles southwest on Farm Road 1581, 8.8 miles northwest on Farm Road 117, 100 feet west.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Amphion	Fine, mixed, hyperthermic Pachic Paleustolls
Antosa	Loamy, siliceous, hyperthermic Aquic Arenic Paleustalfs
Bigfoot	Fine, carbonatic, hyperthermic Cumulic Haplustolls
Bobillo	Loamy, siliceous, hyperthermic Grossarenic Paleustalfs
Bookout	Fine-silty, mixed, hyperthermic Aridic Ustochrepts
Brystal	Fine-loamy, mixed, hyperthermic Aridic Paleustalfs
Caid	Fine-loamy, mixed, hyperthermic Aridic Paleustolls
Campbellton	Fine, mixed, hyperthermic Typic Argiustolls
Comitas	Loamy, mixed, hyperthermic Arenic Aridic Paleustalfs
Denhawken	Fine, montmorillonitic, hyperthermic Vertic Ustochrepts
Devine	Clayey-skeletal, mixed, hyperthermic Udic Paleustalfs
Dilley	Loamy, mixed, hyperthermic, shallow Ustalfic Haplargids
Divot	Fine, montmorillonitic, hyperthermic Vertic Haplustolls
Duval	Fine-loamy, mixed, hyperthermic Aridic Haplustalfs
Elmendorf	Fine, montmorillonitic, hyperthermic Vertic Argiustolls
Falfurrias	Mixed, hyperthermic Typic Ustipsamments
Goldfinch	Loamy-skeletal, mixed, hyperthermic, shallow Ustalfic Haplargids
Hindes	Clayey-skeletal, mixed, hyperthermic Aridic Argiustolls
Imogene	Fine-loamy, mixed, hyperthermic Mollic Natrustalfs
Lacoste	Loamy, mixed, hyperthermic, shallow Petrocalcic Paleustalfs
Laparita	Fine, mixed, hyperthermic Vertic Argiustolls
Miguel	Fine, mixed, hyperthermic Udic Paleustalfs
Montell	Fine, montmorillonitic, hyperthermic Entic Pellusterts
Monteola	Fine, montmorillonitic, hyperthermic Typic Pellusterts
Olmos	Loamy-skeletal, carbonatic, hyperthermic, shallow Petrocalcic Calciustolls
Poteet	Fine-loamy, mixed, hyperthermic Pachic Paleustolls
Poth	Clayey, mixed, hyperthermic Arenic Paleustalfs
Ramadero	Fine-loamy, mixed, hyperthermic Cumulic Haplustolls
Ruiz	Siliceous, hyperthermic Alfic Ustipsamments
Schattel	Fine, montmorillonitic hyperthermic Vertic Ustochrepts
Sinton	Fine-loamy, mixed, hyperthermic Cumulic Haplustolls
Tiocano	Fine, montmorillonitic, hyperthermic Udic Pellusterts
Uvalde	Fine-silty, mixed, hyperthermic Aridic Calciustolls
Valco	Loamy, mixed, hyperthermic, shallow Petrocalcic Calciustolls
Webb	Fine, montmorillonitic, hyperthermic Aridic Paleustalfs
Wilco	Fine, mixed, hyperthermic Udic Paleustalfs
Winterhaven	Fine-silty, carbonatic, hyperthermic Fluventic Ustochrepts
Yologo	Loamy-skeletal, mixed, hyperthermic, shallow Petrocalcic Paleustolls
Zavco	Fine, mixed, hyperthermic Aridic Argiustolls

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