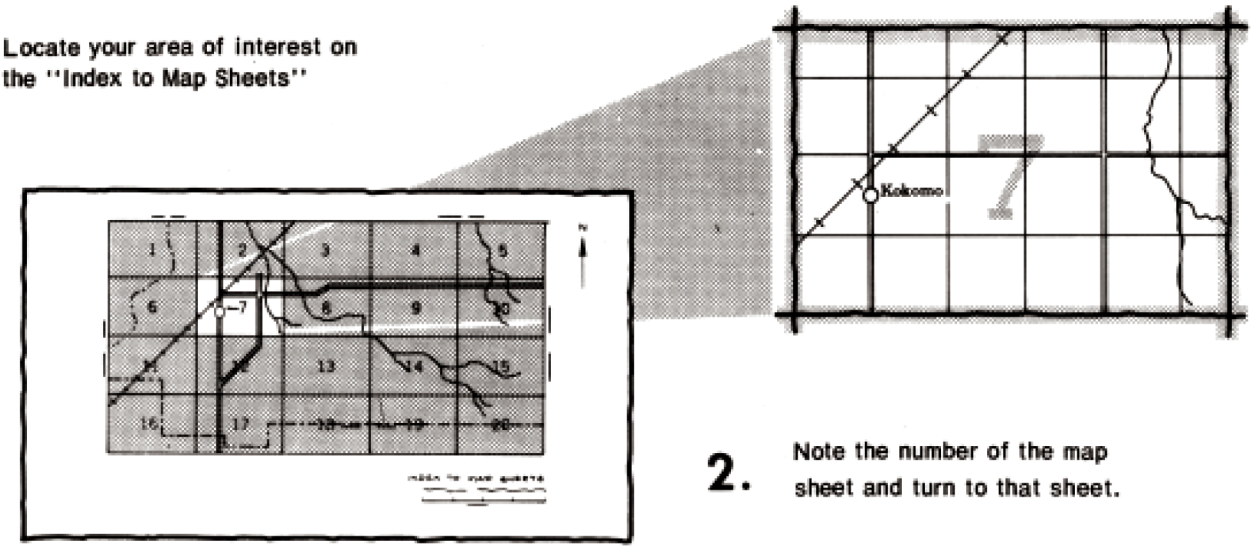
Soil Survey of Bee County, Texas

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

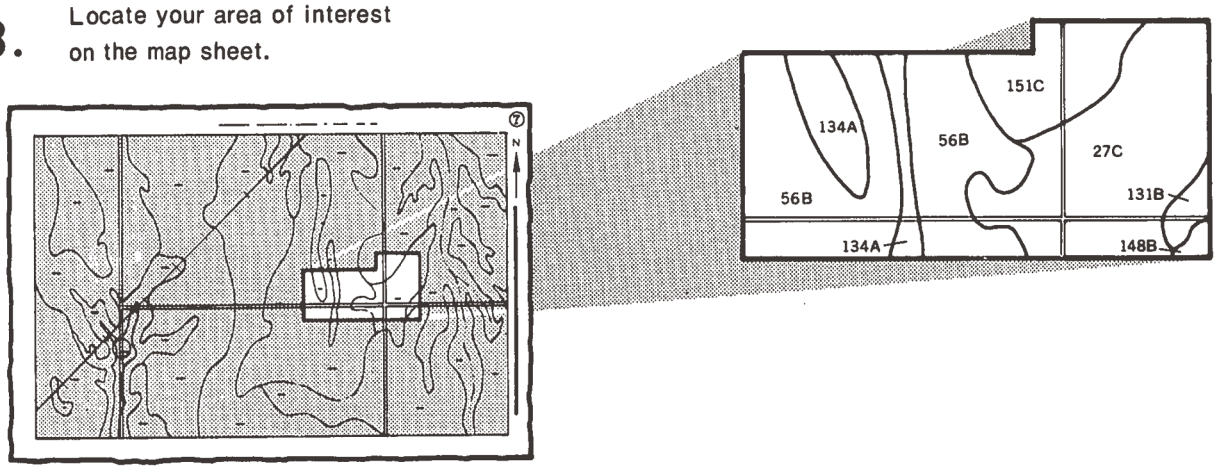
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"



2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



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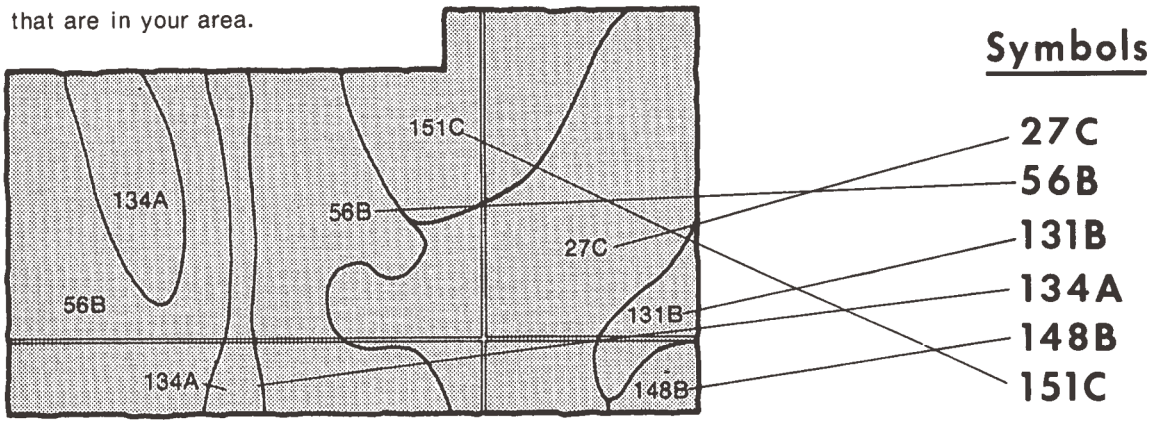
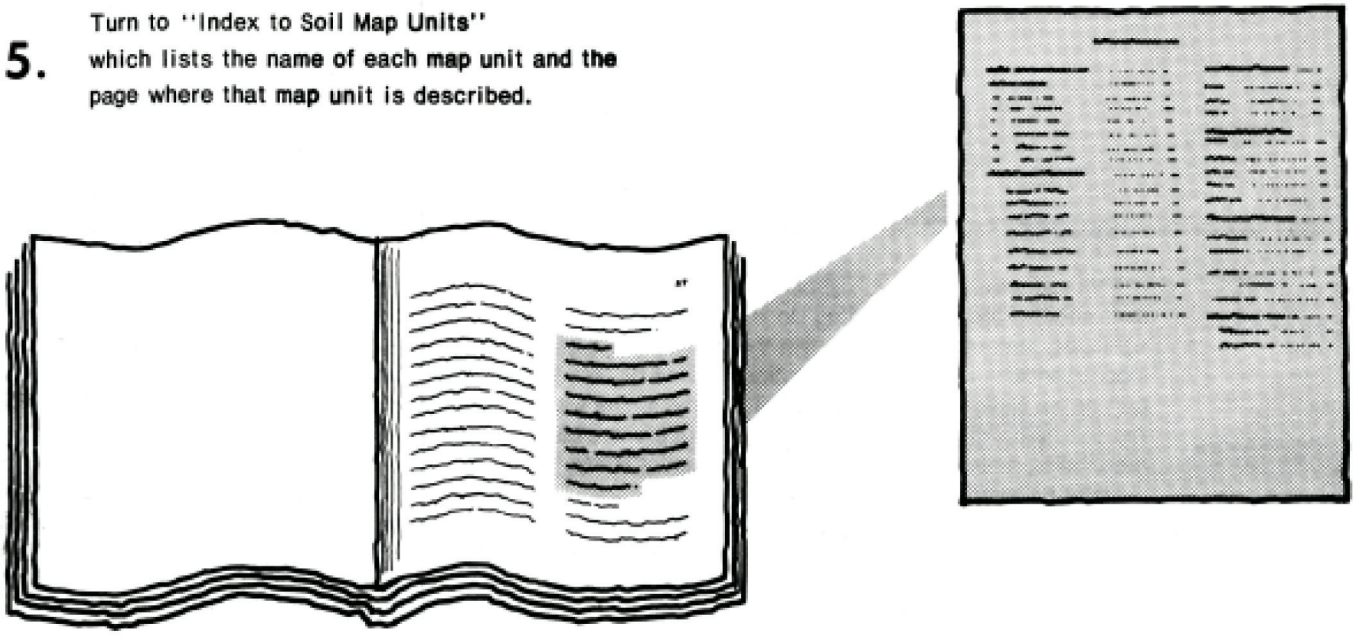
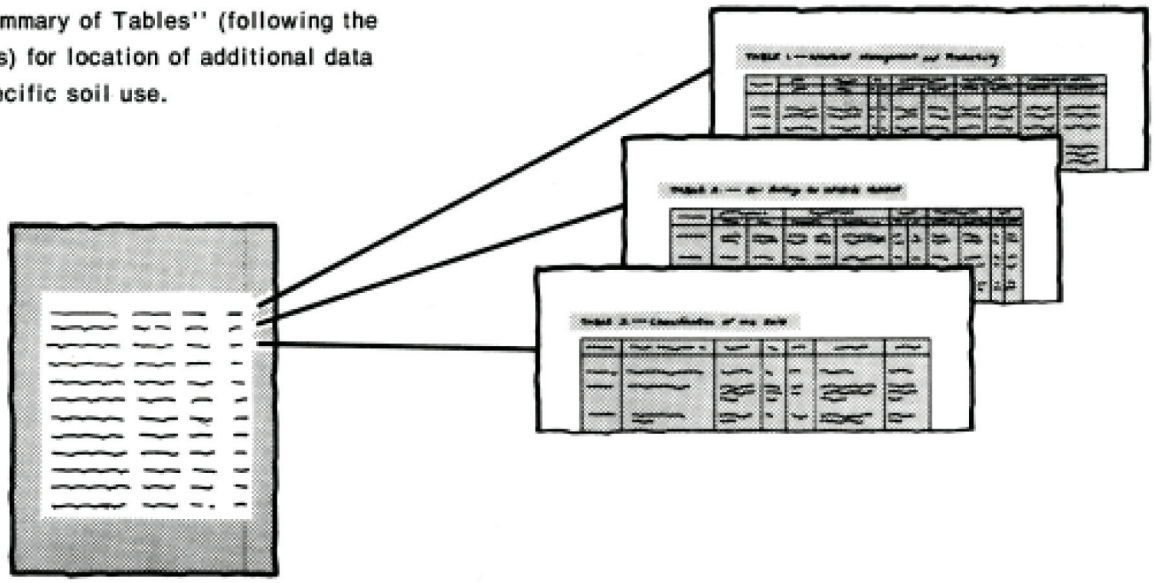


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1974-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Bee and Copano Bay Soil and Water Conservation Districts.

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

This soil survey supersedes the soil survey of Bee County, Texas, published in 1938.

Cover: Excellent cover of kleingrass on Papalote fine sandy loam, 1 to 3 percent slopes. The soil is in Tight Sandy Loam range site.

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foreword

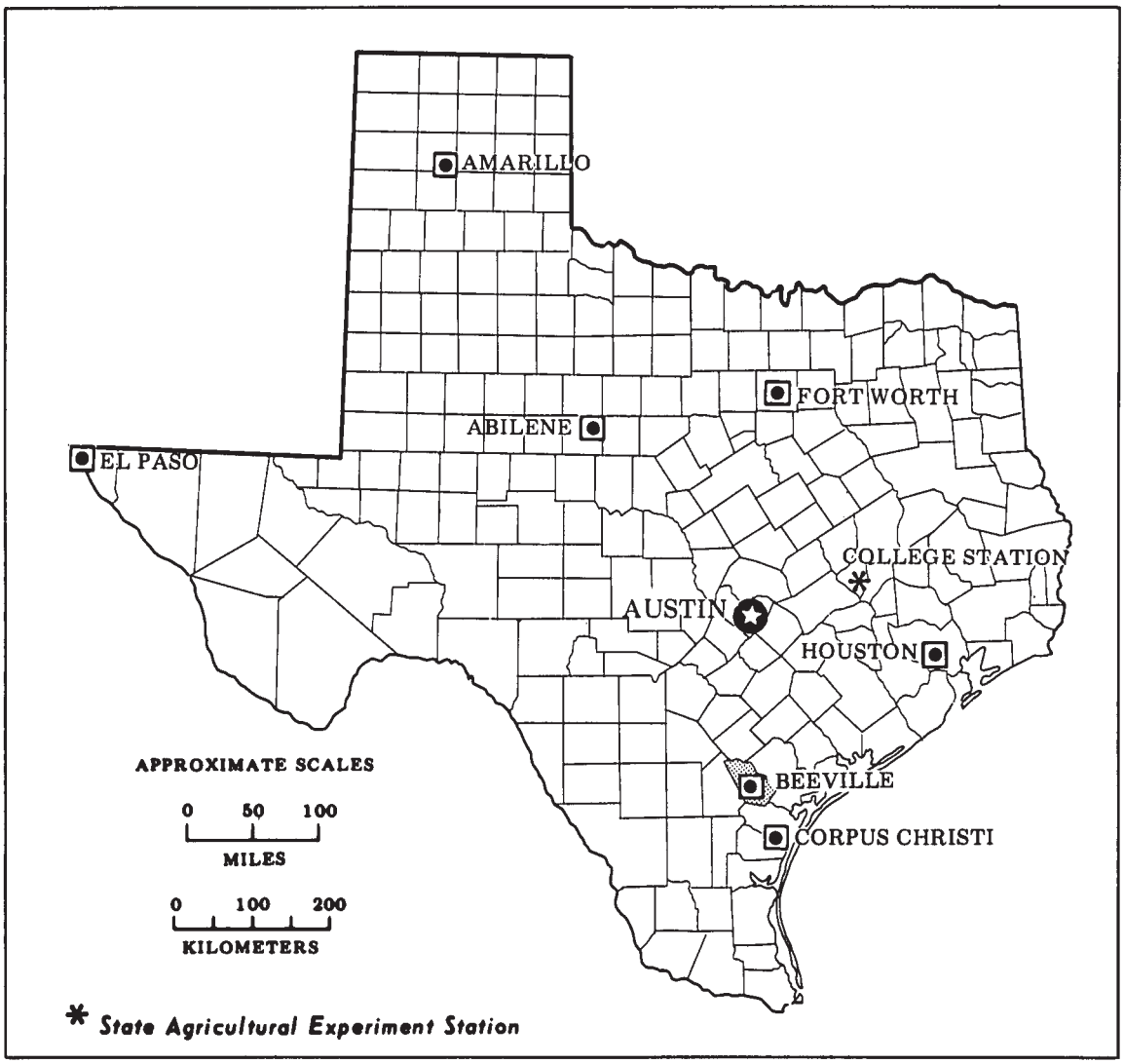
This soil survey contains information that can be used in land-planning programs in Bee County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure 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.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Bee County in Texas.

soil survey of
Bee County, Texas

By William J. Guckian, Soil Conservation Service

Fieldwork by William J. Guckian, Charlie G. Meier, Frank B. Taylor, and Ramiro Molina, Soil Conservation Service

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

BEE COUNTY is in the southern part of Texas. It is mainly in the Rio Grande Plain Land Resource Area, although the southern one-third is in the Coast Prairie Land Resource Area.

The county is roughly rectangular, about 25 miles wide and 38 miles long. It has an area of about 842 square miles, or 538,880 acres. The land surface is nearly level to gently rolling. The elevation ranges from 100 feet above sea level in the southeastern part to 400 feet in the northwestern part. The county is drained by a number of streams, but the most important are the Aransas River and Blanco, Medio, Poesta, West Aransas, Olmos, and Papalote Creeks. Drainage is southeasterly.

In 1977, according to records of the local field office of the Soil Conservation Service, about 74 percent of the county was used for grazing livestock. Of this total, 59 percent was rangeland and 15 percent was improved pasture. About 21 percent of the county was used as cropland and 5 percent for urban and other uses. Cow-calf operations are the main livestock enterprises. Grain sorghum, cotton, corn, and flax are the main cultivated crops.

In 1972 the population of the county was estimated at 24,100. Beeville is the county seat. It is centrally located and has a population of about 16,500. Other communities in the county include Pettus, Skidmore, Tynan, Papalote, Pawnee, Normanna, and Tuleta.

This soil survey supersedes the soil survey of Bee County published in 1938 (*6*). This survey provides additional information and contains larger maps that show the soils in greater detail. Names and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties mainly because of modifications in the series concept or a different intensity of mapping.

general nature of the county

This section provides general information about the climate, history, and natural resources and industry of the county.

climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Beeville in the period 1951 to 1975. 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 55 degrees F, and the average daily minimum temperature is 44 degrees. The lowest temperature on record, which occurred at Beeville on January 12, 1962, is 12 degrees. In summer the average temperature is 83 degrees, and the average daily maximum temperature is 94 degrees. The highest recorded temperature, which occurred on July 27, 1954, 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 30.02 inches. Of this, 19 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 12 inches. The heaviest 1-day rainfall during the period of record was 10.61 inches at Beeville on September 22, 1967. Thunderstorms occur on about 48 days each year, and most occur in August.

Snowfall is rare. In 90 percent of the winters, there is no measurable snowfall. In 5 percent, the snowfall, usually of short duration, is more than 3 inches. The heaviest 1-day snowfall on record was more than 2 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 80 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 12 miles per hour, in April.

history

Bee County was formed from parts of San Patricio, Goliad, Refugio, Live Oak, and Karnes Counties. It was organized on January 25, 1858, and named in honor of Col. Bernard E. Bee, a Texas statesman.

The first county seat was Beeville; it was on Medio Creek about 10 miles east of the present Beeville. In 1860 the county seat was moved to Maryville, which was renamed Beeville-on-the-Poesta to distinguish it from the former county seat.

Railroad service to the county began in 1886. An Agricultural Experiment Station was established at Beeville in 1895. Oil and gas were discovered at Pettus in 1929. Since then additional fields have been discovered in other parts of the county.

natural resources and industry

The soils are the most important natural resource in the county. Most of the soils are excellent for field crops and grasses. Grain sorghum, flax, and cotton are the main field crops. Some corn and vegetables are also grown. The rangeland is used mainly for beef production.

Oil and gas wells are scattered throughout the county, but most are in the northern half. Sand, gravel, and caliche are quarried from pits throughout the county, for use in road and building construction. In the Pawnee area, uranium is mined using the water extraction method.

geology

The parent materials of the soils in Bee County are six geologic formations of the Tertiary and Quarternary systems. These formations, in order of decreasing age, are Catahoula Formation, Oakville Sandstone, Lagarto Clay, Goliad Formation, Lissie Formation, and Beaumont Formation (*3, 4*). These formations cross the county in a general northeast to southwest direction.

The sediment making up each of the formations is believed to have been deposited, by floodwaters from rivers, mostly in the form of natural levees and deltas that coalesced by the shifting of river mouths and channels. These deltaic deposits are interbedded in places with marine and lagoonal beds that were covered by the shifting river mouths. Variations in type of sediment and size of particles among the different geologic formations are attributed to time, source of the material, and velocity of the floodwaters.

The Catahoula Formation crops out in the northwestern part of the county. It is the oldest exposed formation. The area, a belt of rolling, moderately dissected uplands, is mainly cultivated farmland and improved pasture. The formation is composed predominantly of tuffaceous clay and tuff, but locally it contains sandy clay, bentonitic clay, irregularly distributed lenses of sand, and conglomerate. The tuffaceous materials make up about 60 percent of this formation. The rest of the formation is about 20 to 30 percent sandstone and 10 to 20 percent clay with minor amounts of conglomerate. The Monteola soils formed mainly in the Catahoula Formation.

The Oakville Sandstone crops out in an irregular pattern in the northwestern part of the county and unconformably overlies the Catahoula Formation. The area, level to gently rolling, moderately dissected uplands, is crossed by large valleys. Most of the area is cropland or pasture. This formation consists of about 40 percent sand, 30 percent sandy and ashy or bentonitic clay, 20 percent marl, 5 percent redeposited Cretaceous shells, and 5 percent gravel. The Pernitas soils formed in this formation.

The Lagarto Clay crops out in the north-central part of Bee County and conformably overlies the Oakville Sandstone. It extends southeastward down the valley of Medio Creek and westward up the valley of San Domingo Creek for about 4 miles. It is in an area of uplands that are crossed by a broad valley. The surface characteristically is level to gently rolling and maturely dissected. Most of the area is native rangeland or improved pasture. The formation consists primarily of clay and silty calcareous clay interbedded with lenses of sand and gravel. In places it consists of thick beds of caliche.

The Goliad Formation, uncomformably overlying and overlapping the Lagarto Clay, crops out in a broad irregular beltlike area in the central part of the county. The Goliad Formation is characterized by rolling uplands

and maturely dissected, generally tree-covered terrain that has been eroded into resistant ridges and valleys. Some small areas are cultivated farmland and improved pasture. The larger areas are native rangeland. The formation, about 500 feet thick, is predominantly sand and sandstone interbedded with clay and gravel. In some places the sand and clay beds have only a small amount of calcareous material. In other places, solution and redeposition of calcium carbonate have taken place, and beds on or near the surface are as much as 50 percent or more calcium carbonate. The Goliad Formation, where cemented by caliche, is generally harder than the underlying Lagarto Clay. Consequently, in many places, erosion has formed a scarp which marks the surface contact of the two formations. The Goliad, Olmos, and Pettus soils formed in the Goliad Formation.

The Lissie Formation crops out in a large, irregularly shaped area in the southern part of Bee County. It unconformably overlies the Goliad Formation. It is used about equally as native rangeland, cultivated farmland, and improved pasture. The Lissie Formation is a featureless, flat to gently undulating plain. Streams meander through wide shallow valleys and have fringes of trees along their course. The formation is about 400 to 500 feet thick in a belt about 30 miles wide that is parallel to the coastal plain and is about 50 miles from the coast. The formation is composed of thick beds of sand and lentils of gravel interbedded with clay and silt. In places it consists of relatively thick beds of caliche. Papalote soils and Orelia soils in some areas formed in the Lissie Formation.

The Beaumont Formation crops out in small areas in the southern part of the county. The areas are mainly cultivated farmland. The Beaumont Formation is a flat, featureless, treeless coastal plain that is dissected by broad shallow valleys. The formation consists of clay interbedded with layers of medium to fine sand. It has a maximum thickness of about 100 feet. Lattas soils and Orelia soils in some areas formed in the Beaumont Formation.

Recent alluvium is not extensive in Bee County and is found only in some of the stream valleys. It consists of fine sand, silt, and clay and in some small areas is as much as 30 feet thick.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

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, a map unit 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 other units but in a different pattern.

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

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

soil descriptions

1. Parrita-Olmos-Weesatche

Nearly level to undulating, shallow, very shallow, and deep, moderately well drained and well drained, loamy and gravelly soils

This map unit makes up about 21 percent of the county (fig. 1). It is about 30 percent Parrita soils, 14

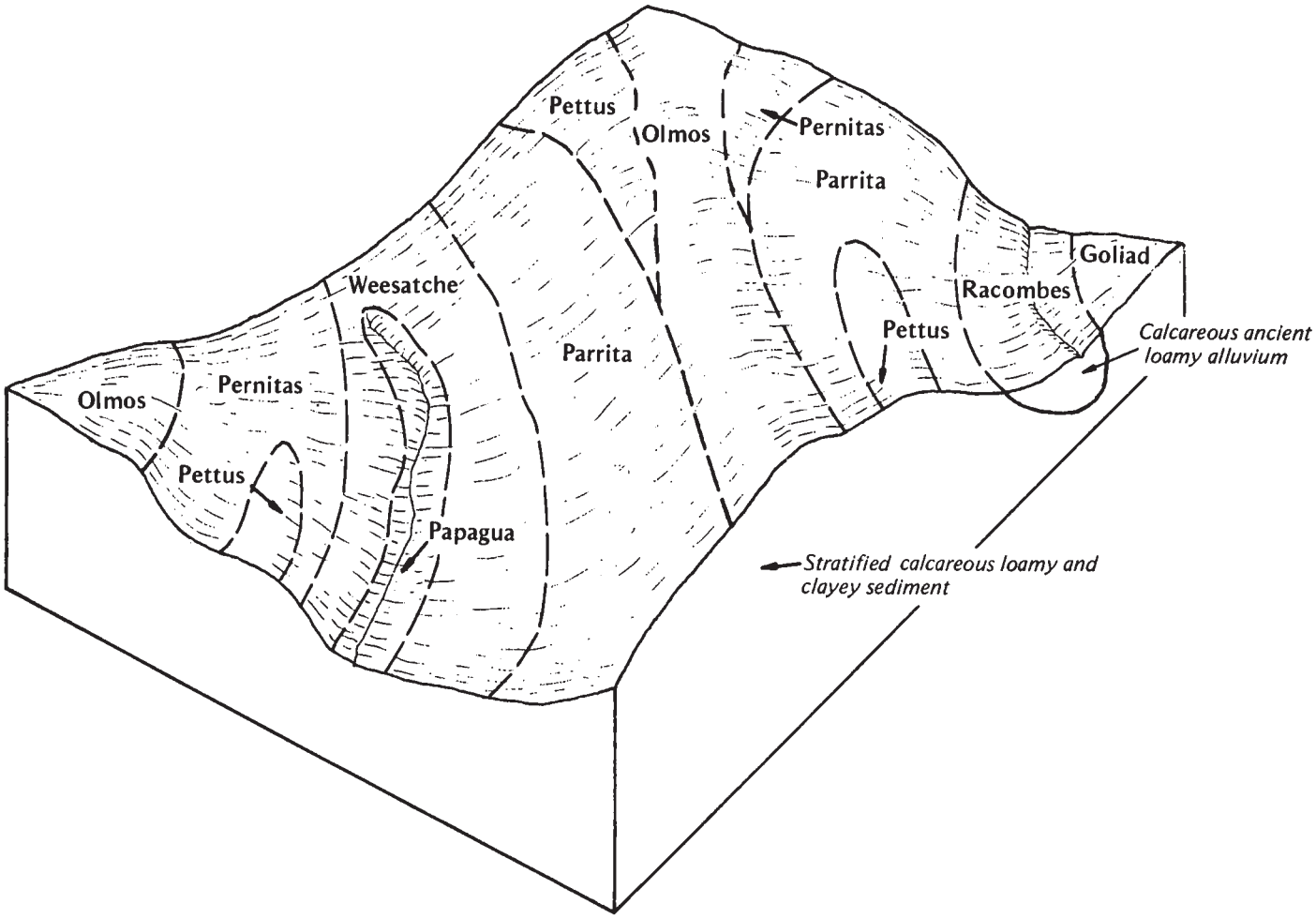


Figure 1.—Typical pattern of soils in the Parrita-Olmos-Weesatche map unit.

percent Olmos soils, 10 percent Weesatche soils, and 46 percent other soils.

Typically, the surface layer of the Parrita soils is brown sandy clay loam about 6 inches thick. The subsoil to a depth of 18 inches is reddish brown sandy clay that grades to clay in the lower part. The underlying layer is strongly cemented caliche.

Typically, the surface layer of the Olmos soils is dark grayish brown gravelly loam about 10 inches thick. The underlying layer is strongly cemented caliche.

Typically, the surface layer of the Weesatche soils is dark brown fine sandy loam about 8 inches thick. The subsoil to a depth of 34 inches is sandy clay loam that is brown in the upper part and reddish brown in the lower part. The underlying layer to a depth of 60 inches is very pale brown sandy clay loam that has common soft masses of carbonates.

The other soils in this unit are Clareville, Edroy, Goliad, Papagua, Pernitas, Pettus, and Racombes soils. Pernitas and Pettus soils are on gently sloping uplands, Clareville and Goliad soils are on nearly level to gently sloping uplands, Papagua and Racombes soils are on nearly level stream terraces, and Edroy soils are in small oval concave areas.

The soils in this unit are used mainly as rangeland and improved pasture. In a few small areas they are used as cropland.

Where they are used as rangeland, these soils produce low yields of forage. Under good management, many kinds of grasses, forbs, and shrubs can be produced. However, thorny brush has invaded many areas of these soils.

These soils are poorly suited to use as pasture and cropland. Yields are low. The shallow and very shallow depth to caliche is the main limitation of the Parrita and Olmos soils. Grain sorghum, flax, and small grains are the main crops. Improved pastures are mainly coastal bermudagrass and kleingrass.

The soils in this unit are poorly suited to most urban and recreation uses. The shallow and very shallow depth to caliche, seepage, and corrosivity to uncoated steel are limitations. Low strength is a limitation for local roads and streets. Slope and rock outcrops are limitations for playgrounds and camping areas.

In some areas caliche and sandstone are quarried for use as road material.

2. Weesatche-Clareville

Nearly level to gently sloping, deep, well drained, loamy soils

This map unit makes up about 19 percent of the county (fig. 2). It is about 44 percent Weesatche soils, 23 percent Clareville soils, and 33 percent other soils.

Typically, the surface layer of the Weesatche soils is dark brown fine sandy loam about 8 inches thick. The subsoil to a depth of 34 inches is sandy clay loam that is brown in the upper part and reddish brown in the lower part. The underlying layer to a depth of 60 inches is very pale brown sandy clay loam that has common soft masses of carbonates.

Typically, the surface layer of the Clareville soils is very dark gray sandy clay loam about 10 inches thick. The upper part of the subsoil to a depth of 32 inches is clay that is very dark gray over grayish brown. The lower part of the subsoil to a depth of 42 inches is very pale brown clay loam. The underlying layer to a depth of 60 inches is very pale brown clay loam that has common soft masses of carbonates.

The other soils in this unit are Edroy, Goliad, Olmos, Papagua, Papalote, Parrita, and Pettus soils. Olmos, Parrita, and Pettus soils are on gently sloping to undulating uplands; Goliad and Papalote soils are on nearly level to gently sloping uplands; Papagua soils are on nearly level stream terraces; and Edroy soils are in small oval concave areas.

The soils in this unit are fairly well suited to use as cropland and pasture. Droughtiness and slow intake are the main limitations. Erosion is a hazard on the gently sloping soils. Grain sorghum, flax, cotton, corn, and small grains are the main crops. Improved pastures are mainly coastal bermudagrass.

If these soils are used as rangeland, they produce moderate yields of forage. Under proper management, a wide variety of grasses, forbs, and shrubs can be produced. In some areas, throny brush has invaded and reduced the quality and quantity of desirable vegetation.

These soils are fairly well suited to urban uses. The moderate to high shrink-swell potential of the soils is the major limitation. Seepage is also a limitation. Low strength is a limitation for roads and streets. The soils are fairly well suited to recreation uses. Clayey texture and moderately slow permeability are limitations.

3. Orelia

Nearly level, deep, somewhat poorly drained, loamy soils

This map unit makes up about 16 percent of the county (fig. 3). It is about 65 percent Orelia soils and 35 percent other soils.

Typically, the surface layer of the Orelia soils is gray fine sandy loam about 6 inches thick. The subsoil to a depth of 30 inches is dark gray sandy clay loam. The underlying layer to a depth of 60 inches is light gray sandy clay loam. There are common soft masses of calcium carbonate below a depth of 24 inches.

The other soils in this unit are Clareville, Edroy, Lattas, Papagua, and Papalote soils. Clareville, Lattas, and Papalote soils are on nearly level to gently sloping uplands, Papagua soils are on nearly level stream terraces, and Edroy soils are in small oval concave areas.

The soils in this unit are used about equally as rangeland, improved pasture, and cropland.

Under proper management, a variety of grasses, forbs,

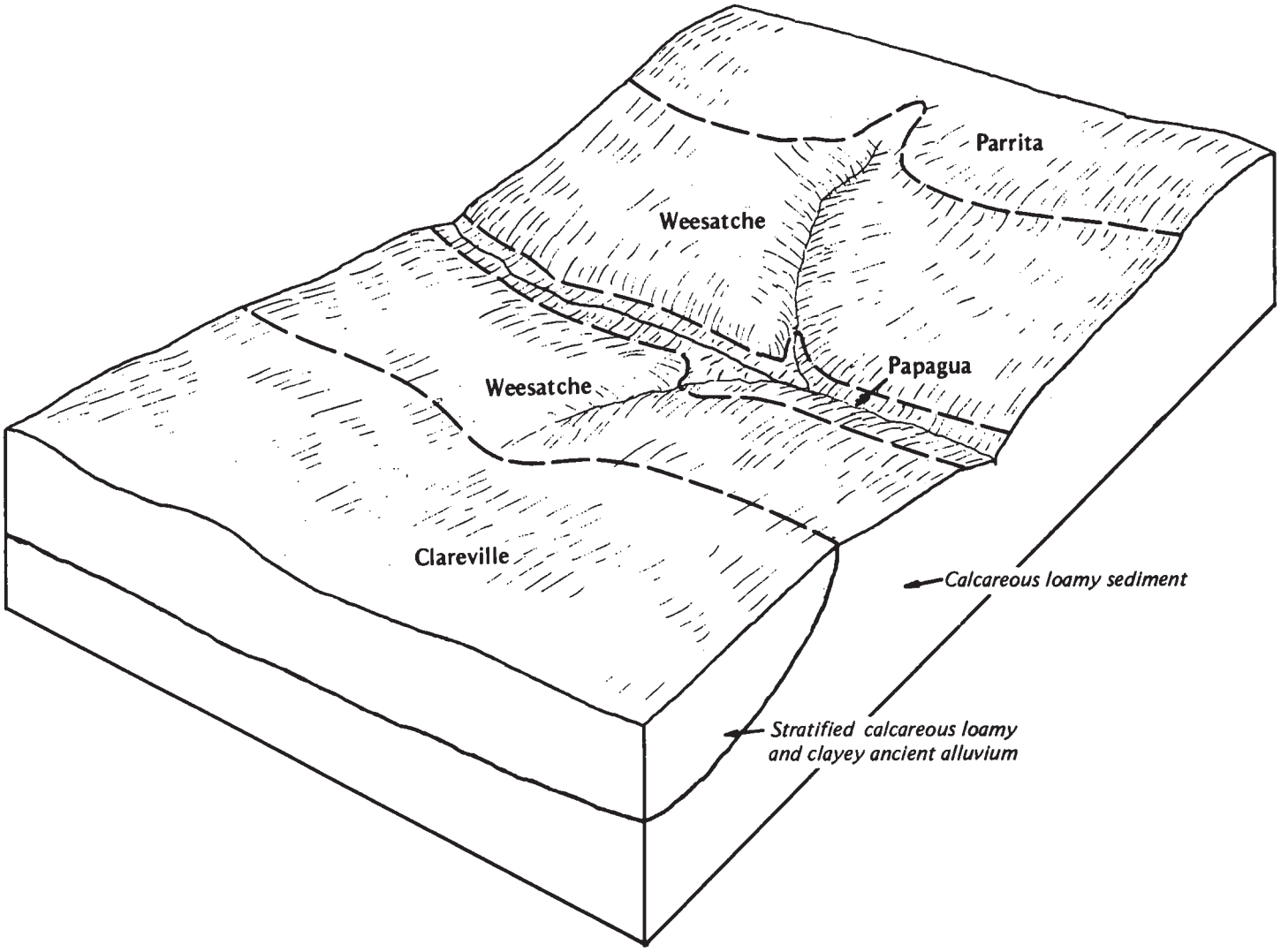


Figure 2.—Typical pattern of soils in the Weesatche-Clareville map unit.

and shrubs can be produced if the soils in this unit are used as rangeland. Thorny brush has invaded in some areas and reduced the quantity of desirable vegetation.

These soils are fairly well suited to use as cropland and pasture. Wetness, very slow permeability, and clayey texture are the main limitations. Grain sorghum and cotton are the main crops. Improved pastures are mainly coastal bermudagrass and varieties of improved bluestem grasses.

These soils are fairly well suited to most urban uses. Wetness is the major limitation. The moderate shrink-swell potential and clayey texture are also limitations. Low strength is a limitation for roads and streets. The soils are poorly suited to recreation uses. Wetness, clayey texture, and very slow permeability are limitations.

4. Papalote

Nearly level to gently sloping, deep, moderately well drained, sandy and loamy soils

This map unit makes up about 13 percent of the county (fig. 4). It is about 55 percent Papalote soils and 45 percent other soils.

Typically, the surface layer of the Papalote soils is light brownish gray loamy fine sand about 12 inches thick. The subsoil to a depth of 54 inches is brownish sandy clay that has red, yellow, and gray mottles. The underlying layer to a depth of 60 inches is brownish sandy clay loam that has common masses of calcium carbonate. About 65 percent of the Papalote soils in this

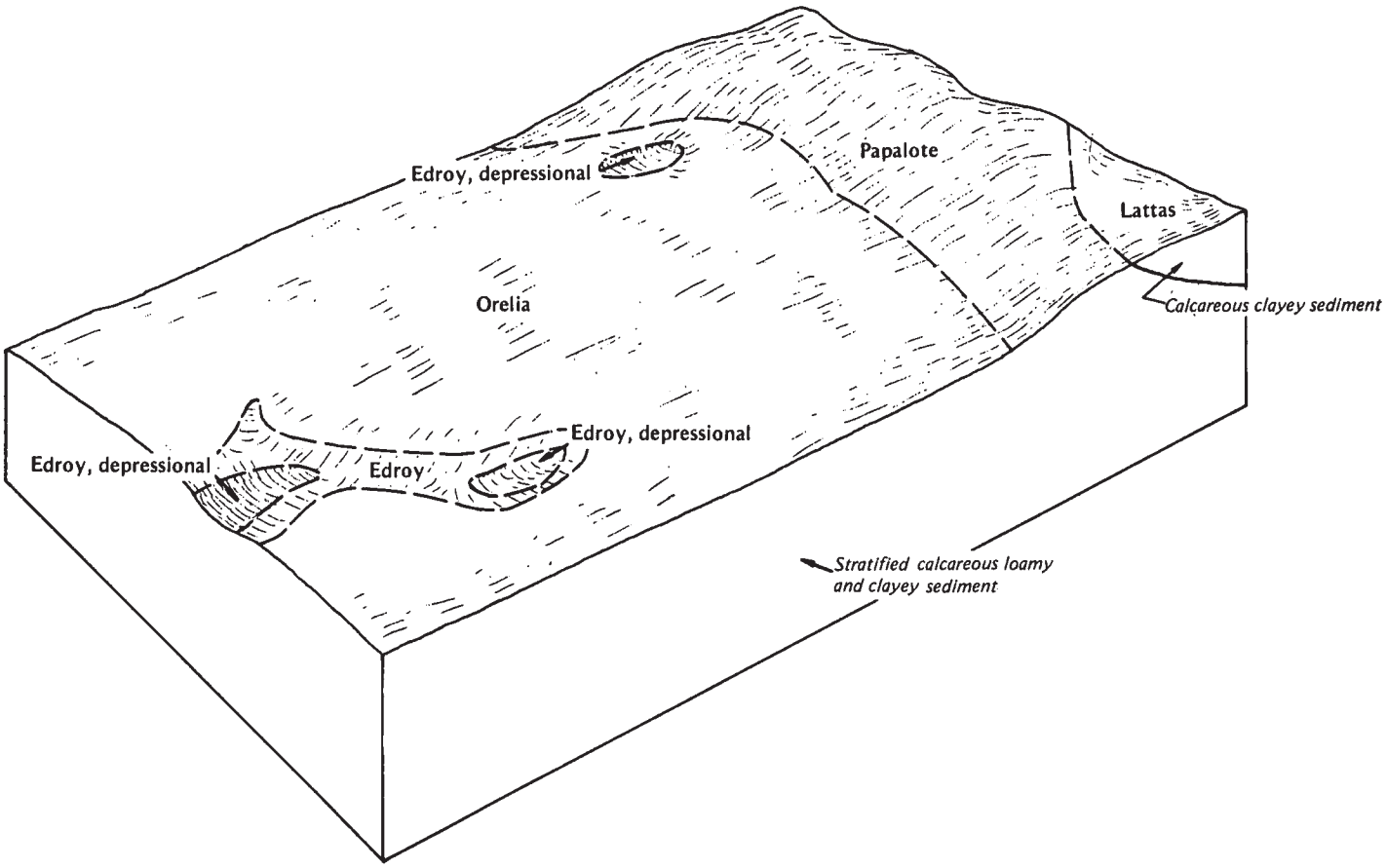


Figure 3.—Typical pattern of soils in the Orelia map unit.

unit have a surface layer of loamy fine sand. In the remaining areas the surface layer is fine sandy loam.

The other soils in this unit are Aransas, Edroy, Leming, Nueces, Odem, Orelia, Papagua, Sarita, and Sinton soils. Nueces and Sarita soils are on gently undulating uplands; Leming and Orelia soils are on nearly level uplands; Papagua soils are on nearly level stream terraces; Aransas, Odem, and Sinton soils are on nearly level bottom lands; and Edroy soils are in small oval concave areas.

The soils in this unit are used mainly as rangeland. In a few areas they are used as improved pasture and cropland.

Under proper management, a wide variety of grasses, forbs, and shrubs are produced where these soils are used as rangeland. A few small areas have been invaded by thorny brush.

These soils are fairly well suited to use as cropland and pasture. Low fertility and soil blowing are limitations. Grain sorghum, flax, and small grains are the main crops. Improved pastures are mainly coastal bermudagrass, kleingrass, and improved varieties of bluestem grasses.

These soils are fairly well suited to most urban uses. The moderate shrink-swell potential is the main limitation. Slow permeability and sandy texture are also limitations. Low strength is a limitation for roads and streets. The soils are fairly well suited to recreation uses. Sandy texture and slow permeability are limitations.

5. Weesatche-Pernitas

Gently sloping, deep, well drained, loamy soils

This map unit makes up about 11 percent of the county (fig. 5). It is about 49 percent Weesatche soils, 30 percent Pernitas soils, and 21 percent other soils.

Typically, the surface layer of the Weesatche soils is dark brown fine sandy loam about 8 inches thick. The subsoil to a depth of 34 inches is sandy clay loam that is brown in the upper part and reddish brown in the lower part. The underlying layer to a depth of 60 inches is very pale brown sandy clay loam that has common soft masses of carbonates.

Typically, the surface layer of the Pernitas soils is dark brown sandy clay loam about 10 inches thick. The subsoil to a depth of 36 inches is brownish sandy clay

loam that grades to clay loam in the lower part. The underlying layer to a depth of 60 inches is brownish sandy clay loam that has many masses of calcium carbonate.

The other soils in this unit are Coy, Edroy, Monteola, Olmos, Parrita, Pettus, and Racombes soils. Olmos, Parrita, and Pettus soils are on gently sloping to undulating uplands; Coy and Monteola soils are on nearly level to gently sloping uplands; Racombes soils are on nearly level stream terraces; and Edroy soils are in small oval concave areas.

The soils in this unit are used about equally as cropland, rangeland, and improved pasture.

The soils in this unit are fairly well suited to use as cropland and pasture. Droughtiness and the high lime content of the Pernitas soils are limitations. Erosion is a hazard in the more sloping areas. Grains sorghum, flax, cotton, corn, and small grains are the main crops. Improved pastures are mainly coastal bermudagrass, kleingrass, and buffelgrass.

Under proper management, a wide variety of grasses, forbs, and shrubs are produced if these soils are used as rangeland. Thorny brush has invaded in many areas and reduced the quantity and quality of desirable vegetation.

These soils are fairly well suited to most urban uses. Seepage and the moderate shrink-swell potential are limitations. Low strength is a limitation for roads and streets. The soils are fairly well suited to recreation uses. Slope is a limitation in some places.

6. Papalote-Orelia

Nearly level, deep, moderately well drained and somewhat poorly drained, loamy and sandy soils

This map unit makes up about 9 percent of the county (fig. 6). It is about 45 percent Papalote soils, 40 percent Orelia soils, and 15 percent other soils.

Typically, the surface layer of the Papalote soils is grayish brown fine sandy loam about 11 inches thick. The upper part of the subsoil to a depth of 16 inches is

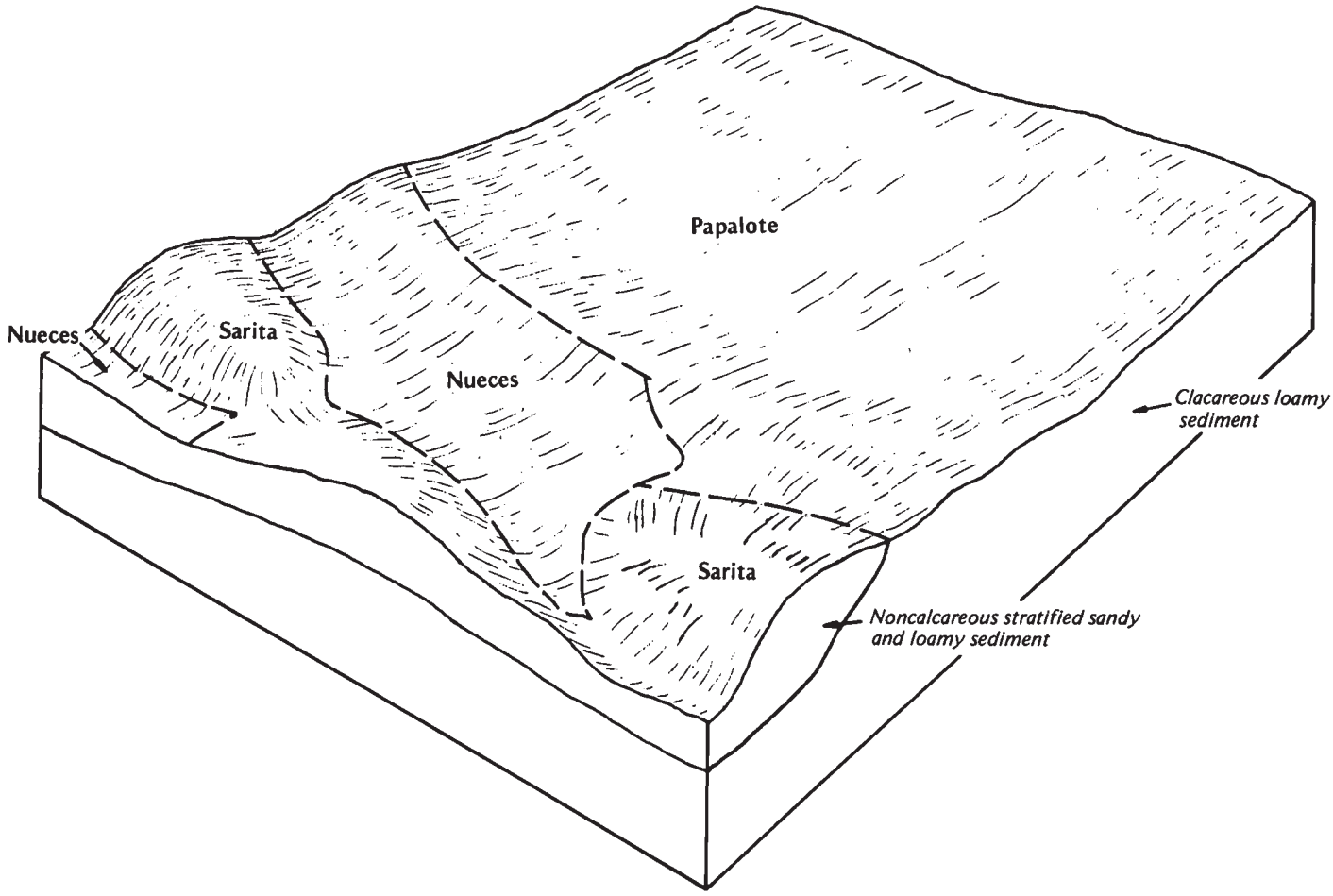


Figure 4.—Typical pattern of soils in the Papalote map unit.

dark grayish brown clay. The lower part to a depth of 50 inches is grayish brown sandy clay over light brownish gray sandy clay. The underlying layer to a depth of 62 inches is very pale brown sandy clay loam that has many masses of calcium carbonate. In some areas the surface layer is loamy fine sand.

Typically, the surface layer of the Orelia soils is gray fine sandy loam about 6 inches thick. The subsoil to a depth of 60 inches is sandy clay loam that is dark gray in the upper part and grades to light gray in the lower part. In the lower part the soil has common soft masses of calcium carbonate.

The other soils in this unit are Edroy, Lattas, Leming, Nueces, Papagua, and Sarita soils. Nueces, Lattas, and Sarita soils are on gently undulating uplands; Leming soils are on nearly level uplands; Papagua soils are on nearly level stream terraces; and Edroy soils are in small oval concave areas.

The soils in this unit are used mainly as rangeland. In a few small areas they are used as improved pasture and cropland.

Under proper management a wide variety of grasses, forbs, and shrubs are produced if these soils are used as rangeland. In some areas, thorny brush has invaded and reduced the quantity and quality of desirable vegetation.

These soils are fairly well suited to use as cropland and pasture. Slow and very slow permeability and wetness in some places are the main limitations. Grain sorghum, cotton, flax, corn, and small grains are the major crops. Improved pastures are mainly coastal bermudagrass.

These soils are fairly well suited to most urban uses. Moderate shrink-swell potential, slow and very slow permeability, and clayey texture are limitations. Low strength is a limitation for roads and streets. The soils are fairly well suited to recreation uses.

7. Lattas-Orelia

Nearly level, deep, somewhat poorly drained, clayey and loamy soils

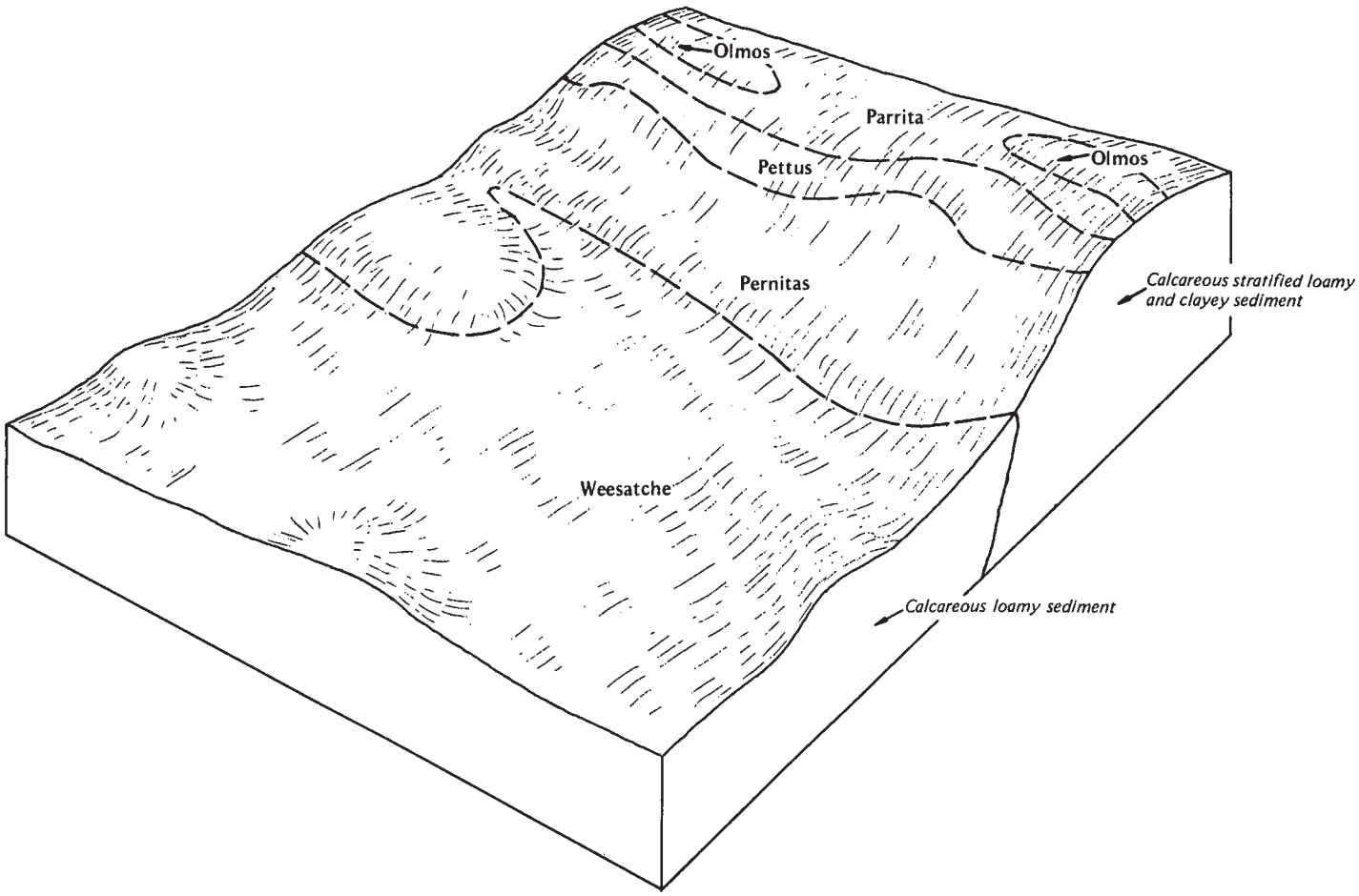


Figure 5.—Typical pattern of soils in the Weesatche-Pernitas map unit.

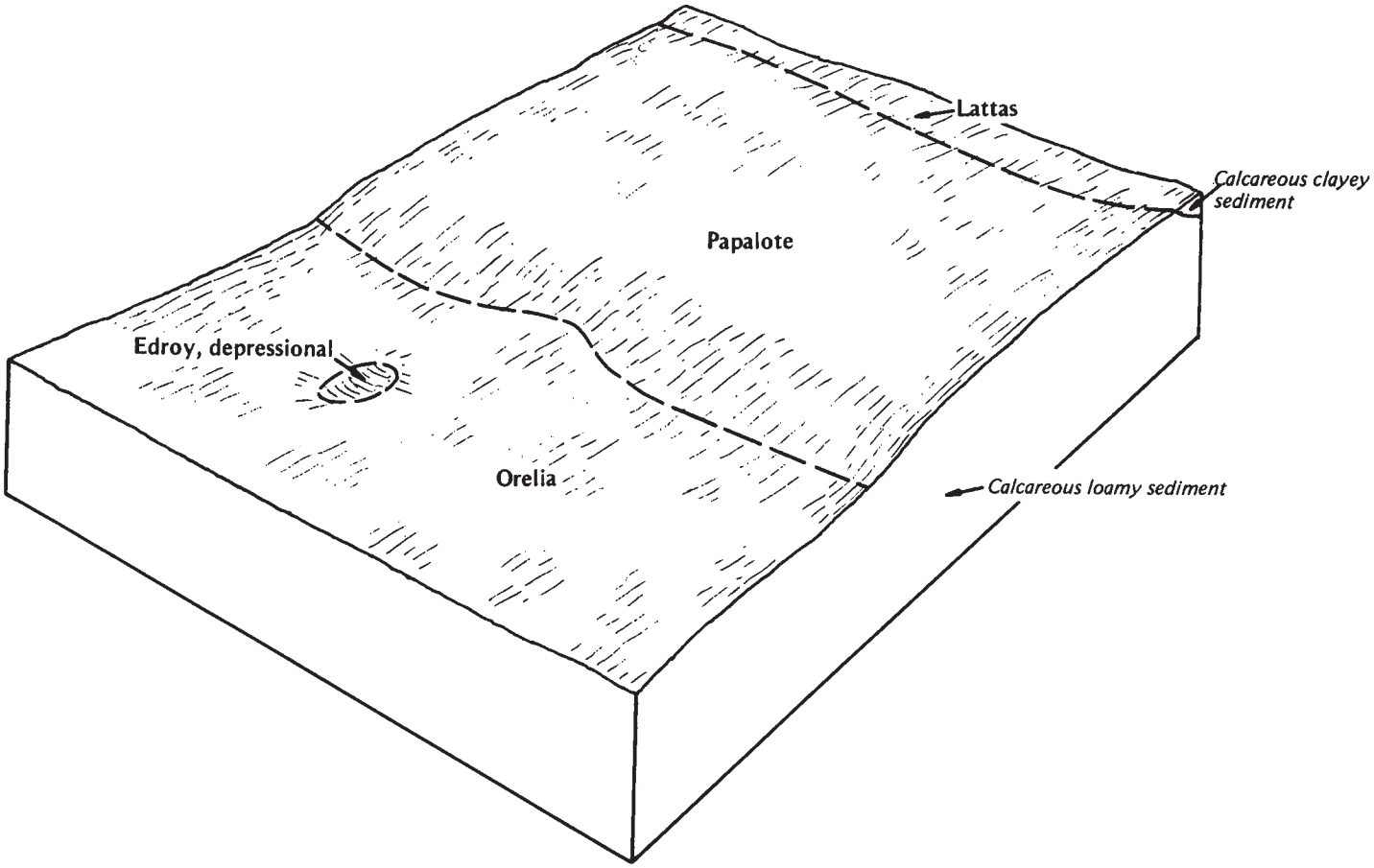


Figure 6.—Typical pattern of soils in the Papalote-Orelia map unit.

This map unit makes up about 6 percent of the county (fig. 7). It is about 50 percent Lattas soils, 30 percent Orelia soils, and 20 percent other soils.

Typically, the Lattas soils are calcareous clay to a depth of 70 inches. In the upper part these soils are very dark gray, in the middle part they are dark gray and gray, and in the lower part they are very pale brown and have a few soft masses of calcium carbonate.

Typically, the surface layer of the Orelia soils is gray fine sandy loam about 6 inches thick. The subsoil to a depth of 60 inches is sandy clay loam that is dark gray in the upper part and grades to light gray in the lower part. The lower part of the soil has common soft masses of calcium carbonate.

The other soils in this unit are Clareville, Edroy, and Papalote soils. Clareville and Papalote soils are on gently sloping to nearly level uplands, and Edroy soils are in small oval concave areas.

The soils in this unit are used mainly as cropland. In a few small areas they are used as improved pasture and rangeland.

These soils are fairly well suited to use as cropland and pasture. Very slow permeability, droughtiness, clayey texture, and wetness in places are the main limitations. Grain sorghum, cotton, flax, corn, small grains, and some truck crops are the main crops. Improved pastures are mainly coastal bermudagrass.

Under proper management, a variety of grasses, forbs, and shrubs are produced if these soils are used as rangeland. In some areas, thorny brush has invaded.

Those soils are poorly suited to most urban and recreation uses. The moderate to high shrink-swell potential, wetness, clayey texture, and very slow permeability are limitations. Low strength is a limitation for local roads and streets.

8. Monteola-Coy

Nearly level to gently sloping, deep, moderately well drained and well drained, clayey soils

This map unit makes up about 5 percent of the county (fig. 8). It is about 45 percent Monteola soils, 14 percent Coy soils, and 41 percent other soils.

Typically, the Monteola soils are calcareous clay to a

depth of 60 inches. These soils are dark gray in the upper part, grayish brown in the middle part, and pale brown in the lower part.

Typically, the surface layer of the Coy soils is calcareous, very dark gray clay about 8 inches thick. The subsoil to a depth of 64 inches is calcareous clay that is very dark gray in the upper part, grayish brown in the middle part, and pale brown in the lower part.

The other soils in this unit are Clareville, Edroy, Kincheloe, Pernitas, Pettus, Racombes, and Weesatche soils. Kincheloe, Pernitas, and Pettus soils are on gently sloping uplands; Clareville and Weesatche soils are on nearly level to gently sloping uplands; Racombes soils are on nearly level stream terraces; and Edroy soils are in small oval concave areas.

The soils in this unit are used mainly as cropland. In a few small areas they are used as improved pasture and rangeland.

These soils are well suited to use as cropland. They are fairly well suited to use as pasture. Clayey texture, very slow permeability, and droughtiness are the main limitations. Grain sorghum, flax, corn, cotton, and small grains are the main crops. Improved pastures are mainly coastal bermudagrass and kleingrass.

Under proper management a variety of grasses, forbs, and shrubs can be produced if these soils are used as rangeland. However, thorny brush has invaded most areas to the extent that the quantity and quality of desirable vegetation is very low.

These soils are poorly suited to most urban and recreation uses. The high to very high shrink-swell potential, clayey texture, and very slow permeability are limitations. Low strength is a limitation for roads and streets.

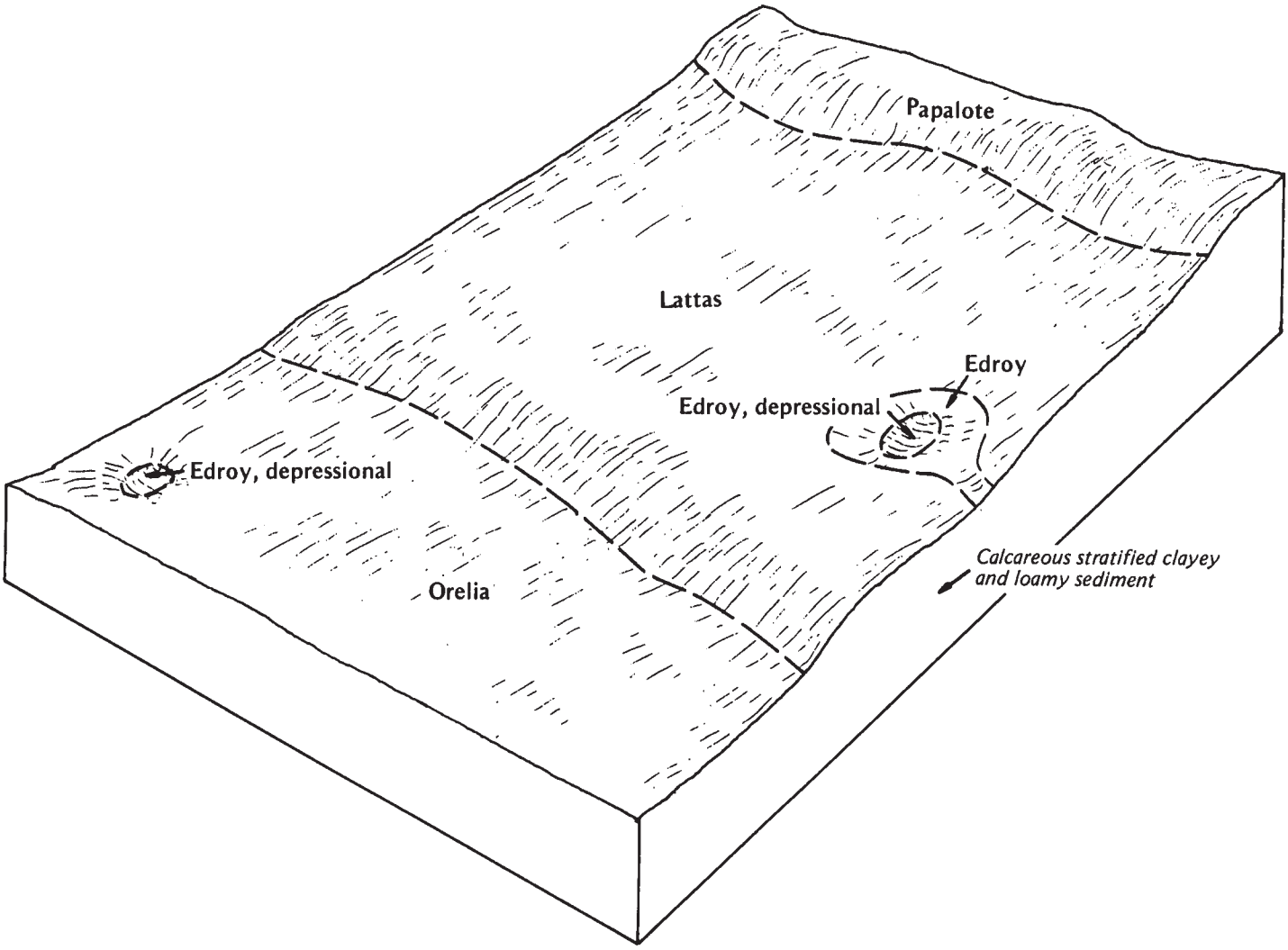


Figure 7.—Typical pattern of soils in the Lattas-Orelia map unit.

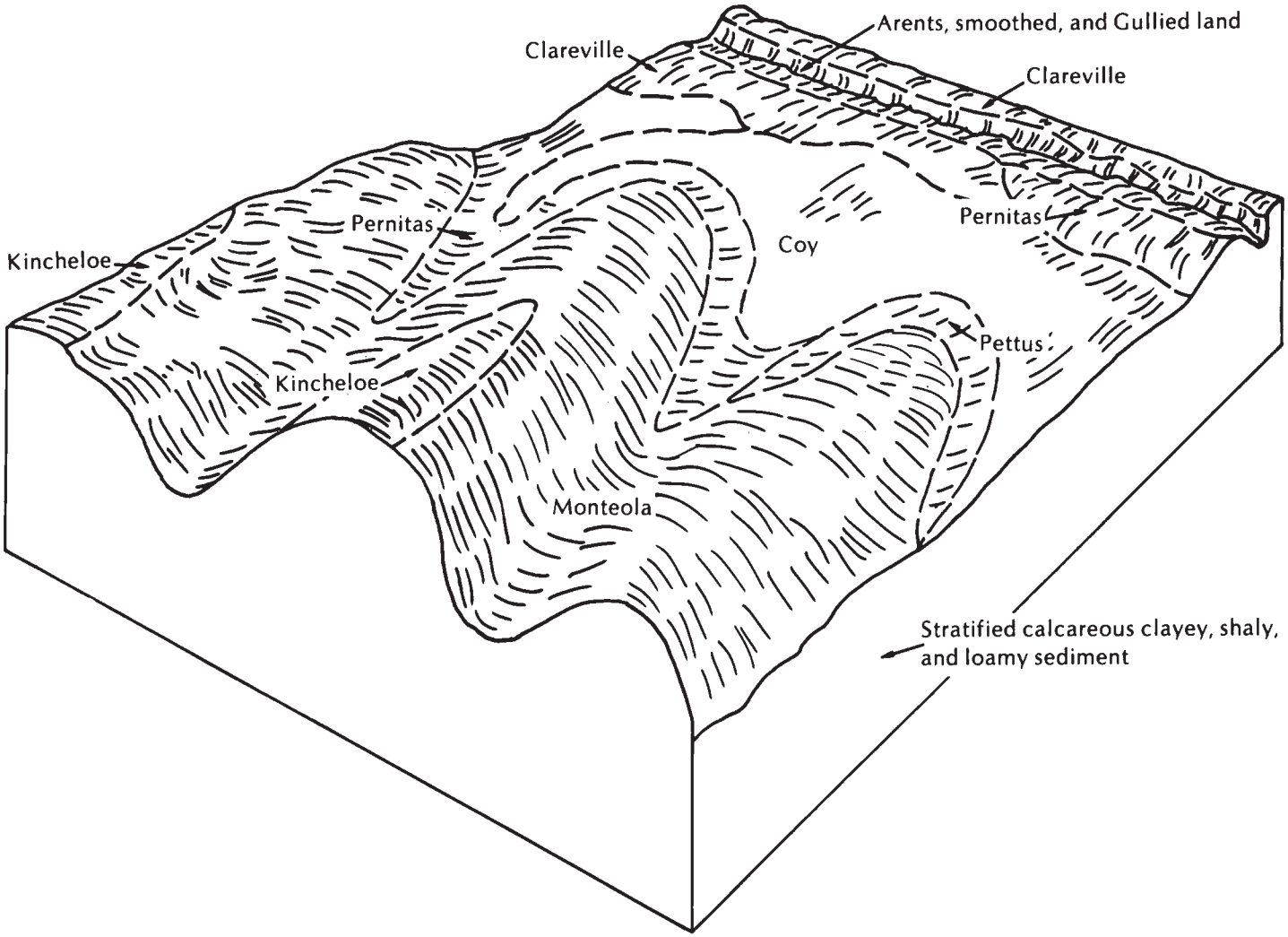


Figure 8.—Typical pattern of soils in the Monteola-Coy map unit.

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.

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

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

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Sarita-Nueces association, undulating, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Gravel pits is an example. These miscellaneous areas are too small to be delineated on the soils maps and 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.

soil descriptions

1—Aransas clay. This is a deep, nearly level soil on flood plains and bottom lands. The surface is slightly concave. Slopes range from 0 to 1 percent and average 0.5 percent. The areas are long and narrow and range from 10 to 70 acres in size.

Typically, the surface layer is about 35 inches thick. It is moderately alkaline, very dark gray clay. Below that, to a depth of 44 inches, the soil is moderately alkaline, dark gray clay that has a few slickensides that do not intersect. The underlying material to a depth of 60 inches is moderately alkaline, light gray clay.

This soil is poorly drained. Runoff is very slow to ponded. The soil is occasionally flooded following heavy rains mostly in the spring and fall. When the soil is dry, cracks up to an inch wide extend to a depth of 30 to 40 inches. Water enters the soil rapidly when the soil is cracked but very slowly when the soil is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay restricts the movement of air, roots, and water. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Sinton, Lattas, and Clareville soils. Also included are small areas of Aransas clay that has loamy or sandy overwash from adjacent upland soils. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as improved pasture. A few areas are used as cropland and rangeland.

This soil is fairly suited to improved pasture. Occasional flooding and wetness are limitations.

Fertilization, weed control, brush management, proper stocking rates, and controlled grazing help maintain productivity. The dry season is the best for fertilization, weed control, and brush management. Improved varieties of bermudagrass, bluestem, and kleingrass grow well on this soil.

This soil is fairly suited to crops. Grain sorghum, corn, cotton, and flax are the main crops. Occasional flooding and wetness are limitations. Simple drainage measures are sufficient in some areas. In other areas diversion terraces and field and lateral drainage ditches are needed to promote better surface drainage and protect against flooding. Cropping systems should take into account the wetness. Practices that help reduce soil temperature, conserve moisture, maintain or improve soil tilth, and maintain crop yields include fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management.

In rangeland the climax plant community is a savannah of mixed grasses with an occasional motte of trees and shrubs. It is composed of about 85 percent grasses, 10 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, switchgrass, Virginia wildrye, Indiangrass, and vine mesquite are the dominant grasses. Trees, such as oak, elm, pecan, hackberry, and anaqua, provide a canopy for about 25 percent of the surface. They generally are more dense in areas adjacent to streams. The understory is woody vines and shrubs. Forbs include Engelmann-daisy, sensitive brier, snoutbean, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, bermudagrass, buffalograss, white tridens, knotroot bristlegrass, and low paspalums and panicums. Under continued heavy grazing, these plants decline and are replaced by bushy bluestem, ragweed, bitter sneezeweed, frogfruit, prairie coneflower, sumpweed, threeawn, and spiny aster in wet places. In some places trees and shrubs have formed a dense canopy causing the shade-sensitive prairie grasses to be replaced by shade-tolerant grasses of lower grazing value.

This soil is poorly suited to urban and recreation uses. Occasional flooding, wetness, high shrink-swell potential, very slow permeability, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IIIw and in Clayey Bottomland range site.

2—Arents, smoothed, and Gullied land, 2 to 10 percent slopes. This map unit consists of eroded soils along escarpments between uplands and bottom lands. The areas, which have been shaped and smoothed by heavy machinery, are intermingled with areas of severely eroded and gullied land. Slopes average 8 percent. The areas are long and narrow and range from 15 to 60 acres in size.

Arents, smoothed make up about 32 percent of this map unit, Gullied land makes up 58 percent, and isolated remnants of other soils make up 10 percent. The components of this map unit are in areas so intricately mixed or so small that it was not practical to map them separately.

Arents, smoothed consist of formerly gullied areas that have been shaped, smoothed, and planted to grass to control erosion. The soil layers have been mixed to a depth of about 60 inches, but remnants of the soil layers are throughout. The soil material is mostly very pale brown or white sandy clay loam, clay loam, clay, fine sandy loam, or loamy fine sand. In some areas it is mixed with a very dark grayish brown or dark gray soil material at various depths.

Gullied land consists of areas that have been severely eroded by water. Most of the upper soil layers have been removed, and there is a network of V-shaped or U-shaped gullies and channels that are 5 to 25 feet wide and 1 to 15 feet deep. The exposed soil material is light colored, limy sandy clay loam, clay loam, clay, fine sandy loam, or loamy fine sand.

Arents, smoothed are poorly to excessively drained. Runoff is rapid. Permeability is moderately slow to very slow, and the available water capacity is low to very low. The root zone ranges from very shallow to deep. Water erosion is a severe hazard.

Included with this soil in mapping are small isolated remnants of Monteola, Coy, Clareville, Pernitas, and Sinton soils. The included soils make up as much as 10 percent of a mapped area.

Arents are used as rangeland, improved pasture, or wildlife habitat. They are not suited to crops. Slope, the hazard of erosion, high lime content, droughtiness, and low fertility are limitations. Improved varieties of bermudagrass and bluestem are adapted pasture grasses. Fertilization, protection from outside water, proper stocking rates, and controlled grazing, are needed to establish and maintain a vegetative cover, which helps control and prevent further erosion.

Rangeland plants are primarily little bluestem, fourflower trichloris, lovegrass tridens, plains bristlegrass, sideoats grama, mesquite, huisache, blackbrush, whitebrush, and tasajillo.

Arents, smoothed are in capability subclass VIe; Gullied land is in capability subclass VIIe. These soils are not assigned to a range site.

3—Clareville sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil in shallow valleys and on old terraces. The surface is plane to slightly concave. Areas are irregularly oval or oblong and range from 10 to 250 acres in size. Slopes, on the average, are 0.5 percent.

Typically, the surface layer is neutral, very dark gray sandy clay loam about 10 inches thick. The subsoil in the upper part, to a depth of 22 inches, is neutral, very

dark gray clay. The subsoil in the middle part, to a depth of 32 inches, is mildly alkaline, grayish brown clay. The subsoil in the lower part, to a depth of 42 inches, is moderately alkaline, very pale brown clay loam. The underlying layer to a depth of 60 inches is moderately alkaline, very pale brown clay loam that has common soft masses and concretions of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep and easily penetrated by roots. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Lattas, Coy, Weesatche, Orelia, and Racombes soils. Also included are a few areas of a soil that is similar to the Clareville soil but has a lighter colored surface layer and is calcareous in some places. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as cropland. In a few areas it is used as rangeland and improved pasture.

This soil is well suited to crops. Grain sorghum, cotton, corn, wheat, and flax are the main crops. Unless this soil is properly managed, the surface layer tends to become pulverized and crusty when tilled. Drought limits yields in some years. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help prevent crusting, reduce soil temperature, conserve moisture, and improve and maintain soil tilth and productivity. Contour farming is desirable in some areas to help conserve moisture.

This soil is well suited to improved pasture. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing help improve and maintain yields. Improved varieties of bermudagrass, bluestem, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional tree or shrub. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, plains, bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, whitebrush, condalia, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, buffalograss, curly mesquite, and perennial threeawn. Under continued grazing, these plants decline and are replaced by red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some places mesquite, whitebrush, and other mixed brush have formed a dense canopy and excluded all understory growth.

This soil is poorly suited to urban uses. Moderately slow permeability, high shrink-swell potential, seepage, clayey texture, and corrosivity to uncoated steel are limitations.

This soil is well suited to recreation uses.

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

4—Coy clay, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is weakly convex to weakly concave. Slopes average about 2 percent. Areas are irregularly oval to irregularly oblong and range from 20 to 300 acres in size.

Typically the surface layer is very dark gray clay about 8 inches thick. The subsoil in the upper part, to a depth of 40 inches, is very dark gray clay that grades to grayish brown clay below. The subsoil in the lower part, to a depth of 50 inches, is pale brown clay with a few soft masses and concretions of calcium carbonate. The underlying layer to a depth of 64 inches is very pale brown clay with a few soft masses and concretions of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay restricts the movement of air, roots, and water. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Monteola, Clareville, Pernitas, and Kincheloe soils. Also included are small areas of soils that are similar to the Coy soil but have a clay loam or sandy clay loam surface layer. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland. A few areas are used as rangeland or improved pasture or are in other uses.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, flax, and wheat are common crops. Droughtiness and water erosion are the main problems. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, control erosion, and maintain tilth. Contour farming, terraces, and waterways help control runoff and protect against erosion. Diversion terraces are needed in some areas to help control surface runoff.

This soil is well suited to use as pasture. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing help control erosion and maintain or increase yields. Improved varieties of bermudagrass, various bluestems, and kleingrass are adapted to this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with an occasional shrub. It is composed of 90 percent grasses, 5 percent forbs, and 5 percent shrubs and woody plants.

Sideoats grama, Texas cupgrass, pinhole bluestem, and plains lovegrass are the dominant grasses. Shrubs include granjeno, acacia, and condalia. Forbs include snoutbean, western indigo, Maximilian sunflower, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, Texas wintergrass, silver bluestem, buffalograss, and curly mesquite. Under continued heavy grazing, these plants decline and are replaced mostly by red grama, purple threeawn, tumble windmillgrass, Texas grama, and prairie coneflower. In some places mesquite, granjeno, whitebrush, agarita, and pricklypear have become dominant.

This soil is poorly suited to urban and recreation uses. The high shrink-swell potential, the very slow permeability, the clay content in the subsoil, and corrosivity to uncoated steel are limitations.

This soil is in capability subclass IIe and in Rolling Blackland range site.

5—Edroy clay. This is a deep soil on nearly level uplands. The surface is plane to slightly concave. Slopes range from 0 to 1 percent and average 0.5 percent. Areas are irregularly oblong or oval and range from 10 to 125 acres in size.

Typically, the surface layer is dark gray clay about 16 inches thick. The subsoil, to a depth of 30 inches, is gray clay loam that grades to gray sandy clay loam in the lower 7 inches. Below that, the subsoil, to a depth of 58 inches, is grayish sandy clay loam that has a few concretions of calcium carbonate.

This soil is poorly drained. Runoff is very slow to ponded. In spring and fall this soil is saturated or ponded for periods up to several weeks. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the clay restricts root growth and hinders the movement of air and water. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Lattas, Orelia, and Papalote soils. Also included are small areas of Edroy soils in depressions and small areas of a soil similar to the Edroy soil except that it has a surface layer of sandy clay loam. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. A few areas are used as cropland and improved pasture.

This soil is suited to use as cropland. Grain sorghum, cotton, and corn are common crops. Most areas used as cropland are farmed with adjacent larger areas of better drained soils. In years of higher rainfall, planting, tillage, and harvest operations may be delayed and yields may be reduced because of ponding and wetness. Simple drainage measures are sufficient in some areas. In other areas, extensive field and lateral drainage ditch systems are needed. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and improve and maintain soil tilth and crop yields. In some areas, construction of diversion terraces or land smoothing is advisable to promote better surface drainage.

This soil is fairly suited to use as improved pasture. Wetness and ponding are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing produce a good vegetative cover and higher forage yields. Improved varieties of bermudagrass and kleingrass grow well on this soil.

On rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional shrub or tree. It is composed of about 95 percent grasses and 5 percent forbs. There are a few shrubs and woody plants.

Longtom, plains bristlegrass, and brownseed paspalum are the dominant grasses. Forbs include bundleflower, sensitive brier, snoutbean, and Engelmann-daisy. Shrubs include huisache, granjeno, kidneywood, and armogosa.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses take over, for example, Texas bristlegrass, buffalograss, hooded and Nash windmillgrasses, and fall witchgrass. Under continued heavy grazing these plants are replaced by plants of low value as forage, for example, purple threeawn, tumblegrass, red grama, whorled dropseed, and tumble windmillgrass. In some areas, huisache, mesquite, granjeno, and lotebush have become dominant.

This soil is poorly suited to urban uses. Wetness, ponding, the very slow permeability, clayey texture, the high shrink-swell potential, and corrosivity to uncoated steel are limitations.

This soil is poorly suited to recreation uses. Wetness, ponding, and clayey texture are limitations.

This soil is in capability subclass IIIw and in Claypan Prairie range site.

6—Edroy clay, depressional. This is a deep soil on nearly level uplands. The surface is concave and depressional. Slopes range from 0 to 1 percent and average 0.5 percent. The areas are irregular, rounded, oval, or long and narrow, and they range from 8 to 75 acres in size.

Typically, the surface layer is dark gray clay about 23 inches thick. The subsoil in the upper part, to a depth of 41 inches, is gray clay loam. The subsoil in the lower part, to a depth of 53 inches, is light brownish gray sandy clay loam with a few concretions and soft masses of calcium carbonate. The underlying layer to a depth of 60 inches is light gray fine sandy loam with a few concretions of calcium carbonate.

This soil is poorly drained. Runoff is ponded. The soil is saturated or ponded for a few weeks to several months in most years, but it is usually dry in summer. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay restricts root growth and hinders the movement of air and water. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Lattas, Orelia, and Papalote soils. Also included are small areas of Edroy sandy clay and Edroy soils that are

gently sloping. The included soils make up less than 10 percent of a mapped area.

This soil is used almost exclusively as rangeland. A few of the smaller areas have been deepened to serve as watering ponds for livestock and wildlife.

This soil is poorly suited to use as cropland. Wetness and ponding are limitations. It is not economically feasible to use this soil as cropland because the areas are small and difficult to drain.

This soil is poorly suited to use as improved pasture because of wetness and ponding.

In rangeland, the climax plant community is an open grassland, with varying degrees of wetness, dominated by short grasses. It is composed of about 95 percent grasses, 5 percent forbs, and a few shrubs and woody plants.

Hartweg paspalum, vine-mesquite, and white tridens are the dominant grasses. Shrubs and woody plants include mesquite, huisache, retama, and sesbania. Forbs include annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses take over, commonly buffalograss, common bermudagrass, and knotroot bristlegrass. With continued heavy grazing, these plants decline and are replaced by rushes, sedges, and woody plants.

The soil is poorly suited to urban uses. Wetness, ponding, the high shrink-swell potential, clayey texture, the very slow permeability, and corrosivity to uncoated steel are limitations.

The soil is poorly suited to recreation uses. Wetness, ponding, and clayey texture are limitations.

This soil is in capability subclass Vw and in Lakebed range site.

7—Goliad sandy clay loam, 0 to 1 percent slopes. This is a moderately deep soil on nearly level uplands. The surface is plane to slightly convex. Slopes average 0.8 percent. Areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark gray sandy clay loam about 12 inches thick. The subsoil in the upper part, to a depth of 18 inches, is dark reddish gray sandy clay. The subsoil in the lower part, to a depth of 25 inches, is reddish brown sandy clay. The underlying layer is strongly cemented, pink caliche.

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

Included with this soil in mapping are small areas of Parrita, Olmos, Clareville, Weesatche, and Pernitas soils. Also included are small areas of Goliad soils that are gently sloping and a soil similar to Goliad soil except that is is underlain by soft caliche. The included soils make up less than 20 percent of a mapped area.

This soil is used in about equal proportions as cropland, rangeland, and improved pasture. In a few areas it is used for other purposes.

This soil is fairly suited to use as cropland. Grain sorghum, cotton, corn, and flax are the main crops. The moderate depth of the root zone and the low available water capacity are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and improve and maintain soil productivity and tilth. Contour farming is desirable in some areas to help conserve moisture.

This soil is fairly suited to use as improved pasture. The moderately deep root zone and the low available water capacity are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing produce a good vegetative cover and improve forage yields. Improved varieties of bermudagrass, various bluestems, buffalograss, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional tree or shrub. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, plains bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, blackbrush, condalia, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses take their place, for example, silver bluestem, buffalograss, curly mesquite, and perennial threeawn. With continued heavy grazing, these plants decline and are replaced by plants of low value as forage, for example, red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some places, mesquite, blackbrush, and other mixed brush have formed a dense canopy and have choked off the understory vegetation.

This soil is fairly suited to urban uses. The moderate depth to the strongly cemented caliche, the moderate shrink-swell potential, clayey texture, the moderately slow permeability, and corrosivity to uncoated steel are limitations.

This soil is well suited to recreation uses.

This soil is in capability subclass IIs and in Clay Loam range site.

8—Goliad sandy clay loam, 1 to 3 percent slopes. This is a moderately deep soil on gently sloping uplands. The surface is slightly convex. Slopes average 2 percent. Areas are irregularly shaped and range from 15 to 175 acres in size.

Typically, the surface layer is dark grayish brown sandy clay loam about 10 inches thick. The subsoil in the upper part, to a depth of 16 inches, is dark reddish gray clay loam. The subsoil in the lower part, to a depth

of 27 inches is reddish brown clay. The underlying material is strongly cemented, strongly alkaline, pink and white caliche.

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

Included with this soil in mapping are small areas of Parrita, Olmos, Clareville, Weesatche, and Pernitas soils. Also included are small areas of a soil that is similar to the Goliad soil but has a surface layer of fine sandy loam and of a soil similar to Goliad soil except that it is underlain by soft caliche. The included soils make up less than 20 percent of a mapped area.

This soil is used in about equal proportions as cultivated cropland, rangeland, and improved pasture.

This soil is fairly suited to use as cropland. Grain sorghum, cotton, corn, flax, and wheat are common crops. Water erosion is a moderate hazard, and the moderate depth of the root zone and the low available water capacity are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, reduce runoff, and maintain soil productivity and tilth. Contour farming, terracing, and waterways help control runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

This soil is fairly suited to use as improved pasture. The hazard of water erosion, moderate depth of the root zone, and the low available water capacity are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control erosion and improve and maintain productivity. Improved varieties of bermudagrass, bluestems, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional tree or shrub. It is composed of about 90 percent grasses; 5 percent trees, shrubs, and woody plants; and 5 percent forbs.

Little bluestem, fourflower trichloris, plains bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, blackbrush, condalia species, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses take their place, for example, silver bluestem, buffalograss, curly mesquite, and perennial threeawn. With continued heavy grazing, these plants decline and are replaced by plants low in grazing value, for example, red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some areas, mesquite, blackbrush, and other mixed brush have formed a dense canopy and have choked off the understory vegetation.

This soil is fairly suited to urban uses. The moderate depth to the strongly cemented caliche, the moderate shrink-swell potential, clayey texture, the moderately slow permeability, and corrosivity to uncoated steel are limitations.

This soil is fairly suited to recreation uses. Slope and the depth to a cemented pan are limitations.

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

9—Kincheloe clay loam, 1 to 5 percent slopes. This is a moderately deep, gently sloping soil on narrow crests of ridges on uplands. The surface is slightly convex. Slopes average 3 percent. Areas are mostly long and narrow and range from 8 to 40 acres in size.

Typically, the surface layer is light brownish gray clay loam about 8 inches thick. The subsoil to a depth of 20 inches is grayish brown clay. Below that, to a depth of 30 inches, it is light yellowish brown clay. The underlying material to a depth of 60 inches is light yellowish brown shaly clay.

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

Included with this soil in mapping are small areas of Pettus, Pernitas, Monteola, Coy, and Olmos soils. Also included are small areas of soils that are similar to this Kincheloe soil but are less clayey in the upper part of the subsoil. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as cultivated cropland. Grain sorghum, corn, flax, and wheat are the main crops. A few areas are used as rangeland and improved pasture. The areas used as cropland and pasture are farmed with adjoining larger areas of soils that are deeper and better suited to crops.

This soil is poorly suited to use as cropland. Water erosion is a moderate hazard, and moderate depth of the root zone and droughtiness are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, reduce runoff, and maintain soil productivity and tilth. Contour farming, terraces, and waterways helps control runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

This soil is poorly suited to use as improved pasture. The hazard of water erosion and the moderate depth of the root zone are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control erosion and improve and maintain productivity. Improved varieties of bermudagrass, bluestems, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with a few scattered shrubs and many forbs. It is composed of about 85 percent grasses, 10 percent forbs, and 5 percent shrubs and woody plants.

Texas cupgrass, Texas wintergrass, sideoats grama, buffalograss, and curly mesquite are the dominant grasses. Shrubs include mesquite, granjeno, acacia, and condalia. Forbs include snoutbean, sensitive brier, orange zexmenia, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, bermudagrass, silver bluestem, Nash and hooded windmillgrasses, and perennial threeawn. With continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, red grama, Texas grama, hairy grama, red lovegrass, and purple threeawn. In some areas, mesquite, granjeno, agarita, tasajillo, and pricklypear have become dominant.

This soil is poorly suited to urban uses. The high shrink-swell potential, the very slow permeability, and corrosivity to uncoated steel are limitations.

This soil is fairly suited to recreation uses. The very slow permeability and clayey texture are limitations.

This soil is in capability subclass IVe and in Shallow range site.

10—Lattas clay, 0 to 1 percent slopes. This is a deep soil on nearly level uplands. The surface is plane. Slopes average less than 0.5 percent. Soil areas are irregular to oval in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is very dark gray, calcareous clay about 23 inches thick. The underlying layer to a depth of 60 inches is calcareous clay that is dark gray in the upper part, gray in the middle, and very pale brown in the lower part. Intersecting slickensides are common in the upper part of this layer.

This soil is somewhat poorly drained. Runoff is slow. After deep plowing, the soil surface in many places exhibits a microrelief in the form of alternating dark-colored microdepressions and lighter colored microknolls (fig. 9). When the soil is dry, cracks up to 1.5 inches wide extend from the surface into the underlying layer. Water enters the soil rapidly when it is cracked but very slowly when the soil is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay restricts root growth and hinders the movement of air and water. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Clareville, Orelia, and Edroy soils. Also included are areas of a soil that is similar to the Lattas soil but has a surface layer of clay loam and areas of Lattas soils that are gently sloping. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as cropland. A few areas are used as rangeland and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, and flax are the main crops. Some onions and cabbage are grown. Crop yields may be reduced during years of above-normal rainfall because of poor drainage. The soil tends to be droughty. If this soil is tilled at a high moisture content, clods tend to form. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and maintain soil productivity and tilth. Land smoothing is desirable in most areas of this soil to promote better surface drainage.

This soil is fairly suited to use as improved pasture. Wetness is a limitation. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover and high forage yields. Fertilization, weed control, and brush management operations can be carried out during the drier seasons. Improved varieties of bermudagrass and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and tall grasses. It is composed of about 95 percent grasses and 5 percent forbs.

Little bluestem, indiangrass, fourflower trichloris, plains bristlegrass, sideoats grama, and vine-mesquite are the dominant grasses. Forbs include snoutbean, Maximilian sunflower, bundleflower, western indigo, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses take their place, for example, Nash windmillgrass, Texas wintergrass, silver bluestem, buffalograss, and curly mesquite. With continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, purple threeawn, tumble windmillgrass, Texas grama, red lovegrass, whorled dropseed, and ragweed. In some areas, overgrazing has caused mesquite, huisache, granjeno, agarita, and lotebush to take over.

This soil is poorly suited to urban uses. The high shrink-swell potential, clayey texture, the very slow permeability, and corrosivity to uncoated steel are limitations.

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

This soil is in capability subclass IIs and in Blackland range site.

11—Lattas clay, 1 to 3 percent slopes. This is a deep soil on gently sloping uplands. The surface is slightly convex. Slopes average 1.5 percent. Areas are irregular to oval in shape and range from 20 to 250 acres in size.

Typically, the surface layer is very dark gray, calcareous clay about 20 inches thick. The underlying layer to a depth of 60 inches is calcareous clay that is very dark gray in the upper part and grades to light gray clay in the lower part. In this layer the dark-colored vertical streaks consist of clay that probably dropped into cracks from the layer above. Intersecting slickensides are common in the upper part of this layer.

This soil is somewhat poorly drained. Surface runoff is medium. When this soil is dry, cracks up to 1.5 inches wide extend from the surface into the underlying layer. Water enters the soil rapidly when it is cracked but very slowly when the soil is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay restricts root growth and hinders the movement of air and water. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Clareville, Orelia, Papalote, and Edroy soils and areas of a soil like the Lattas soil except that it has a surface layer of clay loam. The included soils make up as much as 15 percent of a mapped area.

This soil is used mainly as cultivated cropland. In a few areas, the soil is used as rangeland and improved pasture.

This soil is suited to use as cropland. Grain sorghum,

Figure 9.—Cultivation has exposed the microrelief on Lattas clay, 0 to 1 percent slopes. The light areas are microknolls, and the dark areas are microdepressions.

cotton, corn, and flax are common crops. Some onions and cabbage are grown. Water erosion is a limitation. The soil tends to be droughty. Clods tend to form if this soil is tilled at a high moisture content. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, and improve and maintain soil productivity and tilth. Contour farming, terraces, and waterways control excess runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

The soil is fairly suited to use as improved pasture. Water erosion is a hazard. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control erosion and improve and maintain productivity. Improved varieties of bermudagrass and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and tall grasses. It is composed of about 95 percent grasses and 5 percent forbs.

Little bluestem, indiangrass, fourflower trichloris, plains bristlegrass, sideoats grama, and vine-mesquite are the dominant grasses. Forbs include snoutbean, Maximilian sunflower, bundle-flower, western indigo, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Other grasses take their place, for example, Nash windmillgrass, Texas wintergrass, silver bluestem, buffalograss, and curly mesquite. With continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, purple threeawn, tumble windmillgrass, Texas grama, red lovegrass, whorled dropseed, and ragweed. In some areas, mesquite, huisache, granjeno, agarita, and lotebush have taken over because of overgrazing.

The soil is poorly suited to urban uses. The high shrink-swell potential, clayey texture, the very slow permeability, and corrosivity to uncoated steel are limitations.

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

This soil is in capability subclass IIIe and in Blackland range site.

12—Leming loamy fine sand, 0 to 3 percent slopes. This is a deep soil on nearly level to gently sloping low terraces and in shallow valleys. The surface is plane to slightly convex. Slopes average 1.5 percent. Areas are long and narrow or irregularly oval and range from 10 to 85 acres in size.

Typically, the surface layer is loose, neutral, brown loamy fine sand about 23 inches thick. The subsoil to a depth of 45 inches is mildly alkaline sandy clay that is grayish brown in the upper part and very pale brown in the lower part. The underlying layer to a depth of 72 inches is very pale brown, moderately alkaline clay loam. Yellowish, reddish, grayish, and brownish mottles occur throughout the subsoil.

This soil is moderately well drained. Runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Orelia, Papalote, Nueces, Edroy, and Sarita soils. Also included are small areas of Leming fine sand and small areas of a soil that is similar to this Leming soil but has a sandy surface layer less than 20 inches thick. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cultivated cropland and improved pasture.

This soil is suited to use as cropland. Grain sorghum, corn, cotton, peanuts, and watermelons are common crops. The hazard of soil blowing, the medium available water capacity, and low fertility are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and maintain or increase productivity. Stripcropping helps control soil blowing.

This soil is suited to use as improved pasture. The hazard of soil blowing, medium available water capacity in the upper part of the soil, and low fertility are limitations. Fertilization, weed control, brush managememt, proper stocking rates, and controlled grazing promote a good vegetative cover on the surface, which helps control soil blowing, conserve moisture, and maintain or increase productivity. Improved varieties of bermudagrass, lovegrass, and buffelgrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly tall and mid grasses with an occasional tree or shrub and many forbs. It is about 85 percent grass, 5 percent trees, shrubs, and woody plants, and 10 percent forbs.

Little bluestem, switchgrass, plains bristlegrass, tanglehead, crinkleawn, brownseed paspalum, and sideoats grama are the dominant grasses. Trees, shrubs, and woody plants include live oak, hackberry, mesquite, pricklypear, tasajillo, lantana, and wolfberry. Forbs include snoutbean, western indigo, orange zexmenia, sensitive brier, ragweed, and croton.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced mostly by silver bluestem, knotroot bristlegrass, hooded windmillgrass, and fall witchgrass. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, red lovegrass, hairy grama, signalgrass, threeawn, grassbur, mesquite, lantana, and pricklypear.

This soil is fairly suited to urban uses. The moderate shrink-swell potential, the slow permeability, and corrosivity to uncoated steel are limitations.

This soil is fairly suited to use as recreation areas. The sandy texture is a limitation.

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

13—Monteola clay, 0 to 1 percent slopes. This is a deep soil on uplands. The surface is plane to slightly concave. Slopes average 0.75 percent. Areas are oval to irregularly oblong and range from 20 to 250 acres in size.

Typically, the surface layer is calcareous dark gray clay about 30 inches thick. Below that, to a depth of 48 inches, is calcareous clay that is grayish brown in the upper part and pale brown in the lower part. Slickensides are common in that layer. The underlying layer to a depth of 60 inches is pale brown clay that has a few masses of calcium carbonate.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and the available water capacity is medium. The root zone is deep; however, the clay restricts root growth and hinders the movement of air and water. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Clareville, Coy, Edroy, Orelia, and Pernitas soils. Also included are small areas of Monteola soils that are gently sloping. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as cultivated cropland. In a few areas, it is used as improved pasture and rangeland.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, flax, and wheat are common crops. Droughtiness is a problem. This soil tends to form clods if it is cultivated at too high a moisture content. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and maintain productivity and tilth. Land smoothing and simple drainage practices are needed in some areas to promote better surface drainage.

This soil is fairly suited to use as improved pasture. Droughtiness and very slow permeability limit forage yields. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps maintain or increase productivity. Fertilization, weed control, and brush management operations can be carried out during the dry season. Improved varieties of bermudagrass and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with an occasional shrub. It is about 90 percent grasses, 5 percent forbs, and 5 percent shrubs and woody plants.

Sideoats grama, Texas cupgrass, pinhole bluestem, and plains lovegrass are the dominant grasses. Shrubs include granjeno, acacia, and condalia. Forbs include snoutbean, western indigo, Maximilian sunflower, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, Texas wintergrass, silver bluestem, buffalograss, and curly mesquite. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, red grama, purple threeawn, tumble windmillgrass, Texas grama, and prairie coneflower. In some areas, mesquite, granjeno, whitebrush, agarita, and pricklypear have taken over.

This soil is poorly suited to urban uses. The very high shrink-swell potential, clayey texture, the very slow permeability, and corrosivity to uncoated steel are limitations.

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

This soil is in capability subclass IIs and in Rolling Blackland range site.

14—Monteola clay, 1 to 3 percent slopes. This is a deep soil on uplands. The surface is convex. Slopes average 2 percent. Soil areas are oval to irregularly shaped and 20 to 500 acres in size.

Typically, the surface layer is calcareous dark gray clay about 30 inches thick. The underlying layer to a depth of 60 inches is calcareous clay that is grayish brown in the upper part and pale brown in the lower part. Slickensides are common in this soil below a depth of about 6 inches.

This soil is moderately well drained. Runoff is medium. Permeability is very slow, and the available water capacity is medium. The root zone is deep; however, the clay restricts root growth and hinders the movement of air and water. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Clareville, Coy, Edroy, Pernitas, and Weesatche soils. Also included are small areas of Monteola soils that are nearly level and areas of Monteola soils that have slopes of more than 3 percent. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as cropland. In a few areas, it is used as rangeland and improved pastureland.

This soil is fairly suited to crops. Grain sorghum, cotton, corn, flax, and wheat are the main crops. The hazard of water erosion, medium available water capacity, and droughtiness are limitations. This soil tends to form clods if it is cultivated when it is too moist. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, and improve or maintain productivity and tilth. Contour farming, terraces, and waterways help control runoff and erosion. In some areas, diversion terraces are needed to help control surface runoff.

The soil is fairly suited to use as improved pasture. The hazard of water erosion and droughtiness are limitations. Fertilization, weed control, brush

management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control erosion and increase productivity. Improved varieties of bermudagrass and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with an occasional shrub. It is composed of about 90 percent grasses, 5 percent forbs, and 5 percent shrubs and woody plants.

Sideoats grama, Texas cupgrass, pinhole bluestem, and plains lovegrass are the dominant grasses. Shrubs include granjeno, acacia, and condalia. Forbs include snoutbean, western indigo, Maximilian sunflower, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, Texas wintergrass, silver bluestem, buffalograss, and curly mesquite. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value. The dominant plants at this stage are red grama, purple threeawn, tumble windmillgrass, Texas grama, and prairie coneflower. In some areas, mesquite, granjeno, whitebrush, agarita, and pricklypear have taken over.

The soil is poorly suited to urban uses. The very high shrink-swell potential, clayey texture, the very slow permeability, and corrosivity to uncoated steel are limitations.

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

This soil is in capability subclass IIIe and in Rolling Blackland range site.

15—Nueces fine sand, 0 to 5 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is plane to hummocky. Slopes average 1.5 percent. Areas are long and narrow or irregularly oval and range from 10 to 150 acres in size.

Typically, the surface layer is neutral fine sand that is light brownish gray in the upper part and very pale brown in the lower part. The subsoil, to a depth of 5 inches, is neutral sandy clay loam that has gray, brown, yellow, and red mottles. Below that, to a depth of 70 inches, the subsoil is moderately alkaline white sandy clay loam that has red and yellow mottles.

This soil is moderately well drained. Runoff is very slow because rainfall is absorbed rapidly. Permeability is moderately slow, and the available water capacity is low. The root zone is deep. Water erosion is a slight hazard.

Included with this soil in mapping are areas of Edroy, Leming, Papalote, and Sarita soils. Also included are small areas of soils that are similar to Nueces soils but have a surface layer of fine sandy loam or loamy fine sand that is less than 20 inches thick and areas of another soil that is fine sand to a depth of more than 80 inches. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cropland and improved pasture.

The soil is fairly suited to use as cropland. The main crops are cotton, peanuts, and watermelons. The hazard of soil blowing, low available water capacity, and low natural fertility are limitations. Cropping systems should be planned to control soil blowing and improve or maintain the fertility of the soil. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and improve or maintain soil productivity. Stripcropping helps control soil blowing.

This soil is fairly suited to use as improved pasture. The hazard of soil blowing, the low available water capacity, and low fertility are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control soil blowing, conserves moisture, and improves or maintains productivity. Improved varieties of bermudagrass, lovegrass, and buffelgrass are adapted to this soil.

In rangeland, the climax plant community is an open grassland of dominantly tall and mid grasses with an occasional tree and many forbs. It is composed of about 90 percent grasses, 5 percent forbs, and 5 percent trees, shrubs, and woody plants.

Little bluestem, switchgrass, fringeleaf paspalum, tanglehead, indiangrass, and brownseed paspalum are the dominant grasses. Trees include live oak, mesquite, and huisache. Forbs include snoutbean, croton, western indigo, sensitive brier, bullnettle, beebalm, and lantana.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, knotroot bristlegrass, dropseeds, hooded windmillgrass, and fall and sandy witchgrass. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value. These are mainly red lovegrass, balsamscale, grassbur, tumblegrass, threeawn, croton, and partridgepea. Mesquite, huisache, and lantana also increase, but areas of this soil remain open grassland even under intensive overgrazing.

This soil is suited to urban uses. Seepage, the moderately slow permeability, and the moderate shrink-swell potential are limitations.

This soil is poorly suited to recreation uses. Sandy texture is the main limitation.

This soil is in capability subclass IIIe and in Sandy range site.

16—Odem fine sandy loam. This is a deep soil on flood plains and low terraces. Slopes range from 0 to 2 percent and average 1 percent. Areas are long and narrow and range from 8 to 50 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 48 inches thick. The underlying layer to a depth of 72 inches is grayish brown fine sandy loam that has a few thin strata of loamy fine sand. This soil is

neutral in the upper part and moderately alkaline in the lower part.

This soil is moderately well drained. Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The soil is occasionally flooded following periods of abnormally high rainfall. The root zone is deep, and water erosion is a slight hazard.

Included with this soil in mapping are small areas of Sinton, Aransas, Leming, Racombes, and Papagua soils. Also included are small areas of soils similar to Odem soils except that they have a surface layer that is lighter in color and sandier. The included soils make up less than 25 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cropland and improved pasture.

This soil is fairly suited to crops. Grain sorghum, cotton, corn, and watermelons are common crops. Occasional flooding and droughtiness are limitations. Soil blowing is a hazard where vegetative cover is lacking. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and improve and maintain soil productivity. Stripcropping helps control soil blowing. In some areas, diversion terraces are needed to help control surface runoff from adjacent uplands and protect against flooding.

The soil is fairly suited to use as improved pasture. Soil blowing is a hazard. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, controls soil blowing, and improves or maintains productivity. Improved varieties of bermudagrass, bluestems, lovegrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is a mixture of grasses, trees, shrubs, and forbs. It is composed of about 80 percent grasses, 15 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, switchgrass, fourflower trichloris, big sandbur, and vine mesquite are the dominant grasses. Trees and shrubs include live oak, elm, pecan, hackberry, huisache, and mesquite. Forbs include Engelmann-daisy, bundleflower, snoutbean, sensitive brier, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, white tridens, Texas wintergrass, buffalograss, and sideoats grama. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value. These are dominantly red grama, purple threeawn, tumblegrass, tumble windmillgrass, and hooded windmillgrass. In some areas, mesquite, huisache, and mixed woody plants take over.

This soil generally is not suited to urban uses and is poorly suited to intensive recreation uses because of the hazard of flooding.

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

17—Olmos very gravelly loam, 1 to 8 percent slopes. This is a very shallow to shallow soil on low ridges and on upper side slopes of knolls and ridges on uplands. The surface is smooth and convex. Slopes average 4 percent. Areas are long and narrow and irregularly shaped and range from 5 to 75 acres in size.

Typically, this soil is dark grayish brown very gravelly loam about 10 inches thick. It is about 40 percent caliche fragments in the upper part and about 70 percent in the lower part. The underlying layer is white caliche that is strongly cemented and laminar in the upper part and weakly cemented and nodular in the lower part.

This soil is well drained. Runoff is medium to rapid. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow to shallow. Water erosion is a moderate to severe hazard.

Included with this soil in mapping are small areas of Parrita, Pernitas, Pettus, and Goliad soils. Also included are small areas of a soil that is similar to this Olmos soil except that it is less than 35 percent coarse fragments. Included soils make up less than 20 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cropland and improved pasture.

This soil is generally not suited to use as cropland. Depth to the strongly cemented caliche, the shallow to very shallow root zone, the very low available water capacity, droughtiness, the hazard of water erosion, and the very gravelly surface layer are limitations. This soil is not recommended for crops. The areas of this soil that are presently used as cropland are within larger areas of deeper arable soils that are being tilled.

This soil is generally not suited to use as improved pasture. Depth to the strongly cemented caliche, the shallow to very shallow root zone, the very low available water capacity, the hazard of water erosion, and a very gravelly surface layer are limitations. The areas of this soil that are presently used as pasture are in larger areas of deeper soils that are being used as pasture.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with scattered low-growing shrubs. It is composed of about 85 percent grasses, 10 percent shrubs and woody plants, and 5 percent forbs.

Little bluestem, sideoats grama, plains bristlegrass, curly mesquite, and buffalograss are the dominant grasses. Shrubs and woody plants include guajillo, guayacan, mescalbean, blackbrush, cenizo, and kidneywood. Forbs include Engelmann-daisy, orange zexmenia, evening primrose, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, slim tridens, sand dropseed, fall witchgrass, Nash windmillgrass, hairy grama, and bristlegrass. Under continued heavy grazing, these plants are replaced by plants of low grazing value. These are dominantly red grama, purple threeawn, Halls panicum, Texas grama, and tumble windmillgrass. In

some areas, guajillo, cenizo, blackbrush, brazil, lotebush, and acacia have taken over.

This soil is poorly suited to urban uses. The very shallow to shallow depth to the strongly cemented caliche, slope, the very gravelly surface layer, and corrosivity to uncoated steel are limitations.

This soil is poorly suited to recreation uses. The very gravelly surface layer, the depth to the strongly cemented caliche, and slope are limitations.

This soil is in capability subclass VIIs and in Shallow Ridge range site.

18—Orelia fine sandy loam, 0 to 1 percent slopes. This is a deep soil on nearly level uplands. The surface is slightly concave. Slopes average less than 0.5 percent. Soil areas are irregular, oval, or oblong and range from 20 to several hundred acres in size.

Typically, the surface layer is neutral, gray fine sandy loam about 6 inches thick. The subsoil extends to a depth of 30 inches. It is sandy clay loam; it is dark gray in the upper part and gray in the lower part. The underlying layer to a depth of 60 inches is light gray sandy clay loam that has common soft masses and concretions of calcium carbonate. This soil is neutral in the upper part and moderately alkaline in the lower part.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air, roots, and water. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Edroy, Papalote, Lattas, and Clareville soils. Also included are areas of a similar soil except that it has a clayey subsoil and small areas of Orelia soils that have a surface layer of sandy clay loam, particularly in cultivated areas. The included soils make up less than 20 percent of a mapped area.

This soil is used as cropland and rangeland. A few areas are used for improved pasture.

This soil is fairly suited to crops. Grain sorghum, cotton, corn, flax, and vegetables are the main crops. Some onions and cabbage are grown. Wetness and a tendency to poor tilth are limitations. Poor drainage may reduce crop yields during years of above normal rainfall. This soil tends to be hard and crusty when dry, and clods form if the soil is cultivated at too high a moisture content. Practices that help reduce soil temperature, conserve moisture, and improve or maintain soil tilth and productivity include fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management. Simple drainage measures are sufficient in some areas. In other areas, field and lateral drainage ditches are needed. Diversion terraces or land smoothing is desirable in some areas to promote better surface drainage.

This soil is fairly suited to improved pasture. Wetness is a limitation. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps improve and maintain productivity. The dry season is the best time for fertilization, weed control, and brush management. Improved varieties of bermudagrass, bluestems, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional shrub or tree. It is composed of about 95 percent grasses and 5 percent forbs. There are a few shrubs and woody plants.

Longtom paspalum, plains bristlegrass, and brownseed paspalum are the dominant grasses. Shrubs include huisache, granjeno, kidneywood, and amargosa. Forbs include bundleflower, sensitive brier, snoutbean, and Engelmann-daisy.

As retrogression occurs because of heavy grazing, the more palatable species are grazed first. Then other grasses increase, for example, Texas bristlegrass, buffalograss, hooded and Nash windmillgrasses, and fall witchgrass. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, purple threeawn, tumblegrass, red grama, whorled dropseed, and tumble windmillgrass. In some places huisache, mesquite, and granjeno have become dominant.

This soil is fairly suited to urban uses. Wetness, very slow permeability, and corrosivity to uncoated steel are limitations. This soil is poorly suited to recreation uses. Very slow permeability is the main limitation.

This soil is in capability subclass IIIw and in Claypan Prairie range site.

19—Papagua fine sandy loam. This is a deep, nearly level soil on depressed drainageways and low terraces. The surface is slightly concave. Slopes range from 0 to 1 percent but average less than 0.5 percent. Soil areas are long and narrow or oblong and range from 20 to 150 acres in size.

Typically, the surface layer is neutral, grayish brown fine sandy loam about 10 inches thick. The subsoil to a depth of 33 inches is neutral, grayish brown clay that grades to sandy clay. This layer is mottled in shades of red, brown, and gray. Below that, to a depth of 67 inches, the subsoil is gray sandy clay loam with yellowish and brownish mottles and a few soft masses and concretions of calcium carbonate. The underlying layer to a depth of 80 inches is white sandy clay loam and common soft masses and concretions of calcium carbonate.

This soil is moderately well drained. Surface runoff is slow to ponded. This soil receives runoff from adjacent uplands and is briefly ponded during periods of heavy rainfall. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the clayey subsoil restricts the movement of air, roots, and water. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Papalote, Orelia, Racombes, Clareville, and Sinton soils. Also included are small areas of a soil similar to Papagua soils but with a surface layer of loamy fine sand and some areas where overwash on the surface is up to 6 inches thick. The included soils make up as much as 45 percent of some mapped areas, but generally they make up less than 20 percent.

This soil is used mainly as rangeland and improved pasture. A few areas are used as cropland.

This soil is fairly suited to crops. Grain sorghum, corn, and flax are grown. Wetness is the main limitation. Poor drainage may reduce crop yields in years of above normal rainfall. Practices that help reduce soil temperature, conserve moisture, prevent erosion, and improve or maintain soil tilth and productivity include fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management. Simple drainage measures are sufficient in some areas. In other areas, terraces and waterways or diversion terraces are needed to protect against outside water and promote better surface drainage.

This soil is fairly suited to improved pasture. Wetness is a limitation. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps maintain or increase productivity. The dry season is the best time for fertilization, weed control, and brush management. Improved varieties of bermudagrass, bluestems, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly tall and mid grasses with an occasional tree or shrub. It is composed of about 90 percent grasses, 5 percent shrubs and woody plants, and 5 percent forbs.

Fourflower trichloris, little bluestem, sideoats grama, lovegrass tridens plains bristlegrass, and vine-mesquite are the dominant grasses. Shrubs and woody plants include granjeno, huisache, kidneywood, blackbrush, whitebrush, and mesquite. Forbs include Engelmann-daisy, sensitive brier, bundleflower, and snoutbean.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, Nash and hooded windmillgrasses, fall witchgrass, buffalograss, curlymesquite, and silver bluestem. Under continued heavy grazing, these plants decline and are replaced by tumble windmillgrass, whorled dropseed, Halls panicum, tumblegrass, and threeawn. In some places, blackbrush, whitebrush, mesquite, huisache, granjeno, and lotebush have taken over.

This soil is poorly suited to urban uses. Wetness and slow permeability are limitations.

This soils is poorly suited to recreation. Wetness is a limitation.

This soil is in capability subclass IIIw and in Ramadero range site.

20—Papalote loamy fine sand, 0 to 3 percent slopes. This is a deep soil on nearly level to gently sloping uplands. The surface is plane to slightly convex. Slopes average 1.5 percent. Areas are irregular to oval in shape and range from 15 to 400 acres in size.

Typically, the surface layer is slightly acid, light brownish gray loamy fine sand about 12 inches thick. The subsoil, to a depth of 54 inches, is brownish sandy clay that has red, yellow, and gray mottles. The underlying layer to a depth of 60 inches is brownish sandy clay loam. This soil is neutral in the upper part and grades to calcareous and moderately alkaline in the lower part.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky, clayey subsoil reduces the movement of air, roots, and water. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Leming, Nueces, Orelia, Edroy, and Odem soils. Also included are a few small areas of gently sloping Papalote soils and a few small areas of Papalote fine sandy loam. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cropland and improved pasture.

This soil is fairly suited to crops. The main crops are grain sorghum, cotton, corn, flax, peanuts, and watermelons. Soil blowing, low fertility, and the medium available water capacity are hazards and limitations. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, and improve or maintain soil productivity. Stripcropping helps control soil blowing.

This soil is fairly suited to improved pasture. Soil blowing, the available water capacity, and low fertility are hazards and limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps control soil blowing, conserve moisture, and improve or maintain productivity. Improved varieties of bermudagrass, bluestems, lovegrass, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly tall and mid grasses with an occasional tree or shrub and many forbs. It is about 90 percent grasses, 5 percent forbs, and 5 percent trees, shrubs, and woody plants.

Little bluestem, switchgrass, plains bristlegrass, tanglehead, crinkleawn, brownseed paspalum, and sideoats grama are the dominant grasses. Trees, shrubs, and woody plants include live oak, hackberry, mesquite, pricklypear, tasajillo, lantana, and wolfberry. Forbs include snoutbean, western indigo, orange zexmenia, sensitive brier, ragweed, and croton.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, knotroot bristlegrass, hooded windmillgrass, and fall witchgrass. Under continued heavy grazing, these plants decline and are replaced by plants low in grazing value. These are dominantly red lovegrass, hairy grama, signalgrass, threeawns, grassbur, mesquite, lantana, and pricklypear.

This soil is fairly suited to urban uses. Slow permeability, slope, the clayey subsoil, moderate shrink-swell potential, and corrosivity to uncoated steel are limitations.

This soil is fairly suited to recreation uses. The slow permeability, sandy texture, and slope are limitations.

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

21—Papalote fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Slopes average 0.5 percent. Areas are irregular to oval in shape and range from 10 to 500 acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 11 inches thick. The upper part of the subsoil to a depth of 16 inches is dark grayish brown clay mottled with reds and browns. Below that, to a depth of 60 inches, the subsoil is sandy clay that is grayish brown in the upper part, light brownish gray in the middle part, and light brown in the lower part. The underlying layer to a depth of 62 inches is very pale brown sandy clay loam that has many soft masses of calcium carbonate. This soil is neutral in the upper part and moderately alkaline in the lower part.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air, roots, and water. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Orelia, Edroy, Leming, Nueces, and Weesatche soils. Also included are a few small areas of Papalote fine sandy loam and gently sloping Papalote soils. The included soils make up less than 20 percent of a mapped area.

This soil is used mainly as rangeland. A few areas are used as cropland and improved pasture.

This soil is fairly suited to crops. Grain sorghum, corn, cotton, flax, and some onions and cabbage are grown. The available water capacity and low fertility are limitations. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help conserve moisture, reduce soil temperature, and improve and maintain soil productivity and tilth. Contour farming or land smoothing is desirable in some areas to promote better surface drainage.

This soil is fairly suited to improved pasture. The medium available water capacity and low fertility are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture and maintain or increase productivity. Improved varieties of bermudagrass, bluestems, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees, shrubs, and woody plants. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, tanglehead, sideoats grama, and plains lovegrass are the dominant grasses. Trees, shrubs, and woody plants include live oak, mesquite, huisache, kidneywood, granjeno, colima, pricklypear, tasajillo, and condalia. Forbs include Engelmann-daisy, orange zexmenia, perennial legumes, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silverbluestem, Nash and hooded windmillgrasses, plains bristlegrass, slender grama, and fringeleaf paspalum. Under continued heavy grazing, these plants decline and are replaced by red grama, Texas grama, sandbur, lantana, croton, tallow weed, and broomweed. In some places mesquite, huisache, condalia, granjeno, and other woody plants have become dominant.

This soil is fairly suited to urban uses. The slow permeability, clayey texture, moderate shrink-swell potential, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is fairly suited to recreation uses. The slow permeability is a limitation.

This soil is in capability subclass IIs and in Tight Sandy Loam range site.

22—Papalote fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is convex. Slopes average 2 percent. Areas are irregular to long and narrow in shape and range from 10 to 100 acres is size.

Typically, the surface layer is grayish brown fine sandy loam about 10 inches thick. The subsoil to a depth of 50 inches is sandy clay that is dark grayish brown in the upper part and grades to brown in the lower part. It has grayish, brownish, yellowish, and reddish mottles and common masses of calcium carbonate in the lower part. The underlying layer to a depth of 60 inches is light brown sandy clay loam that has common soft masses and concretions of calcium carbonate.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air, roots, and water. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Orelia, Weesatche, Parrita, and Clareville soils. Also included are small areas of Papalote loamy fine sand and nearly level Papalote soils. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. A few areas are used as cropland and improved pasture.

These soils are fairly suited to improved pasture. The hazard of water erosion, the medium available water capacity, and low fertility are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestems, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees, shrubs, and woody plants. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, tanglehead, sideoats grama, and plains lovegrass are the dominant grasses. Trees, shrubs, and woody plants include live oak, mesquite, huisache, kidneywood, granjeno, colima, pricklypear, tasajillo, and condalia. Forbs include Engelmann-daisy, orange zexmenia, perennial legumes, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, Nash and hooded windmillgrasses, plains bristlegrass, slender grama, and fringeleaf paspalum. Under continued heavy grazing, these plants decline and are replaced by plants of low grazing value, for example, red grama, Texas grama, sandbur, lantana, croton, tallow weed, and broomweed. In some places mesquite, huisache, condalia, granjeno, and other woody plants have become dominant.

This soil is fairly suited to crops. Grain sorghum, cotton, corn, and flax are common crops. The hazard of water erosion, the medium available water capacity and low fertility are limitations. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help conserve moisture, reduce soil temperature, reduce runoff, control erosion, and improve or maintain soil productivity and tilth. Contour farming and terraces and waterways control excess runoff and protect against erosion. Diversion terraces are needed in some areas to help control surface runoff.

This soil is fairly suited to urban uses. The slow permeability, clayey texture, moderate shrink-swell potential, slope, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is fairly suited to recreation uses. Slow permeability and slope are limitations.

This soil is in capability subclass IIe and in Tight Sandy Loam range site.

23—Parrita sandy clay loam, 0 to 3 percent slopes. This is a shallow soil on nearly level to gently sloping uplands. The surface is plane to slightly convex. Slopes average 1.5 percent. Areas are irregular to oval in shape and range from 15 to 200 acres in size.

Typically, the surface layer is brown sandy clay loam about 6 inches thick. The subsoil to a depth of 18 inches is reddish brown sandy clay loam in the upper part and clay in the lower part. The underlying layer to a depth of 25 inches is pinkish white, strongly cemented and laminar caliche that is fractured in the upper part.

This soil is moderately well drained. Surface runoff is medium. Permeability is moderately slow, and the available water capacity is very low. The root zone is shallow. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Goliad, Weesatche, Olmos, and Pernitas soils. Also included are a few small areas of a soil similar to Parrita soil except that it has a surface layer of fine sandy loam. Also included is a soil similar to this Parrita soil except that it has a loamy subsoil. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland and improved pasture. A few areas are used as cultivated cropland.

This soil is poorly suited to crops. Grain sorghum, corn, cotton, and flax are common crops. The shallow depth to the strongly cemented caliche, the hazard of water erosion, the shallow depth of the root zone, the very low available water capacity, and droughtiness are limitations. Cuts or excavations deeper than about 18 inches may expose the strongly cemented caliche. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help conserve moisture, control erosion, reduce soil temperature, reduce runoff, and improve or maintain soil productivity and tilth. Contour farming and terrace and waterway systems help control excess runoff and protect against erosion. Diversion terraces are needed in some areas to help control surface runoff.

This soil is fairly suited to improved pasture. The hazard of water erosion, the shallow depth of the root zone, the shallow depth to the strongly cemented caliche, and the very low available water capacity are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestems, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of mainly mid grasses with an occasional shrub or woody plant and many forbs. It is composed of about 85 percent grasses, 10 percent forbs, and 5 percent shrubs and woody plants.

Little bluestem, tanglehead, bristlegrasses, and sideoats grama are the dominant grasses. Shrubs and woody plants include guajillo, blackbrush, tasajillo, granjeno, leatherstem, guayacan, and cenizo. Forbs include sensitive brier, orange zexmenia, bundleflower, snoutbean, croton, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, fall witchgrass, slim tridens, hooded windmillgrass, and silver bluestem. Under continued heavy grazing, these grasses and guajillo are replaced by plants of low grazing value, for example, red grama, hairy grama, Texas grama, slender grama, and Texas tridens. In some places blackbrush, leatherstem, tasajillo, granjeno, and guayacan have become dominant.

This soil is poorly suited to urban uses. The depth to the strongly cemented caliche and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is poorly suited to recreation uses. The depth to caliche is a limitation.

This soil is in capability subclass IIIe and in Shallow Sandy Loam range site.

24—Parrita-Olmos association, undulating. This association is on uplands. The surface is convex. Slopes range from 1 to 8 percent and average 3 percent. Areas are irregular to oval and range from 20 to several hundred acres in size.

Parrita soils make up about 40 percent of the association, Olmos soils about 35 percent, and other soils about 25 percent. Parrita soils and Olmos soils occur in every mapped area. The composition of individual mapped areas is Parrita soils 10 to 90 percent, Olmos soils 10 to 72 percent, and other soils less than 50 percent. The areas of this unit are large and the composition is variable. However, the mapping is detailed enough for the foreseeable uses of the soils.

Parrita soils are mainly on broad, nearly level ridgetops and the upper side slopes of ridges and undulations. Typically, the surface layer is brown sandy clay loam about 6 inches thick. The subsoil, to a depth of 18 inches, is reddish brown sandy clay loam that grades to clay in the lower part. The underlying layer to a depth of 18 inches is pinkish white and pinkish gray strongly cemented, laminar caliche that has a few fine fractures.

Olmos soils are mainly on side slopes and on narrow tops of ridges. Typically, the soil material to a depth of about 10 inches is dark grayish brown very gravelly loam. The underlying layer, to a depth of 14 inches, is white caliche that is strongly cemented. Below a depth of 14 inches it is weakly cemented.

The Parrita soils are moderately well drained and the Olmos soils are well drained. Surface runoff is medium. Permeability is moderately slow in Parrita soils and moderate in Olmos soils. The available water capacity of both soils is very low. The root zone is shallow to very shallow. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Goliad, Weesatche, Pettus, Pernitas, Clareville, Racombes, Papalote, Papagua, Edroy, and Sinton soils. Also included are a few eroded areas where caliche is at or near the surface. These areas have a 2- to 3-inch layer of fine sandy loam over strongly cemented caliche. The included soils make up less than 25 percent of a mapped area.

The soils making up this association are used mainly as rangeland. A few areas are used as cropland and pasture.

These soils are poorly suited to crops. The main crops are grain sorghum, corn, and flax. The shallow to very shallow depth to the strongly cemented caliche, the shallow to very shallow depth of the root zone, very low available water capacity, the hazard of water erosion, droughtiness, and gravel are limitations. The areas that are used as cropland are intermixed with larger areas of deeper more arable soils. The areas are tilled together because it is difficult to farm around the nonarable soils. Cuts or excavations deeper than about 12 inches may expose the strongly cemented caliche. Fertilization, minimum tillage, high residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, conserve moisture, control erosion, and improve or maintain soil productivity. Contour farming, terraces, and waterways are needed in most areas.

The soils are poorly suited to improved pasture. The shallow to very shallow depth to the strongly cemented caliche, the shallow to very shallow depth of the root zone, the very low available water capacity, the hazard of water erosion, and gravelly soil material in some areas are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing produce a good vegetative cover, which helps conserve moisture, reduce runoff, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestem, buffelgrass, and kleingrass grow well on these soils.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional shrub or woody plant and many forbs. It is composed of about 85 percent grasses, 10 percent forbs, and 5 percent shrubs and woody plants.

Little bluestem, tanglehead, bristlegrasses, and sideoats grama are the dominant grasses. Shrubs and woody plants include guajillo, blackbrush, tasajillo, granjeno, leatherstem, guayacan, and cenizo. Forbs include sensitive brier, orange zexmenia, bundleflower snoutbean, croton, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, fall witchgrass, slim tridens, hooded windmillgrass, and silver bluestem. Under continued heavy grazing, these grasses and guajillo are grazed and replaced by plants even lower in grazing value. They are mainly red grama, hairy grama, Texas grama, slender grama, and Texas tridens. In some

places blackbrush, leatherstem, tasajillo, granjeno, and guayacan have become dominant.

These soils are poorly suited to urban uses. The shallow to very shallow depth to the strongly cemented caliche, slope, corrosivity to uncoated steel, and a very gravelly surface layer in places are limitations. Low strength is a limitation for roads and streets.

The soils are poorly suited to use as recreation areas. The shallow to very shallow depth to the strongly cemented caliche, slope, and a very gravelly surface layer in places impose restrictions.

Parrita soils are in capability subclass IVe and in the Shallow Sandy Loam range site; Olmos soils are in capability subclass VIIs and in the Shallow Ridge range site.

25—Pernitas sandy clay loam, 2 to 5 percent slopes. This is a deep soil on gently sloping uplands. The surface is slightly convex to convex. Slopes average 2.5 percent. Areas are irregularly oblong to oval and range from 20 to 250 acres in size.

Typically, the surface layer is dark brown sandy clay loam about 10 inches thick. The upper part of the subsoil is sandy clay loam that is dark grayish brown to a depth of 17 inches and brown to a depth of 25 inches. The lower part of the subsoil to a depth of 36 inches is light yellowish brown clay loam. The underlying layer to a depth of 60 inches is brownish sandy clay that is about 25 percent calcium carbonate. This soil is calcareous and moderately alkaline throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Coy, Pettus, Kincheloe, Weesatche, and Parrita soils. Also included are small areas of a soil similar to the Pernitas soil except that it has a surface layer of fine sandy loam, some spots of eroded Pernitas soils, and a soil similar to the Pernitas soil except that it has a light-colored surface layer. The included soils make up less than 20 percent of a mapped area.

This soil is used about equally as cropland, rangeland, and improved pasture.

This soil is fairly suited to crops. Grain sorghum, cotton, corn, flax, and wheat are the main crops. The hazard of water erosion, the available water capacity, the tendency to droughtiness, and low fertility are limitations. Some crops, particularly grain sorghum, are subject to chlorosis because of the high content of calcium carbonate (fig. 10). Fertilization, minimum tillage, high residue crops that include legumes, and residue management help reduce soil temperature, conserve moisture, reduce runoff, control erosion, and improve or maintain soil productivity and tilth. Contour farming, terraces, and waterways control runoff and protect against erosion. Diversion terraces are needed in some areas to help conserve moisture and control surface runoff.

This soil is fairly suited to improved pasture. The hazard of water erosion and low fertility are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestem, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered shrubs and woody plants. It is made up of about 90 percent grasses, 5 percent shrubs and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, lovegrass tridens, plains bristlegrass, and sideoats grama are the dominant grasses. Shrubs and woody plants include mesquite, huisache, blackbrush, whitebrush, granjeno, colima, kidneywood, pricklypear, tasajillo, and guajillo. Forbs include snoutbean, bundleflower, sensitive brier, orange zexmenia, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, Nash and hooded windmillgrasses, fall witchgrass, curlymesquite, buffalograss, knotroot bristlegrass, slim tridens, and silver bluestem. Under continued heavy grazing, these plants decline and are replaced by plants even lower in grazing value, for example, threeawn, tumblegrass, grassbur, broomweed, croton, ragweed, and bitter sneezeweed. In some places blackbrush, whitebrush, mesquite, huisache, granjeno, and pricklypear form a dense canopy that excludes all understory growth.

This soil is fairly suited to urban uses. Seepage, clayey texture, slope, moderate shrink-swell potential, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is fairly suited to recreation use. Slope is the main limitation.

This soil is in capability subclass IIIe and in Gray Sandy Loam range site.

26—Pettus sandy clay loam, 2 to 5 percent slopes. This is a moderately deep soil on gently sloping uplands. The surface is convex. Slopes average 3 percent. Areas are mostly long and narrow to irregularly oblong and range from 8 to 90 acres in size.

Typically, the surface layer is dark grayish brown sandy clay loam about 9 inches thick. The subsoil, to a depth of 17 inches, is brown sandy clay loam. The underlying layer, to a depth of 22 inches, is white, weakly cemented caliche that is fractured and platy. The fractures are filled with pale brown sandy clay loam, which makes up 10 to 15 percent of this layer. The underlying material to a depth of 60 inches is sandy clay loam that is about 40 to 50 percent soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep. Many

Figure 10.—Chlorosis in the grain sorghum is a result of the high content of calcium carbonate in the soil. The soil is Pernitas sandy clay loam, 2 to 5 percent slopes.

roots penetrate the caliche layer through the fractures. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Olmos, Pernitas, Weesatche, Parrita, and Kincheloe soils. Also included are a few small areas of rock outcrop and a few small areas of soils that are similar to Pettus soils but have a lighter colored surface layer. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used for cultivated crops or as improved pasture.

This soil is poorly suited to use as cropland. Grain sorghum, cotton, corn, and flax are the main crops. The moderate depth of the root zone, the moderate depth to the weakly cemented caliche, low fertility, droughtiness, and the hazard of water erosion are limitations. Some crops, particularly grain sorghum, tend to become chlorotic because of the high content of calcium carbonate in this soil. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, conserve moisture, control erosion, and improve or maintain soil productivity and tilth. Contour farming, terraces, and waterways control runoff and protect against erosion. In some areas, diversion terraces are needed to help conserve moisture and control surface runoff.

This soil is poorly suited to use as improved pasture. The moderate depth of the root zone, low fertility, and the hazard of water erosion are limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestems, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid and short grasses with a few shrubs and many forbs. It is composed of about 85 percent grasses, 10 percent forbs, and 5 percent shrubs and woody plants.

Texas cupgrass, Texas wintergrass, sideoats grama, buffalograss, and curlymesquite are the dominant grasses. Shrubs include mesquite, granjeno, acacia, and condalia. Forbs include snoutbean, sensitive brier, orange zexmenia, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, bermudagrass, silver bluestem, Nash and hooded windmillgrasses, and perennial threeawn. Under continued heavy grazing, these plants decline and are replaced by plants even lower in grazing value, for example, red grama, Texas grama, hairy grama, red lovegrass, and purple threeawn. In some areas, mesquite, granjeno, agarita, tasajillo, and pricklypear have become dominant.

This soil is fairly suited to some urban uses. The moderate depth to the weakly cemented caliche, slope, and seepage are limitations. Low strength is a limitation for roads and streets.

This soil is poorly suited to recreation uses. The moderate depth to the weakly cemented caliche is the main limitation.

This soil is in capability subclass IVe and in Shallow range site.

27—Racombes sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil in shallow valleys and on low terraces. The surface is plane to slightly concave. Slopes average 0.5 percent. Areas are long and narrow and range from 8 to 75 acres in size.

Typically, the surface layer is dark gray sandy clay loam about 12 inches thick. The subsoil, to a depth of 48 inches, is mildly alkaline, dark gray sandy clay loam that grades to brown sandy clay loam in the lower part. The underlying layer to a depth of 60 inches is moderately alkaline, light brown sandy clay loam that has common soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep and is easily penetrated by roots. Water erosion is a slight hazard. Runoff from adjacent uplands provides this soil with extra water. Stream overflows flood this soil for very brief periods; however, such floods are rare.

Included with this soil in mapping are small areas of Papagua, Clareville, Leming, Sinton, Weesatche, and Odem soils. Also included are small areas of a soil that has a lighter colored and thinner surface layer. Also included is a soil that is calcareous at the surface. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas it is used as cropland and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, corn, flax, wheat, and some vegetables are grown. Rare flooding is a limitation. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help conserve moisture, reduce soil temperature, and maintain or improve soil productivity and tilth. In some areas, diversion terraces are desirable to help control surface runoff from adjacent uplands.

This soil is well suited to use as improved pasture. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture and maintain or improve productivity. Improved varieties of bermudagrass, various bluestems, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with an occasional tree or shrub. It is composed of 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, plains bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, whitebrush, condalia, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. Then other grasses increase, for example, silver bluestem, buffalograss, curlymesquite, and perennial threeawn. Under continued heavy grazing, these plants decline and are replaced by plants of even lower grazing value. These are mainly red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some areas, mesquite, whitebrush, and other mixed brush have formed a dense canopy and have choked off the understory plants.

This soil is poorly suited to urban uses. The hazard of flooding, seepage, the moderate shrink-swell potential, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is suited to recreation uses. Flooding, although it is rare, is a limitation.

This soil is in capability subclass IIw and in Clay Loam range site.

28—Sarita-Nueces association, undulating. This association is on uplands. Slopes range from 0 to 5 percent and average 2 percent. Areas are irregular in shape and range from 25 to 250 acres in size.

Sarita soils make up about 40 percent of the association, Nueces soils about 35 percent, and other soils about 25 percent. The areas of this map unit are large, and the composition is variable. However, the detail is adequate for the foreseeable uses of the soils.

Sarita soils are mainly in the slightly higher, gently sloping dune area of the association. Typically, the surface layer is loose, brownish fine sand about 50 inches thick. The subsoil to a depth of 72 inches is very pale brown sandy clay loam that has grayish, reddish, yellowish, and brownish mottles. These soils are neutral to mildly alkaline in the upper part and slightly acid in the lower part.

Nueces soils are mainly in the nearly level to gently undulating area of this association. Typically, the surface layer is light brownish gray fine sand in the upper part and very pale brown fine sand in the lower part. It is about 34 inches thick. The subsoil to a depth of 50 inches is sandy clay loam that is light gray in the upper part and very pale brown in the lower part. Below that, to a depth of 75 inches, the subsoil is white sandy clay loam. There are yellowish, reddish, and grayish mottles throughout the subsoil.

Sarita soils are well drained, and Nueces soils are moderately well drained. Runoff is slow to very slow. Permeability is moderately rapid in Sarita soils and moderately slow in Nueces soils. The available water capacity of Sarita soils is low, and that of Nueces soils is medium. Water erosion is a slight hazard.

Included with these soils in mapping are small areas of Leming, Papalote, and Edroy soils. Also included are a few small areas of Sarita and Nueces soils that are sloping and a soil that is fine sand to a depth of more than 80 inches. The included soils make up less than 27 percent of a mapped area.

The soils making up this association are used mainly as rangeland. In a few areas, they are used as improved pasture.

These soils are poorly suited to use as improved pasture. Soil blowing, the low to medium available water capacity, and low fertility are the main limitations. Fertilization, weed control, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture and improve or maintain productivity. Improved varieties of bermudagrass, lovegrass, amd bluestem grow well on these soils.

These soils are poorly suited to most of the commonly grown crops. They are well suited to watermelons and peanuts. The hazard of soil blowing, low fertility, and low to medium available water capacity are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, control soil blowing, and improve or maintain soil productivity. Stripcropping helps control soil blowing. These soils need a good cover of vegetation or residue the year round.

In rangeland, the climax plant community is an open grassland of dominantly tall and mid grasses with an occasional tree and many forbs. It is composed of about 90 percent grasses, 5 percent forbs, and 5 percent trees and woody plants.

Little bluestem, switchgrass, fringeleaf paspalum, tanglehead, indiangrass, and brownseed paspalum are the dominant grasses. Trees include live oak, mesquite, and huisache. Forbs include snoutbean, croton, western indigo, sensitive brier, bullnettle, beebalm, and lantana.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced mainly by silver bluestem, knotroot bristlegrass, dropseed, hooded windmillgrass, and fall and sandy witchgrass. Under continued heavy grazing, these grasses decline and are replaced by plants of even lower grazing value, for example, red lovegrass, balsamscale, grassbur, tumblegrass, threeawn, croton, partridgepea, mesquite, huisache, and lantana.

These soils are fairly suited to urban uses. The sandy texture, seepage, the moderately slow permeability in places, the moderate shrink-swell potential, and the instability of excavation banks are limitations.

These soils are poorly suited to recreation uses mainly because of the sandy texture.

Sarita soils are in capability subclass IVe and in the Sandy range site; Nueces soils are in capability subclass IIIe and in the Sandy range site.

29—Sinton sandy clay loam. This is a deep, nearly level soil on bottomlands or low terraces. The surface is slightly concave to plane. Slopes range from 0 to 1 percent and average 0.5 percent. Areas are mostly long and narrow and range in size from 10 to 70 acres.

Typically, the surface layer is about 34 inches thick. In the upper part it is moderately alkaline, very dark gray sandy clay loam, and in the lower part it is dark gray clay loam. The underlying layer to a depth of 72 inches is moderately alkaline, stratified fine sandy loam that is light gray in the upper part and white in the lower part.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion is a slight hazard. In spring and fall, this soil is occasionally flooded for brief periods following heavy rains.

Included with this soil in mapping are small areas of Odem, Aransas, Racombes, and Papagua soils. Also included are a few small areas of soils that have a deposit of sandy overwash several inches thick. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. In a few areas, it is used as cropland and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, flax, wheat, and some vegetables

are grown. Occasional flooding is a hazard. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, maintain tilth, and increase productivity. In some areas, diversion terraces are desirable to help control surface runoff from adjacent uplands and protect against flooding.

This soil is well suited to use as improved pasture. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture and improve productivity. Improved varieties of bermudagrass, bluestem, and kleingrass grow well on this soil.

In rangeland, the climax plant community is a mixture of grasses, trees, shrubs, and forbs. It is composed of 80 percent grasses, 15 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, switchgrass, fourflower trichloris, big sandbur, and vine-mesquite are the dominant grasses. Trees and shrubs include live oak, elm, pecan, hackberry, huisache, and mesquite. Forbs include Engelmann-daisy, bundleflower, snoutbean, sensitive brier, and annual forbs.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced by silver bluestem, white tridens, Texas wintergrass, buffalograss, and sideoats grama. Under continued heavy grazing, these grasses decline and are replaced by plants of even lower grazing value. These are mainly red grama, purple threeawn, tumblegrass, tumble windmillgrass, and hooded windmillgrass. In some areas, mesquite, huisache, and other woody plants have become dominant.

This soil generally is not suited to urban uses. Flooding and seepage are limitations. Low strength is a limitation for roads and streets.

The soil is poorly suited to recreation uses because of the hazard of flooding.

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

30—Weesatche fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is plane to slightly convex. Slopes average 2 percent. Areas are irregularly shaped and range from 20 to 350 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil to a depth of 25 inches is sandy clay loam that is brown in the upper part and reddish brown in the lower part. Below that, to a depth of 34 inches, the subsoil is reddish brown sandy clay loam that is about 20 percent soft masses and concretions of calcium carbonate. The underlying layer to a depth of 60 inches is very pale brown sandy clay loam that is about 25 percent soft masses, concretions, and threads of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Parrita, Goliad, Pettus, Pernitas, and Olmos soils. Also included is a soil that is similar to this Weesatche soil but has an accumulation of calcium carbonate below a depth of 40 inches. Also included are a few small areas of Weesatche soils that have slopes greater than 3 percent. The included soils make up less than 20 percent of a mapped area.

This soil is used in about equal proportions as cropland, rangeland, and improved pasture.

This soil is suited to use as cropland. The main crops are grain sorghum, cotton, corn, flax, wheat, and some vegetables. Water erosion is a hazard. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, conserve moisture, control erosion, improve soil productivity, and maintain tilth. Contour farming, terraces, and waterways control runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

This soil is suited to use as improved pasture. Droughtiness and low fertility are the main limitations. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and maintain or increase productivity. Improved varieties of bermudagrass, bluestem, buffelgrass, and kleingrass grow well on this soil (fig. 11).

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees, shrubs, and woody plants. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, plains bristlegrass, fourflower trichloris, lovegrass tridens, and plains lovegrass are the dominant grasses. Trees, shrubs, and woody plants include blackbrush, kidneywood, granjeno, wolfberry, mesquite, huisache, guayacan, and pricklypear. Forbs include bundleflower, snoutbean, Engelmann-daisy, sensitive brier, indigo, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced mainly by Nash and hooded windmillgrasses, sideoats grama, fall witchgrass, hairy grama, and threeawn. Under continued heavy grazing, these grasses decline and are replaced by plants with even lower grazing value, for example, red grama, purple threeawn, Halls panicum, red lovegrass, tumble windmillgrass, and grassbur. In some areas, blackbrush, mesquite, huisache, and granjeno have formed a dense canopy that has choked off the understory vegetation.

This soil is fairly suited to urban uses. The moderate shrink-swell potential, corrosivity to uncoated steel, and seepage are limitations.

This soil is well suited to recreation uses.

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

31—Weesatche fine sandy loam, 3 to 5 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Slopes average 3.5 percent. Areas are irregularly shaped and range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 38 inches. It is sandy clay loam that is dark brown in the upper part, brown in the middle part, and reddish yellow in the lower part. The underlying layer to a depth of 60 inches is pink sandy clay loam that is about 20 percent soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Parrita, Goliad, Pettus, Pernitas, and Olmos soils. Included are a few areas of a soil that is similar to this Weesatche soil but has a layer of calcium carbonate accumulation below a depth of 40 inches. Also included are a few small areas of Weesatche soils that have slopes of less than 3 percent. The included soils make up less than 20 percent of a mapped area.

This soil is used in about equal proportions as cropland, rangeland, and improved pasture.

This soil is suited to use as cropland. Grain sorghum, cotton, corn, flax, and wheat are the main crops. The hazard of water erosion, droughtiness, and low fertility are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, conserve moisture, control erosion, improve productivity, and maintain tilth. Contour farming, terraces, and waterways control runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

This soil is suited to use as improved pasture. The hazard of water erosion, droughtiness, and low fertility are limitations. Fertilization, weed control, brush

Figure 11.—Improved pasture of coastal bermudagrass. The soil is Weesatche fine sandy loam, 1 to 3 percent slopes.

management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and maintain or increase productivity. Improved varieties of bermudagrass, bluestems, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees, shrubs, and woody plants. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, plains bristlegrass, fourflower trichloris, lovegrass tridens, and plains lovegrass are the dominant grasses. Trees, shrubs, and woody plants include blackbrush, kidneywood, granjeno, wolfberry, mesquite, huisache, guayacan, and pricklypear. Forbs include bundleflower, snoutbean, Engelmann-daisy, sensitive brier, indigo, and orange zexmenia.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced largely by Nash and hooded windmillgrasses, sideoats grama, fall witchgrass, hairy grama, and threeawn. Under continued heavy grazing, these grasses decline and are replaced by grasses of even lower grazing value, for example, red grama, purple threeawn, Halls panicum, red lovegrass, tumble windmillgrass, and grassbur. In some areas, blackbrush, mesquite, huisache, and granjeno have formed a dense canopy that has choked off most of the understory plants.

This soil is fairly suited to urban uses. Slope, the moderate shrink-swell potential, seepage, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is fairly suited to recreation uses, but slope is a limitation.

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

32—Weesatche sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Slopes, on the average, are 0.5 percent. Areas are oval to irregularly shaped and range from 8 to 75 acres in size.

Typically, the surface layer is dark grayish brown sandy clay loam about 7 inches thick. The subsoil to a depth of 22 inches is sandy clay loam that is dark grayish brown in the upper part and dark brown in the lower part. Below that, to a depth of 38 inches, the subsoil is clay loam that is brown in the upper part and reddish yellow in the lower part. The underlying layer is pink sandy clay loam that is about 20 percent soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion is a slight hazard.

Included with this soil in mapping are small areas of Parrita, Pernitas, Pettus, Goliad, and Clareville soils. Also included are a few areas of soils that are similar to this Weesatche soil except that they have an accumulation of calcium carbonate below a depth of 40 inches. Also included are a few areas of Weesatche soils that are gently sloping. The included soils make up less than 10 percent of a mapped area.

This soil is used in about equal proportions as cropland, rangeland, and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, flax, wheat, and some vegetables are the main crops. Low fertility and droughtiness are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, conserve moisture, improve productivity, and maintain soil tilth.

This soil is well suited to use as improved pasture. Low fertility is a limitation in some areas. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture and maintain or increase productivity. Improved varieties of bermudagrass, bluestem, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees or shrubs. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, plains bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, blackbrush, condalia, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced largely by silver bluestem, buffalograss, curlymesquite, and perennial threeawn. Under continued heavy grazing, these grasses decline and are replaced by plants of even lower grazing value, for example, red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some areas, mesquite, blackbrush, and other mixed brush have formed a dense canopy that has choked off most of the understory plants.

This soil is fairly suited to urban uses. The moderate shrink-swell potential and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is well suited to recreation uses.

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

33—Weesatche sandy clay loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is plane to slightly convex. Slopes average 2 percent. Areas are irregularly shaped and range from 15 to 250 acres in size.

Typically, the surface layer is dark grayish brown sandy clay loam about 6 inches thick. The upper part of the subsoil, to a depth of 18 inches, is sandy clay loam that is very dark grayish brown and grades with depth to dark brown. The lower part of the subsoil, to a depth of 36 inches, is clay loam that is brown in the upper part and reddish yellow in the lower part. The underlying layer to a depth of 60 inches is pink sandy clay loam that is about 60 percent soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion is a moderate hazard.

Included with this soil in mapping are small areas of Parrita, Goliad, Pettus, Pernitas, and Olmos soils. Also included are a few small areas of a soil that is similar to this Weesatche soil except that it has an accumulation of calcium carbonate below a depth of 40 inches. Also included are a few areas of Weesatche soils that have slopes greater than 3 percent. The included soils make up less than 15 percent of a mapped area.

This soil is used in about equal proportions as cropland, rangeland, and improved pasture.

This soil is well suited to use as cropland. Grain sorghum, cotton, corn, flax, wheat, and some vegetables are commonly grown. Droughtiness and the hazard of water erosion are limitations. Fertilization, minimum tillage, high-residue crops, cover crops that include legumes, and residue management help reduce soil temperature, reduce runoff, conserve moisture, control erosion, increase productivity, and maintain soil tilth. Contour farming, terraces, and waterways help control runoff and protect against erosion. In some areas, diversion terraces are needed to help control surface runoff.

This soil is fairly suited to use as improved pasture. Water erosion is a hazard, and droughtiness is a limitation. Fertilization, weed control, brush management, proper stocking rates, and controlled grazing promote a good vegetative cover, which helps conserve moisture, control erosion, and improve or maintain productivity. Improved varieties of bermudagrass, bluestem, buffelgrass, and kleingrass grow well on this soil.

In rangeland, the climax plant community is an open grassland of dominantly mid grasses with scattered trees or shrubs. It is composed of about 90 percent grasses, 5 percent trees, shrubs, and woody plants, and 5 percent forbs.

Little bluestem, fourflower trichloris, plains bristlegrass, and sideoats grama are the dominant grasses. Trees and shrubs include mesquite, granjeno, blackbrush, condalia, wolfberry, desert yaupon, and guayacan. Forbs include Engelmann-daisy, bundleflower, orange zexmenia, and sensitive brier.

As retrogression occurs because of heavy grazing, the more palatable plants are grazed first. They are replaced mainly by silver bluestem, buffalograss, curlymesquite, and perennial threeawn. Under continued heavy grazing, these grasses decline and are replaced by plants of even lower grazing value, for example, red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. In some areas, mesquite, blackbrush, and other mixed brush have formed a dense canopy that has choked off most of the understory plants.

This soil is fairly suited to urban uses. The moderate shrink-swell potential, slope, and corrosivity to uncoated steel are limitations. Low strength is a limitation for roads and streets.

This soil is fairly suited to recreation uses. Slope is a limitation in some places.

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

prime farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Bee County are listed.

Each year thousands of acres of land throughout the United States are converted from agricultural to industrial, urban, and other uses. Some of the converted land is prime farmland.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing 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 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 producing food, feed, forage, fiber, and oilseed crops. Such soils have soil properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be long enough. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland, or they may be in other uses but may not be urban and built-up land or be in water areas. They are either used for producing food or fiber or are available for these uses.

Prime farmland soils usually get 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 flooded during the growing season. The slope ranges mainly from 0 to 5 percent.

Soils that have a high water table, are subject to flooding, or are in areas of inadequate rainfall may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. For more detailed information on the criteria for prime farmland soils, consult the local staff of the Soil Conservation Service.

prime farmland in Bee County

About 339,000 acres, or nearly 63 percent of the county, is prime farmland. The areas of prime farmland are scattered throughout the county, but the largest areas are in map units 2, 4, 5, and 8 on the general soil map. Substantial areas are in map units 1, 6, and 7, and only small scattered areas are in map unit 3. Approximately 85,000 acres of the prime farmland are used for cultivated crops. The crops, mainly grain sorghum, cotton, corn, and flax, account for an estimated one-third of the county's total agricultural income each year (*5*).

A recent trend in land use in some parts of Bee County has resulted in the loss of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, difficult to cultivate, and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Bee County. Limitations, if any, are shown in parentheses after the name of the map unit. 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.

3—Clareville sandy clay loam, 0 to 1 percent slopes
4—Coy clay, 1 to 3 percent slopes
7—Goliad sandy clay loam, 0 to 1 percent slopes (if irrigated)
8—Goliad sandy clay loam, 1 to 3 percent slopes (if irrigated)
10—Lattas clay, 0 to 1 percent slopes
11—Lattas clay, 1 to 3 percent slopes
12—Leming loamy fine sand, 0 to 3 percent slopes (if irrigated)
13—Monteola clay, 0 to 1 percent slopes
14—Monteola clay, 1 to 3 percent slopes
16—Odem fine sandy loam
20—Papalote loamy fine sand, 0 to 3 percent slopes (if irrigated)
21—Papalote fine sandy loam, 0 to 1 percent slopes

22—Papalote fine sandy loam, 1 to 3 percent slopes
25—Pernitas sandy clay loam, 2 to 5 percent slopes (if irrigated)
27—Racombes sandy clay loam, 0 to 1 percent slopes
29—Sinton sandy clay loam
30—Weesatche fine sandy loam, 1 to 3 percent slopes
31—Weesatche fine sandy loam, 3 to 5 percent slopes
32—Weesatche sandy clay loam, 0 to 1 percent slopes
33—Weesatche sandy clay loam, 1 to 3 percent slopes

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help 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 behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other 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 in harmony with the natural soil.

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

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

crops and pasture

General management needed for crops and pasture is suggested in this section. The 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.

More than 146,000 acres in Bee County was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*10*). Of that total, 32,000 acres was used for permanent pasture; 105,000 acres for row crops, mainly grain sorghum; and 5,000 acres for close-growing crops, mainly small grains and flax. The rest was idle cropland.

The potential of soils in Bee County for increased production of food is good. About 305,000 acres of potentially good cropland is currently used as rangeland, and about 29,000 acres is used as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county.

Soil erosion is the major soil problem on about 60 percent of the cropland and pasture in Bee County. If the slope is more than 1 percent, erosion is a hazard. Coy, Goliad, Monteola, Pernitas, and Weesatche soils have slopes of 1 to 5 percent.

Erosion of the surface layer results in reduced productivity. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, for example, Orelia and Papalote soils, because part of the subsoil is incorporated into the plow layer. Loss of the surface layer is also damaging to soils that have a layer in or below the subsoil that limits the depth of the root zone. Goliad and Parrita soils, for example, have a layer of cemented caliche.

In many areas of sloping soils, tilling or preparing a good seedbed is difficult if the soils have a claypan or a hardpan because the original friable surface layer has been eroded away. Claypans and hardpans are common in moderately eroded Papalote and Goliad soils.

Erosion also reduces productivity on soils that tend to be droughty, for example, Pernitas and Pettus soils.

Soil erosion also results in the sedimentation of streams. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide a protective cover on the surface, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil

for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the crop that follows.

In some areas of the sloping Coy, Goliad, Monteola, Papalote, Pernitas, and Weesatche soils, slopes are so short and irregular that contour tillage or terracing is not practical. On these soils, a cropping system that provides substantial vegetative cover is required to control erosion unless minimum tillage is practiced. Minimum tillage and crop residue left on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be used on most soils in the survey area, but they are more difficult to use successfully on eroded soils and on soils that have a clayey surface layer, for example, Kincheloe, Lattas, and Monteola soils. Minimum tillage for grain sorghum is used on an increasing acreage. It effectively reduces erosion on sloping land.

Terraces and diversions reduce the length of the slope and help to control runoff and erosion. Because of short periods of heavy rainfall, terraces are necessary to carry the excess water to a safe outlet. Coy, Clareville, Lattas, Monteola, Papalote, and Weesatche soils are suitable for terraces. The other soils in the county are less suitable for terraces and diversions because of irregular slopes, excessive wetness in the terrace channels, a thick, sandy surface layer, a clayey subsoil that would be exposed in terrace channels, or cemented caliche at a depth of less than 40 inches.

Contour farming to control erosion is in widespread use in the survey area. It is best suited to soils that have smooth, uniform slopes, for example, Coy, Goliad, Kincheloe, Lattas, Monteola, Papalote, Pernitas, and Weesatche soils.

Soil blowing is a hazard on the sandy Leming, Nueces, Papalote, and Sarita soils. It can damage these soils in a few hours if the winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a vegetative cover or surface mulch minimizes soil blowing.

Information on erosion control practices for each kind of soil in the survey area is available at local offices of the Soil Conservation Service.

Soil drainage is the major management need on about 35 percent of the acreage used for crops and pasture in the survey area. The poorly drained Aransas and Edroy soils, which take up about 15,000 acres in the survey area, are too wet for producing crops common to the area.

Without artificial drainage, the somewhat poorly drained Lattas and Orelia soils, which take up about 112,000 acres, stay wet for such long periods that planting is delayed or crops are damaged in some years.

Clareville, Coy, Kincheloe, and Racombes soils have good natural drainage most of the year, but they tend to dry out slowly after rains. Artifical drainage is needed in some small areas of wet soils along drainageways and in swales that are commonly included in areas of the moderately well drained Goliad, Leming, Nueces, Odem, Papagua, and Papalote soils, especially those that have slopes of 1 to 5 percent.

The design of surface and subsurface drainage systems varies with the kind of soil. Surface drainage is needed in most areas of poorly drained soils that are used for row crops. Drains have to be more closely spaced in areas of slowly permeable soils than in areas of more permeable soils. Finding adequate outlets for a drainage system is difficult in some areas of Coy, Lattas, Monteola, Orelia, and Papagua soils.

Information on drainage design for each kind of soil in the survey area is available in local offices of the Soil Conservation Service.

Fertility is naturally medium in most soils on uplands in the survey area. Most of the soils are neutral or alkaline to some degree. The soils on flood plains, for example, Aransas, Sinton, and Odem soils, range from neutral to moderately alkaline. They naturally have a higher content of plant nutrients than do most soils on uplands. Edroy and Orelia soils, in low swales and drainageways, are slightly acid to mildly alkaline.

Most soils on uplands are neutral to moderately alkaline in their natural state. A few soils, for example, Edroy, Leming, Orelia, and Papalote soils, may be slightly acid in the surface layer but do not need lime for crop production. Available phosphorus is naturally low, and potassium is medium to high in most of these soils. The amount of fertilizer added to a soil should be based on the results of soil tests, the needs of the crop, and the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that are granular and porous have good tilth.

Some of the soils in the survey areas that are used for crops have a surface layer of fine sandy loam that is light in color and low in content of organic matter. Generally, the structure of such soils is weak, and heavy rainfall causes a crust to form on the surface. The crust is hard when the surface is dry, and it is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help to improve soil structure and reduce crusting.

Fall plowing is generally considered a good practice on the soils in Bee County. It effectively kills vegetation, returns organic matter to the soil to maintain or improve tilth, and enables the soil to store moisture for spring planting. It also helps to control crop-damaging insects, and for some crops this makes fall plowing a requirement.

The dark-colored Edroy, Lattas, and Monteola soils are clayey, and tilth is a concern because the soils often stay wet until late in spring. If they are plowed when wet, they tend to be very cloddy when dry, making it difficult to prepare a good seedbed. Fall plowing these soils generally results in good tilth in spring.

Field crops that are suited to the soils and climate of the survey area include many that are not now commonly grown. Grain sorghum and cotton are the main row crops. Other crops, however, including corn, sunflowers, soybeans, and peanuts can be grown if economic conditions are favorable.

Small grains and flax are the most common close-growing crops. Rye, barley, forage sorghum, wheat, and oats could be grown, and grass seed could be produced from various species of adapted improved grasses.

Vegetables and small fruits are the *special crops* that are grown commercially in the survey area. Cabbage and onions are grown in the large areas of nearly level Orelia, Lattas, and Papalote soils south of Beeville. A small acreage throughout the survey area is used for melons, cantaloups, okra, squash, turnips, peas, blackberries, dewberries, sweet corn, tomatoes, peppers, and other vegetables and small fruits. Most of the produce from these small areas is marketed locally. In addition, large areas can be adapted to other special crops, for example, spinach and carrots. Citrus is the most important tree fruit in the survey area, but it is not grown commercially.

Deep soils that have good natural drainage are suited to many vegetables and small fruits. Clareville, Coy, Racombes, and Weesatche soils are suitable. They have slopes of less than 5 percent. These soils take up an area of about 120,000 acres. Also, if irrigated, about 35,000 acres of the Pernitas soils that have slopes of less than 5 percent are suited to vegetables and small fruits.

If adequately drained, the poorly and somewhat poorly drained Edroy, Orelia, and Lattas soils are suited to a wide range of vegetable crops. These soils take up an area of about 132,000 acres.

Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low positions, where late frost occurs and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

The acreage in crops and pasture has gradually decreased as more and more land is used for urban development. In 1967, about 22,000 acres, or 4 percent of the survey area, was urban or built-up land, according to the Conservation Needs Inventory (*10*). Since then, about 800 acres per year have been converted to urban uses. Some of that acreage was well suited to use as cropland.

In general, the soils in the survey area that are well suited to crops are also well suited to urban uses. The data about specific soils in this soil survey can be helpful in planning future land use patterns. The potential productive capacity of the soils in farming should be weighed against the limitations and potential of the soils for nonfarm uses.

Some soils that are well suited to farming are poorly suited to nonfarm uses. These soils, in map units 3, 6, 7, and 8 on the general soil map at the back of this publication, are the Monteola, Coy, Lattas, and Orelia soils. Some of these soils are wet, and others have a high shrink-swell potential. In spite of these serious limitations, some of these soils have been used for nonfarm uses.

Some soils are not suited or are only fairly suited to farming but are generally suited to nonfarm uses. These are mainly the Parrita, Olmos, Weesatche, Clareville, Pernitas, and Papalote soils in map units 1, 2, 4, 5, and 6. Some of these soils are underlain by cemented caliche at a depth of less than 40 inches, but the rolling landscape, soil drainage, and other soil qualitites are favorable for residential and other urban uses.

Some soils, mainly in map units 3, 4, 6, and 7 and in scattered pockets in other map units, are poorly suited to urban uses and to most other uses. They provide habitat for wetland wildlife.

In 1967, approximately 6 percent of Bee County, about 32,000 acres, was used as permanent pasture and hayland, according to the Conservation Needs Inventory (*10*) of that year. In 1977, according to local records of the Soil Conservation Service, 15 percent, or about 81,000 acres, was used as permanent pasture and hayland. Introduced species of perennial grasses generally are used for forage production.

The more important grasses are coastal bermudagrass, kleingrass, and several species of improved bluestem. They are harvested by grazing or by mowing and baling.

Fertilization, weed and brush control, and proper stocking rates are needed for good forage yields. The soil type, plant species, and the desired level of forage production determine fertilizer requirements. Soil tests help determine the kind and amount of fertilizer needed. A proper stocking rate balances the number of grazing animals with forage production. Weeds and brush compete with desirable vegetation for the available moisture and nutrients. They can be controlled by mowing or by herbicides. Weeds generally are a minor problem on pasture that is well fertilized and properly grazed.

Irrigation is of minor importance in Bee County. It is used by a few landowners near the towns of Skidmore, Tynan, and Papalote mainly during extended dry periods.

Most of the water used for irrigation comes from wells. In 1967, about 15 wells were in use on about 3,000

acres (*10*). In 1977, about 30 wells were in use on about 5,000 acres.

Most wells are 200 to 600 feet deep. Production is 600 to 1,400 gallons per minute. The water is of poor quality. Wells that are 200 to about 300 feet deep produce better water than deeper wells. In some areas the water contains salts that can seriously harm the crops and the soils. The most harmful salts are sodium chloride, sodium sulfate, magnesium sulfate, and sodium bicarbonate. Other salts are calcium sulfate, calcium carbonate, and magnesium carbonate.

The three irrigation methods used are furrow, border, and sprinkler. The furrow and border methods work best on nearly level soils, where less leveling and smoothing are needed, than on more sloping soils. These methods are also better suited to soils that are loamy and clayey and not very permeable. Sprinkler irrigation is used mainly on more sloping and sandy soils.

Yields produced under irrigation will generally be higher than those from dryland farming. More information can be obtained by contacting the local office of the Soil Conservation Service.

yields per acre

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

The 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 insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for these crops.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*8*). 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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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 or for engineering purposes.

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

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 slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

George W. Love, range conservationist, and Jerry B. Lee, conservation agronomist, Soil Conservation Service, helped prepare this section.

About 68 percent of Bee County was rangeland in 1967 (*10*). In 1977, according to Soil Conservation Service records, only 59 percent was rangeland.

About two-thirds of farm income in the county is derived from livestock, principally cattle. Cow-calf operations are dominant. In years when there is enough rainfall, some stocker-type animals are grazed. The average ranch is about 3,000 acres in size. Some livestock farms use small areas of small grains and stalk fields for supplemental grazing. In winter the forage produced on rangeland is supplemented by hay and protein concentrate. Some horses are raised for ranch work.

The original native plant community in Bee County was primarily mid and tall grasses and forbs. A few areas were dominantly in short grasses. Continuous heavy grazing for many years has resulted in the deterioration of the climax plant community and in lower production of forage. Many of the better forage plants have been largely replaced by less palatable grasses, weeds, and brush.

The production of forage is highest in April, May, and June, when the rainfall and temperature are most favorable.

A midsummer growth slump occurs in July and August because of lower rainfall and higher temperatures. Plant growth resumes in September and lasts through early November. Rainfall is greatest in fall, and the highest monthly average is in September.

The soils vary in their capacity to produce rangeland forage. In the north-central part of the county, most of the soils are shallow over hard caliche. These are the Parrita and Olmos soils in general soil map unit 1. They support mostly short and mid grasses; their potential productivity is low because of the shallow root depth. The northern and southern parts of the county are made up of deep, clayey, loamy, and sandy soils in general soil map units 2, 3, 4, 5, 6, 7, and 8. The potential forage production on these soils is much greater than on the shallower soils in map unit 1.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential 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 natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. 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 recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation 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 mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

Paths and trails for hiking, horseback riding, and bicycling 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.

wildlife habitat

Jerry Turrentine, biologist, and Steve Warner, range conservationist, Soil Conservation Service, helped prepare this section.

Bee County provides suitable habitat for a wide variety of wildlife species. Through management and manipulation of the habitat, many wildlife species are increasing.

The major species in the county are white-tailed deer, javelina, bobwhite and blue quail, whitewing and mourning doves, Rio Grande turkey, bobcat, coyote, gray fox, raccoon, opossum, armadillo, cottontail rabbit, jackrabbit, striped skunk, bat, fox squirrel, and badger. Fish, reptiles, and amphibians are numerous in localized wet habitats. The American alligator inhabits several streams and permanent ponds throughout the county. Mountain lions are occasionally seen. During migration, waterfowl use the water areas and croplands in the county for rest and food. They include snow, white-fronted, and Canada geese, pintail, widgeon, gadwall, green-winged teal, and mallard ducks, and sandhill crane. Numerous species of songbirds, water-associated species, birds of prey, and vultures inhabitat the county. In addition to the resident birds of prey, several species migrate through Bee County or spend part of the year in the county.

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, and sunflowers.

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 kleingrass, switchgrass, trefoil, and vetch.

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 bluestem, longtom, beggarweed, and partridge pea.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are agarita, guajillo, and lantana.

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. The wildlife attracted to these areas include bobwhite quail, dove, bobcat, cottontail rabbit, and red fox.

Proper management of these areas is important. Areas in corn and grain sorghum provide food for dove and quail. Small grains are grazed by geese and also by deer if suitable cover is nearby. Crop residue left on the surface provides forage for numerous species of wildlife. Small areas of unharvested grain provide food and cover. Waterways can be managed to afford cover for small mammals and birds. Fence rows that are left untrimmed provide additional cover. Disking field borders greatly increases the food supply in pasture. Brushy areas in pasture are a source of food and cover. Kleingrass provides seed for birds.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include white-tailed deer, jackrabbit, coyote, bobcat, javelina, and wild turkey.

Management includes several of the rangeland improvement practices. Proper grazing use, planned grazing systems, and deferred grazing increase the production of forage for wildlife. A good vegetative cover provides cover for quail and turkey and fawning areas for deer. Grasses, if allowed to mature, provide seed for dove, quail, and turkey.

Brush management is important. Brush cleared in strips and patterns creates a diversity of food sources for various species of wildlife. Other practices include disking and food plantings.

engineering

G. P. Johnson, Jr., civil engineer, and Tony G. Funderburk, agricultural engineer, Soil Conservation Service, helped prepare this section.

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 need to 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 to 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 (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) 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, and local roads and streets. 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 the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. 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 to 6 feet are not considered.

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

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 good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates

that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of 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 needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 soil blowing.

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 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, 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 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 the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel 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 water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

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

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

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

material. Excessive slope can affect the storage capacity of the reservoir area.

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce 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 to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

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 classifications, 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 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, 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 20.

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 oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

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

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, 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 is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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

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

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The 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 in tons per acre per year. The estimates

are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

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

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 of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of 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 not protected by vegetation are assigned to one of four groups. They are grouped according to the intake 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 inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps or marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high

the water rises above the surface. The second numeral indicates the depth below the surface.

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 severe corrosion 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 amount of sulfates in the saturation extract.

physical and chemical analyses of selected soils

The results of physical analysis of Lattas clay in the survey area are given in table 17, the results of chemical analysis are given in table 18, and clay mineralogy is given in table 19. Soil samples were analyzed by the Texas Agricultural Experiment Station.

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 (*9*).

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).

Organic carbon—dichromate, ferric sulfate titration (6A1a).

Extractable cations—ammonium acetate pH 7.0, uncorrected; magnesium (602), sodium (6P2), potassium (6Q2).

Cation-exchange capacity—sodium acetate, pH 8.2 (5A2a).

Reaction (pH)—1:1 water dilution (8C1a).

Carbonate as calcium carbonate—titrimetric (6E1e).

Sodium-adsorption ratio (5E).

engineering index test data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." 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) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—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 (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 21, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten 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 Aqualf (*Aqu*, meaning water, 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 Albaqualfs (*Alb*, meaning presence of an albic horizon, plus *aqualf*, the suborder of the Alfisols that have an aquic moisture regime).

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

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

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

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*7*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*11*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Aransas series

The Aransas series consists of deep, poorly drained clayey soils on flood plains and bottom lands. These soils formed in calcareous clayey alluvium. The slope ranges from 0 to 1 percent.

Typical pedon of Aransas clay, 4 miles southwest on Texas Highway 72 from its intersection with Farm Road 673 in Pawnee, 2 miles south on county road, and 825 feet east, in a pasture:

A11—0 to 2 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and very fine

granular structure; hard, firm, plastic and sticky; many fine roots; many fine pores; few worm casts; about 5 percent, by volume, partly decomposed organic residue; calcareous; moderately alkaline; clear smooth boundary.

A12—2 to 35 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium and fine subangular blocky and blocky structure; very hard, very firm, plastic and sticky; common fine roots; common fine pores; few insect nests and tunnels; few fine threads and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A13—35 to 44 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few fine distinct gray, grayish brown, pale brown, and light yellowish brown mottles; moderate medium and fine angular blocky structure; very hard, very firm, plastic and sticky; few fine roots; few fine pores; few small slickensides that do not intersect; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; common medium distinct light brownish gray (10YR 6/2), light gray (10YR 7/1, 7/2), and very pale brown (10YR 7/3) mottles; extremely hard, very firm; sticky; few fine pores; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

This soil has cracks 0.5 inch to 1.0 inch wide that extend from the surface to a depth of 30 to 40 inches.

The A horizon is black, very dark gray, or dark gray. The 10- to 40-inch control section is clay or clay loam. It is 35 to 60 percent clay.

The C horizon is light gray, gray, or dark gray. It has few to common concretions and soft masses of calcium carbonate.

Clareville series

The Clareville series consists of deep, well drained loamy soils in shallow valleys or on old terraces. These soils formed in calcareous loamy and clayey ancient alluvium. The slope ranges from 0 to 1 percent.

Typical pedon of Clareville sandy clay loam, 0 to 1 percent slopes, 4.0 miles west on U.S. Highway 59 from the courthouse in Beeville, 2.7 miles southeast on county road, and 100 feet north, in rangeland:

A1—0 to 10 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak fine granular and weak subangular blocky structure; hard, friable; slightly sticky; many fine roots; neutral; clear smooth boundary.

B21t—10 to 22 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to fine subangular blocky; hard, firm; slightly sticky; common fine roots; common fine pores; few insect nests and tunnels; few clay films; neutral; gradual wavy boundary.

B22t—22 to 32 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky; hard, firm, sticky; common fine pores; few worm casts; few insect nests; distinct clay films; mildly alkaline; gradual wavy boundary.

B3—32 to 42 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; weak medium and fine subangular blocky structure; very hard, very firm; sticky; few fine pores; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—42 to 60 inches; very pale brown (10YR 8/4) clay loam, very pale brown (10YR 7/4) moist; massive; hard, firm, sticky; about 10 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 55 inches thick. The mollic epipedon is 21 to 28 inches thick. The depth to masses and concretions of carbonate is 24 to 36 inches.

The A horizon is dark gray, very dark gray, dark grayish brown, very dark grayish brown, or dark brown. It is neutral or mildly alkaline.

The B2t horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark brown, grayish brown, or brown clay, clay loam, or sandy clay. It is 35 to 45 percent clay. The B21t ranges from neutral to moderately alkaline, and the B22t is mildly alkaline or moderately alkaline.

The B3 and Cca horizons are pale brown, very pale brown, strong brown, light yellowish brown, or pink. Soft masses and concretions of calcium carbonate make up 2 to 25 percent of the volume.

Coy series

The Coy series consists of deep, well drained clayey soils on uplands. These soils formed in calcareous clayey sediment. The slope ranges from 0 to 3 percent.

Typical pedon of Coy clay, 1 to 3 percent slopes, 4.0 miles south on Farm Road 673 from schoolhouse in Pawnee, 2.9 miles south on winding county road, and 50 feet east, in a pasture:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak fine granular and subangular blocky structure; hard, friable; slightly sticky; common fine roots; few insect nests, tunnels, and worm casts; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B21t—8 to 16 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; slightly sticky; common fine roots; few insect nests, tunnels, and worm casts; shiny pressure faces and thin clay films on ped faces; few snail shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

B22t—16 to 24 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine and medium blocky; very hard, very firm; plastic and sticky; few fine roots; few insect nests and tunnels; clay films on ped faces; pressure faces on peds; few fine weakly cemented concretions of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

B23t—24 to 40 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium blocky; very hard, very firm; plastic and sticky; clay films on ped faces; few slickensides; pressure faces on peds; common vertical streaks that are apparently filled cracks; calcareous; moderately alkaline; gradual wavy boundary.

B3ca—40 to 50 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak medium blocky structure; very hard, very firm; plastic and sticky; shiny surfaces on peds; common vertical streaks that are apparently filled cracks; few slickensides; pressure faces on peds; estimated 5 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual lower boundary.

Cca—50 to 64 inches; very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; massive; very hard, very firm, plastic and sticky; common vertical streaks of grayish brown (10YR 5/2) up to 1/2 inch wide; few fine faint yellowish brown mottles; common soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. The soil is weakly cyclic within the limits of the pedon. The thinnest sola are on the microknolls and the thickest in the microdepressions. When dry, these soils have cracks 0.25 to 1.50 inches wide that extend from the surface into the C horizon.

The A horizon is dark gray, very dark grayish brown, or dark grayish brown.

The B2t horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark brown, brown, or grayish brown clay or clay loam. It is 35 to 55 percent clay. The B3ca horizon is grayish brown, light gray, pale brown, very pale brown, or light yellowish brown clay or clay loam. Soft masses and concretions of calcium carbonate make up 2 to 10 percent of the volume.

The Cca horizon is pale brown, very pale brown, or brownish yellow clay or shaly clay. Soft masses and concretions of calcium carbonate make up 2 to 5 percent of the volume and also decrease with depth in most pedons.

Edroy series

The Edroy series consists of deep, poorly drained clayey soils on uplands. These soils formed in calcareous clayey sediment over loamy sediment in depressional or ponded areas. The slope ranges from 0 to 1 percent.

Typical pedon of Edroy clay, depressional, 15 miles east on Texas Highway 202 from its intersection with U.S. Highway 181 bypass in Beeville, 6.25 miles south on private ranch road to ranch headquarters, and 3 miles south of ranch headquarters to a depressed area, in rangeland:

A11—0 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; very hard, friable, plastic and sticky; common fine roots in and between peds; few fine pores; neutral; gradual smooth boundary.

A12—8 to 23 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, very firm; plastic and sticky; uncoated sand grains in partially closed cracks that extend to lower boundary; common fine roots; few small slickensides; pressure faces on peds; neutral; gradual smooth boundary.

B2g—23 to 41 inches; gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; few fine faint light brownish gray mottles; moderate medium prismatic structure parting to weak medium blocky; extremely hard, very firm, plastic and sticky; few fine roots; few fine pores; few dark gray (10YR 4/1) streaks that are apparently filled cracks; pressure faces on peds; noncalcareous in matrix; moderately alkaline; gradual wavy boundary.

B3g—41 to 55 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; few medium faint gray (10YR 6/1) mottles; moderate medium prismatic structure parting to weak fine and medium blocky; extremely hard, firm, slightly plastic and sticky; few fine pores; about 3 percent, by volume, soft masses and cemented concretions of calcium carbonate; few fine black concretions; calcareous; moderately alkaline; clear wavy boundary.

IICg—55 to 60 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; few medium distinct yellowish brown (10YR 5/6) and few fine faint gray mottles; massive; hard, friable; few concretions of calcium carbonate; few fine black concretions; noncalcareous in matrix; moderately alkaline.

The solum is 40 to 62 inches thick. When the soil is dry, cracks up to 1 inch wide extend into the lower part of the B horizon. The COLE values in the upper 24 inches are 0.11 to 0.14. The soil ranges from nonsaline to moderately saline; salinity increases with depth.

The A horizon is very dark gray, dark gray, or gray. It is slightly acid or neutral.

The B2g horizon is clay, sandy clay, or clay loam that is gray in the upper part and gray, light gray, grayish brown, or light grayish brown in the lower part. It is 35 to 50 percent clay. It is mildly or moderately alkaline.

The B3g horizon is gray, light gray, or light brownish gray sandy clay loam, clay loam, or loam. It is calcareous or noncalcareous and is 2 to 5 percent, by volume, soft masses and concretions of calcium carbonate.

The IIC horizon is white, light brownish gray, or light gray fine sandy loam or loamy fine sand. It is moderately alkaline or strongly alkaline. In some pedons the C horizon is clay, clay loam, or sandy clay loam.

Goliad series

The Goliad series consists of moderately deep, moderately well drained loamy soils on uplands (fig. 12). These soils formed in beds of calcareous loamy sediment. The slope ranges from 0 to 3 percent.

Typical pedon of Goliad sandy clay loam, 1 to 3 percent slopes, 9.6 miles northeast on U.S. Highway 59 from its intersection with U.S. Highway 181 bypass in Beeville to county road, 2.5 miles east, 1.4 miles south on county road, and 500 feet east, in rangeland:

A1—0 to 10 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable, slightly sticky; common fine roots; common fine pores; few insect nests and tunnels; mildly alkaline; clear smooth boundary.

B21t—10 to 16 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; weak coarse prismatic structure parting to moderate medium blocky; hard, firm, sticky; common fine roots; common fine pores; few insect nests and tunnels; common distinct clay films on faces of peds; moderately alkaline; clear smooth boundary.

B22t—16 to 27 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky; few fine roots; between peds; common fine pores; few insect nests and tunnels; many thick clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

Ccam—27 to 33 inches; pink (7.5YR 8/4) and pink (7.5YR 7/4) moist; strongly cemented caliche that is fractured in the upper 1 to 2 inches; interstices filled with reddish brown (5YR 4/4) clay; cemented caliche fragments make up 95 percent of the volume in the upper 2 inches.

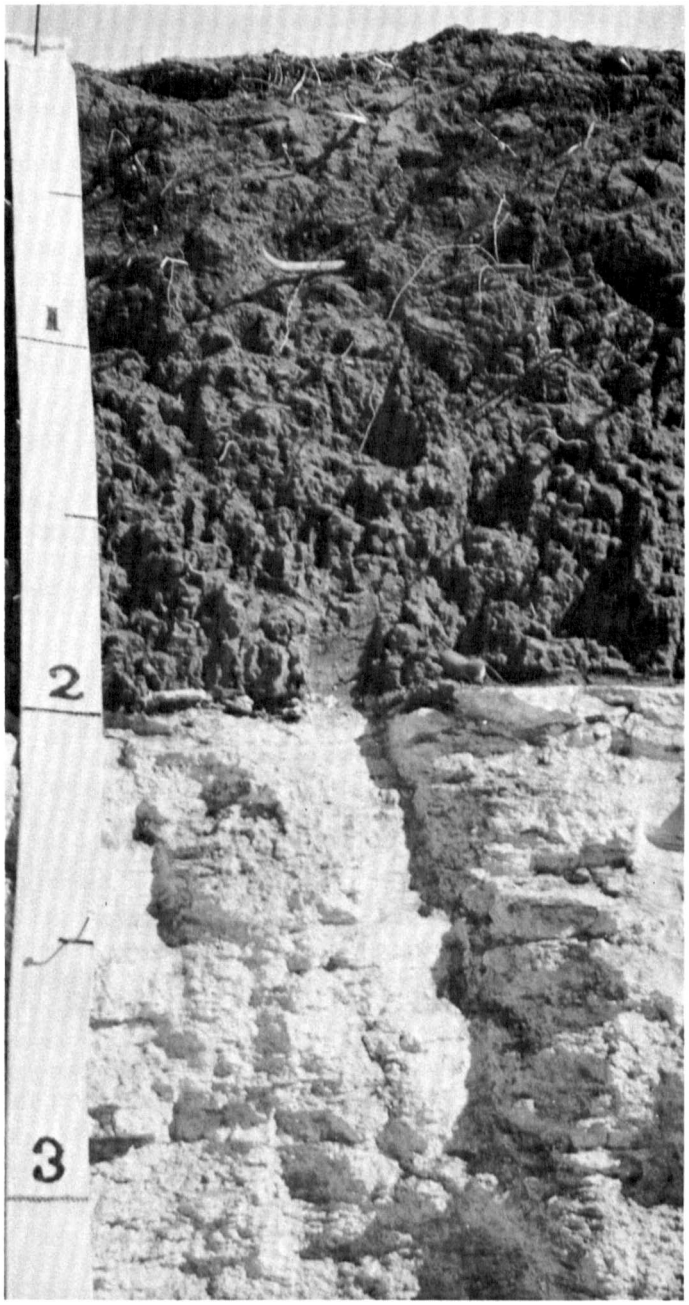


Figure 12.—Goliad sandy clay loam, 0 to 1 percent slopes. The strongly cemented caliche (petrocalcic horizon) begins at a depth of 2 feet.

The solum is 22 to 38 inches thick.

The A horizon is dark gray, very dark grayish brown, dark grayish brown, or dark brown. It is neutral to moderately alkaline.

The B2t horizon is brown, dark brown, reddish brown, dark reddish gray, yellowish red, or reddish yellow clay loam, sandy clay loam, sandy clay, or clay. It is 37 to 45 percent clay. It is mildly alkaline or moderately alkaline. In some pedons, a B3 or B3ca horizon is light yellowish brown, yellowish red, or reddish yellow.

The Ccam horizon is white or pink caliche that is strongly cemented. In the upper 1 to 2 inches it is nodular and somewhat fractured. Hardness and degree of cementation decrease with depth.

Kincheloe series

The Kincheloe series consists of moderately deep, well drained clayey soils on uplands. These soils formed in beds of calcareous clayey and loamy sediment. The slope ranges from 1 to 5 percent.

Typical pedon of Kincheloe clay loam, 1 to 5 percent slopes, 0.3 miles southeast on Farm Road 673 from its intersection with Texas Highway 72 in Pawnee and 40 feet east, in a cultivated field:

Ap—0 to 8 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular and subangular blocky structure; hard, firm, sticky; common fine roots; common fine pores; calcareous; moderately alkaline; gradual wavy boundary.

B2—8 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few medium light yellowish brown (2.5Y 6/4) mottles; moderate fine and medium blocky structure; very hard, very firm, sticky and plastic; few fine roots; few medium pores; common dark streaks of soil materials from above; pressure faces on peds; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C1—20 to 30 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak coarse blocky structure; extremely hard, extremely firm, sticky; few fine pores; few dark streaks from root channels and old cracks partly filled with darker soil material from upper horizons; few soft masses and concretions of calcium carbonate; few gypsum crystals; calcareous; moderately alkaline; gradual smooth boundary.

C2—30 to 60 inches; pale yellow (2.5Y 7/4) shaly clay, light yellowish brown (2.5Y 6/4) moist; massive; extremely hard, extremely firm, sticky; few dark streaks from root channels and old cracks partly filled with darker material from upper horizons; few soft masses and concretions of calcium carbonate; common fine gypsum crystals; few shale fragments that increase with depth; calcareous; moderately alkaline.

The solum is 20 to 35 inches thick and calcareous throughout. When dry, these soils have cracks 0.25 inch or more wide in the upper part of the subsoil.

The A horizon is dark grayish brown, grayish brown, brown, yellowish brown, or light brownish gray.

The B2 horizon is grayish brown, light brownish gray, light gray, pale brown, light olive brown, light yellowish brown, or pale yellow. Some pedons have grayish or yellowish mottles. Gray colors are due to parent sediment and not to wetness. This horizon is clay or silty clay and is 40 to 55 percent clay. Calcium carbonate accumulations range from few to common.

The C horizon is light gray, light yellowish brown, or pale yellow clayey shale, shaly clay, or clay. In some pedons there are few to common masses and strata of gypsum and soft masses and concretions of calcium carbonate.

Lattas series

The Lattas series consists of deep clayey soils on uplands. These soils formed in calcareous clayey sediment on old terraces. The slope ranges from 0 to 3 percent.

Typical pedon of Lattas clay, 0 to 1 percent slopes, from courthouse in Beeville 9.0 miles west on U.S. Highway 59 to its intersection with Farm Road 796, 7.1 miles south and east on Farm Road 796, 0.3 miles north on county road, and 150 yards east, in a microdepression in a cultivated field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak fine subangular blocky structure; very hard, firm, plastic and sticky; few fine roots; few fragments of snail shells; few worm casts and insect nests; calcareous; moderately alkaline; clear smooth boundary.

A12—8 to 23 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak fine angular blocky structure; very hard, very firm, plastic and sticky; few fine roots; common shiny pressure faces on peds; calcareous; moderately alkaline; gradual wavy boundary.

A13—23 to 35 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine angular blocky structure; very hard, very firm, plastic and sticky; few fine roots; few fine pores; common shiny pressure faces on peds; few streaks of gray (10YR 5/1) clayey material; few intersecting slickensides; few brownish threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—35 to 50 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common very pale brown (10YR 7/3) streaks in upper part increasing with depth; moderate fine and medium angular blocky structure;

very hard, very firm, plastic and sticky; few fine pores; few vertical seams of dark gray (10YR 4/1) material in old cracks; common intersecting slickensides; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—50 to 70 inches; very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; massive; extremely hard, very firm, plastic and sticky; few vertical seams of dark gray (10YR 4/1) material in old cracks; few soft masses and concretions of calcium carbonate; few gypsum crystals; calcareous; moderately alkaline.

These soils are cyclic. The relief consists of microknolls and microdepressions that repeat every 12 to 24 feet. The boundaries between the horizons are wavy below the plow layer. When the soil is dry, cracks 0.5 inch to 1.5 inches wide extend from the surface or the base of the Ap horizon into the C horizon. The soils are 40 to 55 percent clay throughout. In more than half of each pedon the dominant chroma is 1.5 or less to a depth of 40 inches.

The A horizon is dark gray or very dark gray. It ranges in thickness from 6 inches on the microknolls to 34 inches in the microdepressions.

The AC horizon is gray in the upper part and gray, grayish brown, or light brownish gray in the lower part. This horizon is thickest under the microknolls.

The C horizon is gray, light brownish gray, light gray, pinkish gray, white, or very pale brown.

Leming series

The Leming series consists of deep, moderately well drained sandy soils on low terraces and shallow valleys. These soils formed in calcareous sandy and loamy ancient alluvial sediment. The slope ranges from 0 to 3 percent.

Typical pedon of Leming loamy fine sand, 0 to 3 percent slopes, 1.6 miles north on U.S. Highway 181 from its intersection with Main Street in Normanna, 1.4 miles west on paved county road, and 300 feet south, in rangeland:

A11—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose; many fine roots; few insect nests and tunnels; slightly acid; clear smooth boundary.

A12—8 to 17 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many fine roots; common fine pores; few insect nests and tunnels; slightly acid; clear smooth boundary.

A2—17 to 23 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; common fine pores; slightly acid; abrupt wavy boundary.

B21t—23 to 33 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common medium distinct and prominent brownish yellow (10YR 6/8), reddish yellow (7.5YR 6/6), yellowish red (5YR 5/6), and gray (10YR 5/1) mottles; moderate fine and medium blocky structure; very hard, very firm, sticky; few fine roots; few fine pores; thick continuous clay films on peds; neutral; gradual wavy boundary.

B22t—33 to 45 inches; very pale brown (10YR 7/3) sandy clay, pale brown (10YR 6/3) moist; common medium and fine distinct gray (10YR 5/1), brownish yellow (10YR 6/8), and strong brown (7.5YR 5/8) mottles; moderate fine and medium blocky structure; very hard, very firm, sticky; few fine pores; thick discontinuous clay films on peds; mildly alkaline; gradual wavy boundary.

B3—45 to 59 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; common medium distinct reddish yellow (7.5YR 6/8) and few fine faint gray mottles; weak fine blocky structure; hard, firm, slightly sticky; few fine concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—59 to 72 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; few fine faint reddish yellow mottles; massive; hard, friable; moderately alkaline.

The solum is 48 to 72 inches thick.

The A horizon is brown, pale brown, grayish brown, or light brownish gray loamy fine sand or fine sand. Some pedons have an A2 horizon that is very pale brown, light brownish gray, or light gray. The A horizon is slightly acid or neutral.

The Bt horizon is light brownish gray, grayish brown, light gray, pale brown, or very pale brown clay, sandy clay, or clay loam that is distinctly mottled with gray, red, yellow, and brown. It is 35 to 48 percent clay. It is slightly acid to moderately alkaline.

The B3 and C horizons are very pale brown, reddish yellow, light brownish gray, light gray, or yellow with distinct to faint mottles of red, yellow, and brown. They are sandy clay, clay loam, or sandy clay loam. They are mildly alkaline or moderately alkaline. In some pedons they are calcareous and have a few concretions of calcium carbonate.

Monteola series

The Monteola series consists of deep, moderately well drained clayey soils on uplands. These soils formed in calcareous clays and shaly clays. The slope ranges from 0 to 5 percent.

Typical pedon of Monteola clay, 1 to 3 percent slopes, 2.0 miles east on Farm Road 798 from its intersection

with Farm Road 673 in Pawnee, 2.75 miles north on paved county road, and 150 feet northeast, in a cultivated field:

Ap—0 to 7 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; very hard, very firm, plastic and sticky; common fine roots; few patches of clean sand grains; calcareous; moderately alkaline; clear smooth boundary.

A1—7 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common wedge-shaped peds tilted about 15 to 30 degrees from horizontal axis parting to fine and very fine angular blocky structure; extremely hard, very firm, plastic and sticky; few fine roots; few fine pores; common shiny pressure faces on peds; intersecting slickensides; snail shell fragments; few thin lenses of uncoated sand grains; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—30 to 40 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common streaks of dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay in partly filled old cracks; many distinct wedge-shaped peds tilted about 30 degrees from the horizontal axis parting to moderate fine angular blocky structure; extremely hard, very firm, plastic and sticky; few fine roots; few fine pores; common intersecting slickensides; common pressure faces on peds; few thin lenses of uncoated sand grains; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC2—40 to 48 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; common streaks of dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay in partly filled old cracks; common distinct wedge-shaped peds tilted about 30 degrees from the horizontal axis parting to weak fine and medium angular blocky structure; extremely hard, very firm, plastic and sticky; common intersecting slickensides; few fine cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—48 to 60 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; few dark grayish brown and dark gray vertical seams that are apparently filled cracks; massive; very hard, very firm, plastic and sticky; few fine concretions and soft masses of calcium carbonate; few gypsum crystals; calcareous; moderately alkaline.

These soils are cyclic, and the horizon boundaries are wavy. The relief consists of microknolls and microdepressions. The solum is 40 to 60 inches thick. The soils are dominantly calcareous, but in the upper 7 to 8 inches they are noncalcareous in some microdepressions. Cracks 0.5 to 1.5 inches wide extend from the surface to a depth of 40 to 50 inches. The clay content of the 10- to 40-inch control section is 40 to 60 percent.

The A horizon is dark gray or very dark gray. It is thickest in the microdepressions and thinnest on the microknolls.

The AC horizon is gray, light grayish brown, grayish brown, dark grayish brown, very pale brown, pale brown, light yellowish brown, or yellowish brown clay with streaks of dark gray and very dark gray clay. Soft masses and cemented concretions of calcium carbonate are few to common in some pedons.

The C horizon is white, light gray, light brownish gray, pale brown, very pale brown, or light yellowish brown clay or shaly clay. Soft masses and cemented concretions of calcium carbonate are few to common. Some pedons have few to common crystals of gypsum.

Nueces series

The Nueces series consists of deep, moderately well drained sandy soils on uplands. These soils formed in noncalcareous sandy and loamy sediment. The slope ranges from 0 to 5 percent.

Typical pedon of Nueces fine sand, 0 to 5 percent slopes, in an area of Sarita-Nueces association, undulating, 15 miles east on Texas Highway 202 from its intersection with U.S. Highway 181 bypass in Beeville, 6.25 miles south on private ranch road to ranch headquarters, and 0.5 mile south, in rangeland:

A11—0 to 10 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose, very friable; common fine and medium roots; neutral; clear smooth boundary.

A12—10 to 22 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose, very friable; common fine roots; neutral; clear smooth boundary.

A13—22 to 34 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose, very friable; few fine roots; neutral; abrupt wavy boundary.

B21t—34 to 42 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many medium distinct yellow (10YR 7/6) and yellowish red (5YR 5/6) and few fine gray mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots along ped surfaces; few fine pores; thin continuous clay films; neutral; gradual wavy boundary.

B22t—42 to 50 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; many medium distinct yellowish red (5YR 5/8) and red (2.5YR 4/8) and a few fine faint gray mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm, sticky; few fine pores; thin continuous clay films; few dark concretions; neutral; gradual wavy boundary.

B3—50 to 75 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common coarse distinct and faint yellowish red (5YR 5/8) and brownish yellow (10YR 6/8) mottles; massive; very hard, very firm; few dark concretions; mildly alkaline.

The solum is 60 to 100 inches thick.

The A horizon is fine sand or loamy fine sand that is light brownish gray, grayish brown, or brown in the upper part and pale brown, very pale brown, or light yellowish brown in the lower part. It is slightly acid or neutral.

The Bt horizon is light brownish gray, light gray, pale brown, very pale brown, yellow, or light yellowish brown and is mottled in shades of red, yellow, brown, or gray. It is neutral to moderately alkaline sandy clay loam or sandy loam.

The B3 horizon is very pale brown, light gray, or white and is mottled in shades of red, yellow, and brown. It is mildly or moderately alkaline sandy clay loam or sandy loam.

The Nueces soils in Bee County are considered to be taxadjuncts to the Nueces series because they have a silicious mineralogy rather than a mixed mineralogy. However, this feature does not affect their use and management.

Odem series

The Odem series consists of deep loamy soils on flood plains and low terraces. These soils formed in calcareous loamy alluvial sediment. The slope ranges from 0 to 2 percent.

Typical pedon of Odem fine sandy loam, 15 miles east on Texas Highway 202 from its intersection with U.S. Highway 181 bypass in Beeville, 4.5 miles south on private ranch road, and 300 yards southwest on the south bank of Medio Creek, in rangeland:

A11—0 to 18 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine and very fine granular structure; slightly hard, friable; many fine roots; common fine pores; few insect nests and tunnels; neutral; gradual smooth boundary.

A12—18 to 48 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few plant roots; few fine and medium pores; noncalcareous; mildly alkaline; diffuse smooth boundary.

C—48 to 72 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; structureless; slightly hard, friable; few bedding planes; few thin strata of loamy fine sand; few pores; moderately alkaline.

The A horizon is 30 to 50 inches thick. It is neutral to moderately alkaline and noncalcareous to calcareous. The clay content of the 10- to 40-inch control zone ranges from 10 to 18 percent.

The A horizon is dark gray, very dark gray, dark grayish brown, or very dark grayish brown fine sandy loam in the upper part and dark gray, grayish brown, dark grayish brown, or very dark grayish brown fine sand or loam in the lower part.

The C horizon is grayish brown, light gray, light brownish gray, brown, pale brown, or very pale brown. It is dominantly fine sandy loam and loam with thin strata of sandy clay loam, loam, fine sandy loam, and loamy fine sand. It is mildly or moderately alkaline. In some pedons it is noncalcareous.

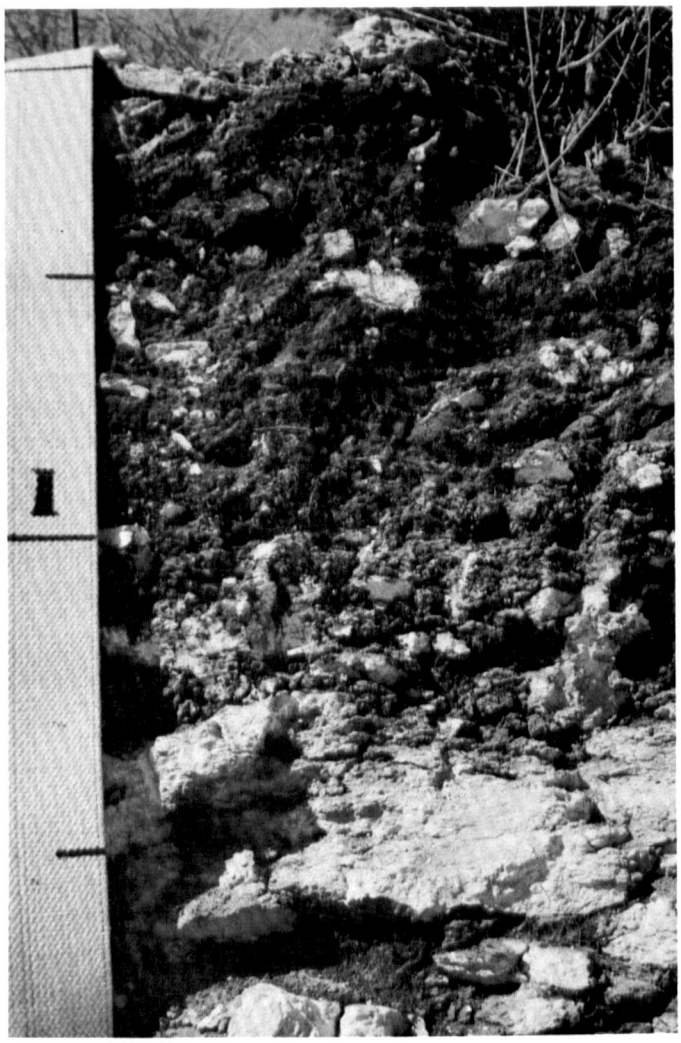


Figure 13.—Olmos very gravelly loam, 1 to 8 percent slopes. The indurated caliche (petrocalcic horizon) is at a depth of about 14 inches.

Olmos series

The Olmos series consists of very shallow and shallow, very gravelly loamy soils on uplands (fig. 13). These soils formed in calcareous loamy outwash sediment from areas of limestone. The slope ranges from 1 to 8 percent.

Typical pedon of Olmos very gravelly loam, 1 to 8 percent slopes, 3.5 miles west on Farm Road 623 from its intersection with U.S. Highway 181 in Pettus and 50 feet south, in rangeland:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; about 40 percent, by weight, indurated caliche fragments, most of which are 3 to 8 cm across; about 10 percent are larger than 8 cm, and 25 percent are smaller than 3 cm; calcareous; moderately alkaline; clear wavy boundary.

A12—5 to 10 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; about 70 percent, by weight, platy caliche fragments, most of which are 3 to 8 cm across; about 40 percent are larger than 8 cm, and 20 percent are smaller than 3 cm; calcareous; moderately alkaline; abrupt wavy boundary.

Ccam—10 to 14 inches; strongly cemented white (10YR 8/2) laminar caliche; few solution channels in the upper part filled with dark grayish brown loamy material.

The solum is 7 to 16 inches thick over strongly cemented caliche. This range in thickness is common within horizontal distances of less than 20 feet.

The A horizon is 35 to 75 percent coarse caliche fragments, by volume. Many of the caliche fragments are strongly cemented and laminar in the upper part and knobby or nodular on their lower sides. The A horizon is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. The fraction of fine earth is 22 to 35 percent clay.

The Ccam horizon is strongly cemented caliche that is laminar in the upper part and is fractured in places and filled with material from the A horizon. The lower part is moderately to weakly cemented fractured caliche.

Orelia series

The Orelia series consists of deep, somewhat poorly drained loamy soils on uplands (fig. 14). These soils formed in calcareous loamy sediment. The slope ranges from 0 to 1 percent.

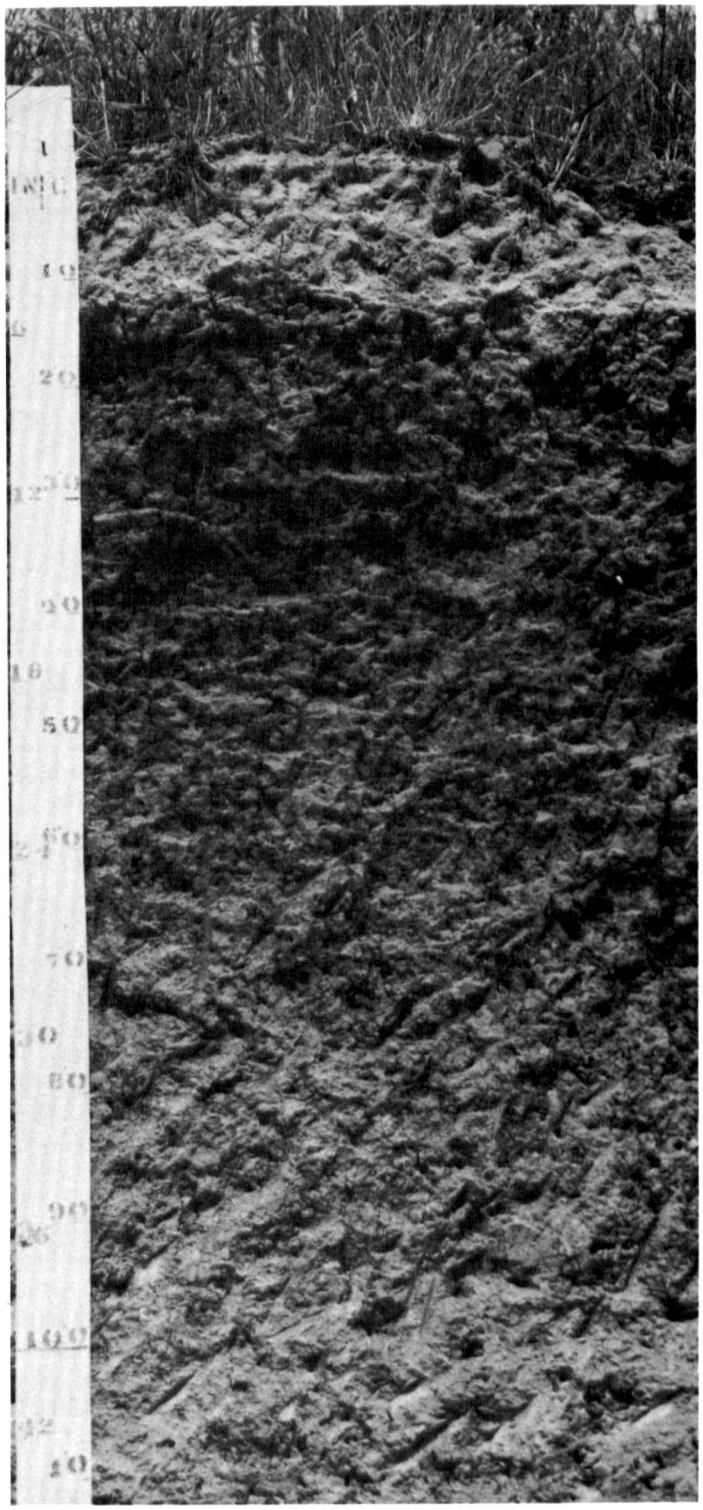


Figure 14.—Orelia fine sandy loam, 0 to 1 percent slopes. This soil has a light-colored surface layer and is somewhat poorly drained. Depth is shown in inches on the left side of the tape and in centimeters on the right side.

Typical pedon of Orelia fine sandy loam, 0 to 1 percent slopes, 16 miles east on Texas Highway 202 from its intersection with U.S. Highway 181 bypass in Beeville and 100 feet north, in rangeland:

A1—0 to 6 inches; gray (10YR 5/1) fine sandy loam, dark gray (10YR 4/1) moist; massive; hard, friable; common fine roots; few fine pores; few insect nests and tunnels; neutral; abrupt smooth boundary.

B21tg—6 to 14 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate medium and fine blocky; very hard, very firm; few fine roots mostly between prism faces; few fine pores; few distinct clay films on peds; neutral; clear smooth boundary.

B22tg—14 to 24 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, very firm; few fine roots; few fine pores; many prominent clay films on peds; few fine black concretions; mildly alkaline; clear smooth boundary.

B3cag—24 to 30 inches; gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; weak fine subangular blocky structure; hard, firm; about 5 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cca—30 to 60 inches; light gray (10YR 7/2) sandy clay loam, light grayish brown (10YR 6/2) moist; few fine faint yellowish brown mottles; massive; hard, friable; about 10 percent, by volume, concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 28 to 50 inches thick. A distinct zone of accumulated calcium carbonate is at a depth of 18 to 34 inches.

The A horizon is dark gray, gray, or very dark grayish brown fine sandy loam or sandy clay loam. It is neutral or mildly alkaline; salinity ranges from 0.4 to about 4.0 millimhos per centimeter.

The Btg horizon is dark gray, gray, very dark gray, dark grayish brown, or grayish brown sandy clay loam or clay loam and is less than 35 percent clay. It is neutral or mildly alkaline in the upper part and moderately alkaline in the lower part. Salinity is less than 8.0 millimhos per centimeter. Prism tops are commonly rounded and covered with a thin sandy layer. There are a few soft masses and fine concretions of calcium carbonate in the lower part of the horizon.

The B3cag horizon is gray, grayish brown, light gray, or light grayish brown sandy clay loam or clay loam. It has few to common soft masses and concretions of calcium carbonate.

The Cca horizon is gray, light gray, white, or light brownish gray sandy clay loam, clay loam, or sandy clay. It has few to common soft masses and concretions of calcium carbonate.

Papagua series

The Papagua series consists of deep, moderately well drained loamy soils that formed in calcareous loamy sediment in weakly depressed drainageways or on low terraces. The slope ranges from 0 to 1 percent.

Typical pedon of Papagua fine sandy loam, from the intersection of U.S. Highway 59 and Farm Road 673 in Beeville, 8 miles north on Farm Road 673 to Friendship Church, 2 miles west on county road, 0.6 mile north on county road, and 700 feet east, in a pasture:

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; single grained; hard, friable; common fine roots; few fine pores; neutral; abrupt wavy boundary.

B21t—10 to 19 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common medium and fine distinct yellowish red (5YR 5/6), strong brown (7.5YR 5/6), and few fine faint gray mottles; moderate coarse prismatic structure parting to moderate fine blocky; very hard, very firm, plastic and sticky; few fine roots; thin continuous clay films; few fine black concretions; neutral; clear smooth boundary.

B22t—19 to 33 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common medium and fine strong brown (7.5YR 5/6) and few fine faint gray mottles; moderate coarse prismatic structure parting to moderate medium and fine blocky; very hard, very firm, plastic and sticky; few fine roots; thin continuous clay films; few fine black concretions; neutral; gradual wavy boundary.

B23t—33 to 48 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; few fine faint gray and strong brown mottles; moderate fine blocky structure; very hard, very firm, slightly sticky; thin patchy clay films; few fine black concretions; moderately alkaline; gradual wavy boundary.

B3ca—48 to 67 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; few fine faint reddish yellow mottles; weak fine subangular blocky structure; hard, firm, slightly sticky; few fine black concretions; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—67 to 80 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; massive; hard, friable; common soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 45 to 67 inches thick. The depth to secondary carbonates is 40 to 50 inches.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or dark brown. It is slightly acid or neutral. Some pedons have a weakly expressed A2 horizon that is lighter in color value by one or two units. This horizon is up to 2 inches thick.

The Bt horizon is dark grayish brown, grayish brown, light brownish gray, light gray, or pale brown clay, sandy clay, or sandy clay loam and is more than 35 percent clay. Only the lower part has chroma of 3 or more. The horizon is faintly or distinctly mottled in shades of brown, yellow, red, or gray. It is neutral or slightly acid in the upper part and mildly alkaline or moderately alkaline in the lower part.

The B3 and C horizons are pale brown, very pale brown, light brownish gray, light gray, or white. They have few to common soft masses and concretions of calcium carbonate. In some pedons they are noncalcareous.

Papalote series

The Papalote series consists of deep, moderately well drained loamy and sandy soils on uplands (fig. 15). These soils formed in calcareous loamy sediment. The slope ranges from 0 to 3 percent.

Typical pedon of Papalote fine sandy loam, 0 to 1 percent slopes, 1.2 miles west on Farm Road 797 from its intersection with U.S. Highway 181 in Skidmore and 150 feet north, in rangeland:

A1—0 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular and subangular blocky structure; hard, friable; common fine roots; few fine pores; insect nests and tunnels; neutral; abrupt smooth boundary.

B21t—11 to 16 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm, plastic and sticky; common fine roots between peds; few fine and medium pores; continuous thick clay films; mildly alkaline; clear smooth boundary.

B22t—16 to 28 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, very firm, plastic and sticky; few fine roots between peds; few fine pores; continuous thick clay films; mildly alkaline; gradual smooth boundary.

B23t—28 to 39 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common fine distinct dark grayish brown and common medium distinct yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, plastic and sticky; few fine pores; thin continuous clay films; few fine concretions of calcium carbonate; mildly alkaline; gradual smooth boundary.

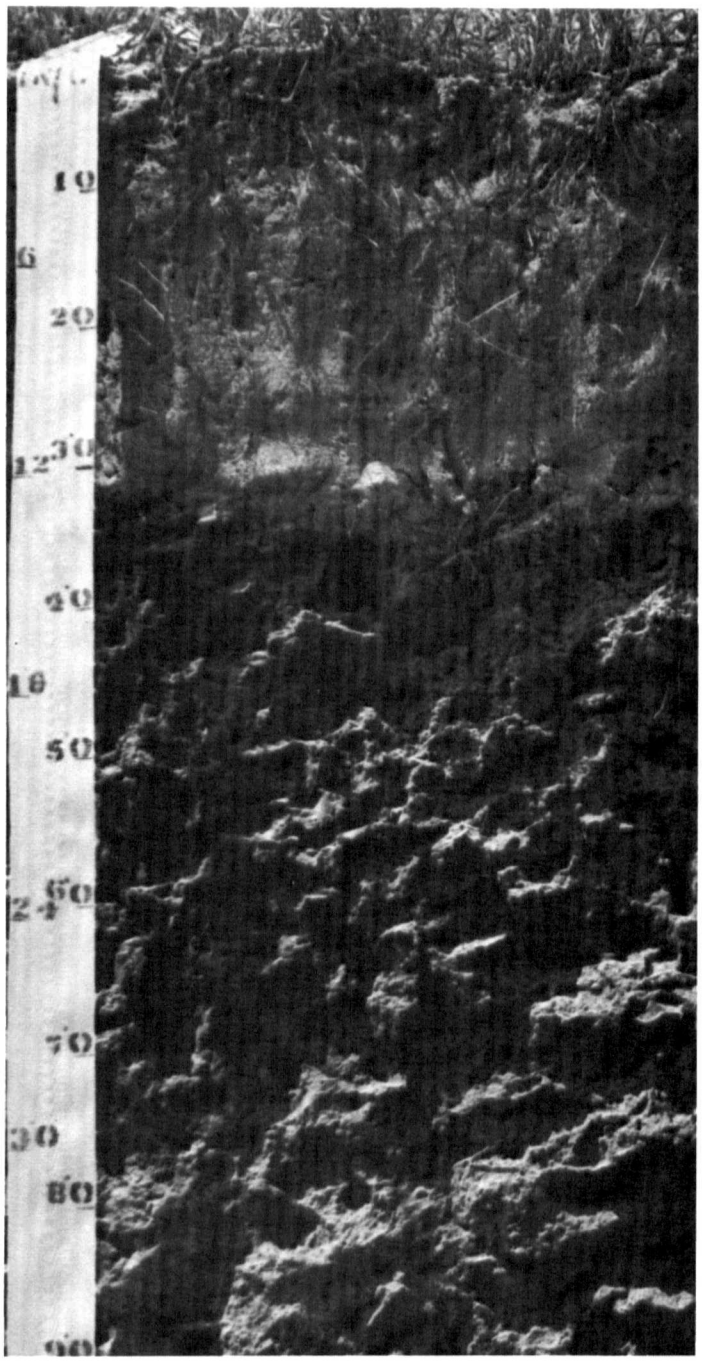


Figure 15.—Papalote fine sandy loam, 0 to 1 percent slopes. An abrupt boundary between the loamy surface layer and the clayey blocky subsoil is at a depth of about 12 inches. Depth is shown in inches on the left side of the tape and in centimeters on the right side.

B3ca—39 to 50 inches; light brown (7.5YR 6/4) sandy clay, brown (7.5YR 5/4) moist; few fine faint grayish

and common fine faint strong brown mottles; weak medium blocky structure; very hard, very firm, sticky; common soft masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—50 to 62 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, firm, slightly sticky; about 25 percent, by volume, soft masses and fine concretions of calcium carbonate; moderately alkaline.

The solum is 40 to 55 inches thick. The depth to secondary carbonates is 28 to 50 inches.

The A horizon is light brownish gray, grayish brown, pale brown, or brown fine sandy loam or loamy fine sand. It is slightly acid to mildly alkaline. Some pedons have a thin A2 horizon that is light gray, light brownish gray, or white.

The B2t horizon is very dark brown, very dark grayish brown, light brownish gray, grayish brown, or dark grayish brown clay, sandy clay, or clay loam. It is mottled in shades of red, yellow, brown, and gray. It is neutral to moderately alkaline. The horizon in the upper 20 inches is 35 to 55 percent clay. The content of clay decreases with depth.

The B3 is light brownish gray, grayish brown, brown, light brown, pale brown, or light gray sandy clay, sandy clay loam, or clay loam. It is mildly alkaline or moderately alkaline and calcareous or noncalcareous.

The C horizon is light brownish gray, light gray, pale brown, yellowish brown, very pale brown, pink, yellowish red, or white sandy clay or sandy clay loam. It is 3 to 30 percent, by volume, soft masses and concretions of calcium carbonate.

Parrita series

The Parrita series consists of shallow, moderately well drained loamy soils on uplands. These soils formed in calcareous loamy sediment. The slope ranges from 0 to 8 percent.

Typical pedon of Parrita sandy clay loam, in an area of Parrita-Olmos association, undulating, 8.5 miles north on Farm Road 673 from its intersection with U.S. Highway 59 in Beeville, 2.1 miles east and south on Farm Road 2824, and 160 feet west, in rangeland:

A1—0 to 6 inches; brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common insect nests and tunnels; mildly alkaline; clear smooth boundary.

B21t—6 to 11 inches; reddish brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky; common fine pores; continuous thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—11 to 18 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, very firm, sticky; common fine roots; few fine pores; continuous thick clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

Ccam—18 to 25 inches; pinkish white (7.5YR 8/2) and pinkish gray (7.5YR 7/2) strongly cemented laminar caliche that has a few fine fractures at intervals of 1 to 4 feet horizontally.

The solum is 12 to 20 inches thick. It is neutral to moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, brown, dark brown, dark reddish gray, or reddish brown.

The B2t horizon is dark brown, dark reddish gray, reddish brown, or red. It is sandy clay loam, sandy clay, or clay in the upper part and sandy clay or clay in the lower part. It is 35 to 45 percent clay. In some pedons it is calcareous in the lower part.

The Ccam horizon is strongly cemented caliche that breaks into platelike fragments. In some pedons it is weakly cemented at the lower depths.

Pernitas series

The Pernitas series consists of moderately deep, well drained loamy soils on uplands (fig. 16). These soils formed in calcareous loamy and clayey sediment. The slope ranges from 2 to 5 percent.

Typical pedon of Pernitas sandy clay loam, 2 to 5 percent slopes, 4 miles south on Farm Road 673 from schoolhouse in Pawnee to county road, 4.4 miles south and west on county road, and 100 feet south, in rangeland.

A1—0 to 10 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky; many fine roots; common fine pores; few worm casts; insect nests and tunnels; few snail shell fragments; few calcium carbonate films, threads, and concretions; calcareous; moderately alkaline; clear smooth boundary.

B21t—10 to 17 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable, slightly sticky; common fine roots; common fine pores; few worm casts, insect nests, and tunnels; few patchy

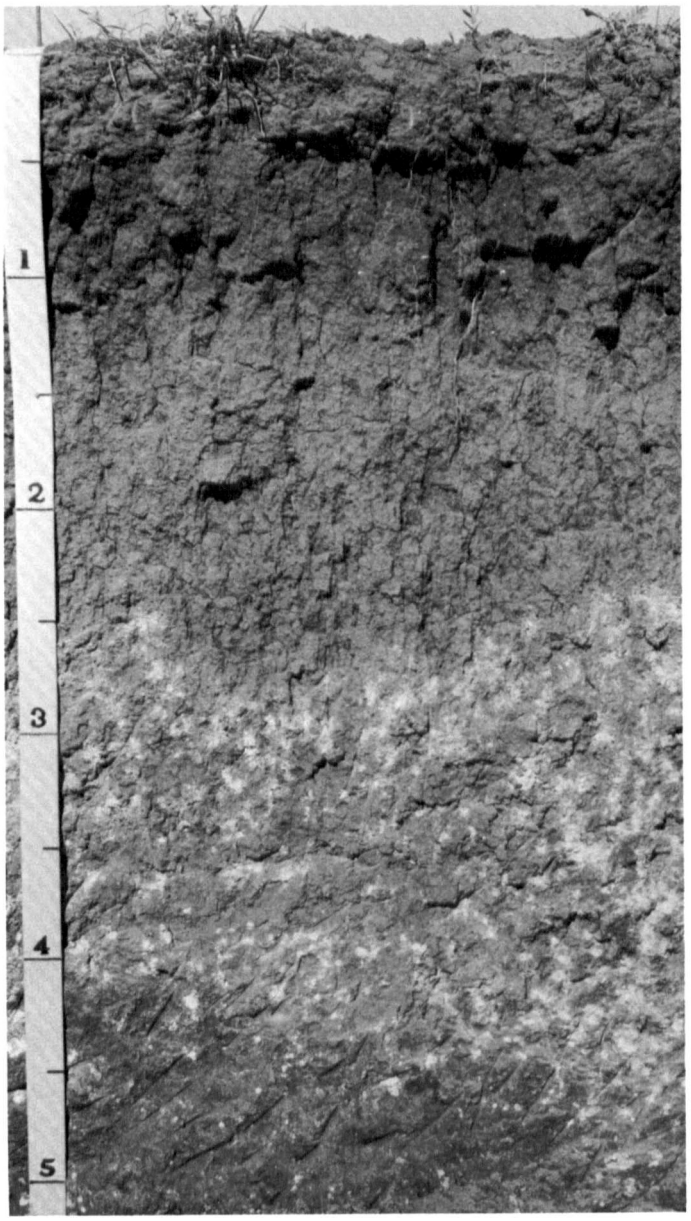


Figure 16.—Pernitas sandy clay loam, 2 to 5 percent slopes. An accumulation of calcium carbonate begins at a depth of about 3 feet.

thin clay films; few snail shell fragments; few threads, films, and concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B22t—17 to 25 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable, slightly sticky; few fine and medium roots; common fine pores; thin patchy clay films; few snail shell fragments; few threads, films, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23t—25 to 36 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm, slightly sticky; few fine roots; thin patchy clay films; few snail shell fragments; about 5 percent, by volume, threads, films, and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1ca—36 to 42 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky; about 25 to 30 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—42 to 60 inches; very pale brown (10YR 8/4) sandy clay loam, very pale brown (10YR 7/4) moist; massive; hard, friable; about 35 to 40 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 26 to 40 inches thick.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark brown, or brown. The calcium carbonate equivalent is 5 to 10 percent.

The Bt horizon is dark grayish brown, grayish brown, brown, pale brown, or yellowish brown sandy clay loam or clay loam. The content of silicate clay is 21 to 40 percent, and the calcium carbonate equivalent is 8 to 20 percent.

The Cca horizon is light brownish gray, light gray, very pale brown, or light yellowish brown sandy clay loam or clay loam. It is 10 to 40 percent, by volume, soft masses and concretions of calcium carbonate up to 1 1/2 inches across. The calcium carbonate equivalent decreases with depth in some pedons.

Pettus series

The Pettus series consists of moderately deep loamy soils on uplands. These soils formed in calcareous loamy sediment. The slope ranges from 2 to 5 percent.

Typical pedon of Pettus sandy clay loam, 2 to 5 percent slopes, from intersection of U.S. Highway 181 and Main Street in Normanna, 4 miles west on Main Street and county road to point where county road makes a right angle turn south, 0.25 mile south on county road, and 50 feet east, in rangeland:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine granular and subangular blocky; slightly hard, friable; common fine roots; common fine pores; few worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2—9 to 17 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium

prismatic structure parting to weak fine subangular blocky; hard, friable; common fine roots; common fine pores; few worm casts; common fine concretions and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Ccam&B2—17 to 22 inches; white (10YR 8/2) weakly cemented, fractured, platy caliche, light gray (10YR 7/2) moist; about 10 to 15 percent, by volume, root and solution channels filled with pale brown sandy clay loam; calcareous; moderately alkaline; gradual wavy boundary.

Cca—22 to 60 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; structureless; about 40 to 50 percent soft masses and concretions of calcium carbonate up to 2 cm wide.

The solum is 20 to 30 inches thick.

The A horizon is grayish brown, dark grayish brown, or brown. Calcium carbonate concretions make up 2 to 6 percent of the volume, and the calcium carbonate equivalent is 7 to 15 percent.

The B2 horizon is grayish brown, light brownish gray, brown, or pale brown sandy clay loam or loam. It is 22 to 38 percent clay and 20 to 34 percent silicate clay. Calcium carbonate concretions in the upper part of the B2 horizon make up 5 to 15 percent of the volume and are mostly less than 1 cm in diameter. The calcium carbonate equivalent is 10 to 40 percent.

The C horizon is white, light gray, or very pale brown. The Ccam part of the Ccam and B2 horizon is weakly cemented, platy, and fractured caliche. The Cca horizon is weakly cemented, fractured caliche or 10 to 50 percent weakly cemented nodular concretions and soft masses of calcium carbonate. The fine earth fraction is light brownish gray or pale brown and is sandy clay loam or loam.

Racombes series

The Racombes series consists of deep, well drained loamy soils in shallow valleys and on old terraces. These soils formed in calcareous ancient loamy alluvium. The slope ranges from 0 to 1 percent.

Typical pedon of Racombes sandy clay loam, 0 to 1 percent slopes, 5 miles west on U.S. Highway 59 from courthouse in Beeville, 1.6 miles north on paved road, 1.2 miles west and north on county road, and 300 feet west, in a pasture:

A1—0 to 12 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; hard, firm, slightly sticky; common fine roots; many fine pores; mildly alkaline; clear smooth boundary.

B21t—12 to 23 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, very firm, slightly sticky; common fine roots; many fine pores; thick continuous clay films; mildly alkaline; gradual smooth boundary.

B22t—23 to 35 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, very firm, sticky; few roots; common fine pores; thin continuous clay films; mildly alkaline; gradual smooth boundary.

B3—35 to 48 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky; moderately alkaline; clear smooth boundary.

Cca—48 to 60 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; common soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. The mollic epipedon is 20 to 33 inches thick. The depth to a layer of calcium carbonate accumulation is 36 to 50 inches.

The A horizon is very dark gray, very dark grayish brown, dark gray, or dark grayish brown. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam or clay loam that is very dark grayish brown, dark grayish brown, very dark gray, dark gray, grayish brown, or dark brown in the upper part and dark grayish brown, brown, grayish brown, pale brown, or yellowish brown in the lower part. The clay content is 25 to 34 percent. The B21t horizon is neutral to moderately alkaline, and the B22t horizon is mildly alkaline or moderately alkaline.

The B3 horizon is grayish brown, brown, or pale brown sandy clay loam or clay loam.

The Ca horizon is light brown, pink, very pale brown, or pale brown sandy clay loam or clay loam. Soft masses and concretions of calcium carbonate make up 3 to 15 percent of the volume.

Sarita series

The Sarita series consists of deep, well drained sandy soils on uplands. These soils formed in noncalcareous sandy and loamy sediment. The slope ranges from 0 to 5 percent.

Typical pedon of Sarita fine sand, in an area of Sarita-Nueces association, undulating, 15 miles east on Texas Highway 202 from its intersection with U.S. Highway 181 bypass in Beeville, 6.25 miles south on private ranch road to ranch headquarters, and 0.6 mile south, in rangeland:

A1—0 to 8 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; many fine and medium roots; neutral; clear smooth boundary.

A2—8 to 50 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; few fine and medium faint yellowish brown (10YR 5/8) mottles; single grained; loose; very friable; common fine roots; mildly alkaline; abrupt wavy boundary.

B21t—50 to 56 inches; very pale brown (10YR 7/3) sandy clay loam, light brownish gray (10YR 6/2) moist; few medium distinct red (2.5YR 4/8) and many medium distinct brownish yellow (10YR 6/6, 6/8) and reddish yellow (7.5YR 6/6, 6/8) mottles; weak fine and medium blocky structure; very hard, friable; common fine pores; discontinuous thin clay films; slightly acid; gradual wavy boundary.

B22t—56 to 60 inches; very pale brown (10YR 7/3) sandy clay loam, light brownish gray (10YR 6/2) moist; common coarse distinct dark red (2.5YR 3/6) and few fine brownish yellow mottles; moderate coarse prismatic structure parting to weak fine and medium blocky; extremely hard, friable; continuous thin clay films; slightly acid; gradual wavy boundary.

B3—60 to 72 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; weak medium blocky structure; hard, friable; slightly sticky.

The solum is 60 to 100 inches thick.

The A horizon is grayish brown, pale brown, light brown, or light brownish gray in the upper part and light gray, pale brown, very pale brown, or light brown in the lower part. It is slightly acid or neutral in the upper part and slightly acid to moderately alkaline in the lower part.

The B horizon is light brownish gray, light gray, pale brown, very pale brown, or light yellowish brown sandy clay loam or fine sandy loam and is mottled in shades of red, brown, and yellow. It is slightly acid to moderately alkaline.

The Sarita soils in Bee County are considered to be taxadjuncts to the Sarita series because they have a siliceous mineralogy rather than a mixed mineralogy. This difference does not affect the use and management of the soils.

Sinton series

The Sinton series consists of deep, well drained loamy soils on bottom lands. These soils formed in calcareous loamy stratified alluvial sediment along streams subject to periodic flooding. The slope ranges from 0 to 1 percent.

Typical pedon of Sinton sandy clay loam, 6.5 miles east on county road from the schoolhouse in Skidmore to the Aransas River, 2 miles east along the south bank of the Aransas River, and 200 feet southwest of large oxbow on bottom land along the Aransas River, in rangeland:

A11—0 to 15 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak fine granular and subangular blocky structure; hard, friable, slightly plastic and sticky; many fine roots; common fine and medium pores; common insect nests, tunnels, and worm casts; few thin films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

A12—15 to 28 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; hard, firm; friable; many fine roots; common fine and medium pores; few insect nests, tunnels, and worm casts; few fine threads and films of calcium carbonate; moderately alkaline; clear smooth boundary.

C1—28 to 44 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; hard, friable; few thin strata of clay, loamy fine sand, and sandy clay loam; few evident bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—44 to 72 inches; white (10YR 8/2) fine sandy loam, light gray (10YR 7/2) moist; massive; hard, friable; few thin strata of loamy fine sand and sandy clay loam; calcareous; moderately alkaline.

The A horizon is 22 to 35 inches thick. It is very dark gray, very dark grayish brown, dark grayish brown, or dark gray.

The C horizon is gray, light gray, light brownish gray, pale brown, very pale brown, or white loam, sandy clay loam, fine sandy loam, or loamy fine sand with evident bedding planes and thin lenses and strata of these textures.

Weesatche series

The Weesatche series consists of deep, well drained loamy soils on uplands (fig. 17). These soils formed in calcareous loamy sediment. The slope ranges from 0 to 5 percent.

Typical pedon of Weesatche fine sandy loam, 1 to 3 percent slopes, 8.6 miles west and north on Farm Road 798 from its intersection with U.S. Highway 181 in Tulsita, 1.1 mile north on unpaved county road, and 100 feet west, in a cultivated field:

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; slightly hard, friable; many fine roots; common fine pores; common insect nests, tunnels, and worm casts; neutral; clear smooth boundary.

B21t—8 to 17 inches; brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable; many fine roots; common fine pores; common insect nests, tunnels, and worm casts; few thin clay films; neutral; gradual smooth boundary.

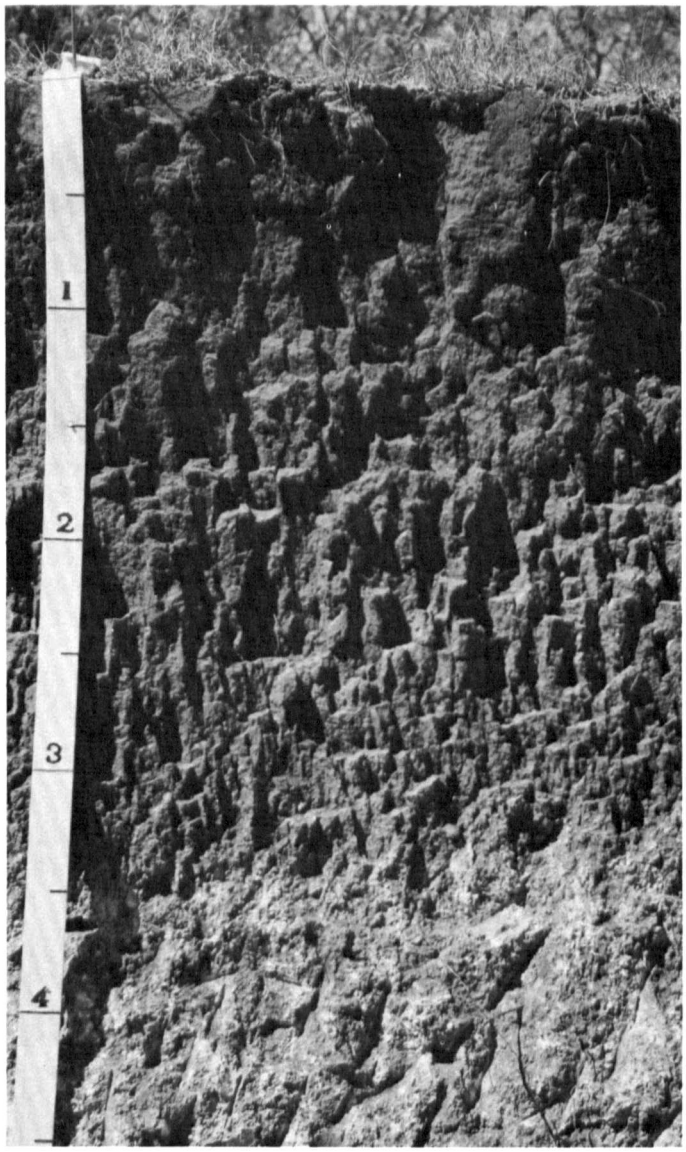


Figure 17.—Weesatche fine sandy loam, 1 to 3 percent slopes. The structure is prismatic to a depth of about 3 feet. Concretions of calcium carbonate begin at a depth of 3 feet.

B22t—17 to 25 inches, reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky; common fine roots; common very fine pores; common thin clay films; noncalcareous; mildly alkaline; gradual smooth boundary.

B23tca—25 to 34 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky; common fine roots; few fine pores; few thin clay films; about 4 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—34 to 60 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; about 20 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 30 to 54 inches thick. Segregated carbonates in soft masses, threads, and weakly cemented concretions are at a depth of 20 to 36 inches. A calcic horizon is at a depth of 22 to 40 inches.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark brown, or brown fine sandy loam or sandy clay loam. It is neutral or mildly alkaline.

The B2t horizon is very dark grayish brown, dark grayish brown, dark brown, or brown in the upper part and brown, yellowish brown, strong brown, reddish yellow, yellowish red, reddish brown, or light brown in the lower part. It is sandy clay loam or clay loam and is 22 to 34 percent clay. It is mildly or moderately alkaline. In some pedons there is a B3 or B3ca horizon.

The Cca horizon is pink, pinkish white, white, reddish yellow, light brown, or very pale brown sandy clay loam or loam. It is 5 to 20 percent calcium carbonate, by volume.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in Bee County.

factors of soil formation

Soil is the product of the action and interaction of five major soil-forming factors: parent material, climate, living organisms (especially vegetation), relief, and time. The interaction among these five factors is a complex and continuous process that determines the kind of soil that forms at any given point. One factor, or more, may be dominant in a particular area; consequently, soils differ from place to place.

parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineral composition of the soil. The soils in Bee County formed in parent material derived from two geologic systems, the Tertiary and Quaternary. The geology of Bee County is discussed in more detail under "General nature of the survey area."

The soils in the northern two-thirds of the county formed in materials of the Tertiary System. These soils are Monteola, Pernitas, Coy, Parrita, Olmos, and Weesatche soils.

The soils in the southern one-third of the county formed in material of the Quaternary System. These soils are Lattas, Orelia, Papalote, Nueces, and Sarita soils.

The Aransas, Sinton, and Odem soils on flood plains formed in recent deposits of alluvium. Many of these deposits have been reworked by wind and water.

climate

Bee County has a subtropical climate. Winters are mild and dry, and summers are hot and humid. The climate has a definite effect on soil formation. Rainfall, evaporation, temperature, wind, and length of growing season are some of the influencing factors.

Rainfall patterns cause the soils to be alternately wet and dry. When clayey soils, such as Lattas and Monteola soils, dry out, they crack severely. When it rains, the cracks fill with water, wetting the soils thoroughly. Then the soils swell and the cracks close. The alternate shrinking and swelling causes the soil material to churn and heave, thus affecting the downward movement of clay.

Other soils, such as Orelia and Leming soils, have clayey layers in the lower part. Water moving through the soil carries clay particles downward from the surface layer and deposits them in the lower layers as the water movement slows. As clay accumulates, the water moves even more slowly and deposition of clay speeds up; eventually the lower layers become clayey.

Rainfall leaches minerals from the upper soil layers and deposits them in lower layers. As a result, some of the soils, such as Papalote and Weesatche soils, have an accumulation of calcium carbonate in the lower part.

Wind also affects the formation of soils in the county. Wind has reworked the soil material in which the Sarita soils formed.

living organisms

Plants, animals, insects, bacteria, and fungi affect the formation of soils, as does man. Changes caused by living organisms include gains or losses of organic matter, nitrogen, and plant nutrients and changes in structure and porosity.

Plants have played a major role in soil formation in Bee County. The fibrous root system of grasses has contributed a large amount of organic matter to the soils. Roots of grasses, shrubs, and trees have decayed and left holes and pores in the soil that serve as passageways for air and water.

Earthworms, insects, rodents, and other animals have mixed the soil. Worms and insects hasten the decay of organic matter, and their tunnels improve soil structure and facilitate the movement of air and water through the soil. Bacteria and fungi help decompose organic matter, thus adding humus to the soil and improving fertility and tilth.

Man has also influenced soil formation. He has changed the character of the plant community by bringing in cattle to graze, changed the soil structure by plowing and planting crops, and altered soil development by construction and excavation activities.

relief

Relief, or topography, affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature.

The relief in Bee County ranges from nearly level in the southern part of the county to gently rolling and

undulating in the northern part. Soil profile development depends on the amount of moisture and the depth to which moisture penetrates. Sloping soils take in less water and normally have a less well developed profile than nearly level soils. Many of the more sloping soils erode almost as fast as they form.

The deepest soils in the county are the nearly level Lattas and Clareville soils. Soils of intermediate depth are the gently rolling Goliad and Pernitas soils. The shallow and very shallow soils are the sloping Parrita and Olmos soils on uplands. Some of these soils have well-defined horizons, others have faint or weakly defined horizons.

time

Time is required for a soil to form. Many soil characteristics are determined by the length of time that the soil-forming processes have been acting on the parent material in place.

The soils in Bee County range from young to old. The young soils have very little profile development, and the older soils have well-defined soil horizons. Odem soils, for example, are young soils. The darker Clareville and Coy soils show more profile development.

Some older soils have a noticeable accumulation of calcium carbonate, a calcic horizon, in the lower part of the profile. Aging causes the calcium carbonate to leach from the upper horizons to lower horizons; the calcium carbonate is deposited in the form of soft masses or concretions. Papalote, Pernitas, and Weesatche soils are examples of soils that have calcium carbonate in the lower horizons. Some soils have a concentration of calcium carbonate in the lower horizons that, after a great length of time, has become cemented or indurated (petrocalcic horizon). The Goliad, Parrita, and Olmos soils are examples of soils that have a petrocalcic horizon.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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—

	Inches
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 cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

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) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures 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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

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.

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.

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 plants of the climax vegetation. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing 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 or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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 the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some 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 rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey 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 7.5 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 (7.5 centimeters) in diameter.

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.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

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 upper case letter represents the major horizons. Numbers or lower case 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.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. 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 Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Large stones (in tables). Rock fragments 3 inches (7.5 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.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, 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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward 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). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

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.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range 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.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
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.

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. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

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.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or

clayey, is slippery when wet, and is low in productivity.

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.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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 and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which 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.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material 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.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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 melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Beeville, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- 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----	65.2	42.1	53.7	86	19	221	1.58	.36	2.54	3	.0
February---	68.3	44.7	56.6	88	24	226	2.22	.45	3.58	4	.2
March------	75.2	51.4	63.3	93	30	428	1.04	.24	1.66	2	.0
April------	81.9	60.4	71.2	98	40	636	2.09	.56	3.31	3	.0
May--------	86.6	66.1	76.4	97	50	818	3.63	1.48	5.36	5	.0
June-------	91.9	71.0	81.5	101	60	945	3.21	.77	5.16	4	.0
July-------	95.5	72.6	84.1	104	67	1,057	1.55	.17	2.60	3	.0
August-----	95.8	72.5	84.2	104	66	1,060	2.65	.31	4.41	4	.0
September--	90.4	68.8	79.6	101	54	888	5.53	1.89	8.44	6	.0
October----	83.7	59.9	71.9	95	40	679	3.05	.73	4.90	4	.0
November---	74.2	50.8	62.5	89	30	382	1.85	.46	2.96	4	.0
December---	67.6	44.1	55.9	85	24	229	1.62	.34	2.63	3	.0
Yearly:											
Average--	81.4	58.7	70.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	18	---	---	---	---	---	---
Total----	---	---	---	---	---	7,569	30.02	22.16	37.33	45	.2

[1]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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Beeville, 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--	February 11	March 3	March 18
2 years in 10 later than--	February 1	February 21	March 9
5 years in 10 later than--	January 8	February 2	February 21
First freezing temperature in fall:			
1 year in 10 earlier than--	December 13	November 25	November 13
2 years in 10 earlier than--	December 23	December 3	November 21
5 years in 10 earlier than--	January 16	December 20	December 6

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-75 at Beeville, 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	318	289	260
8 years in 10	332	299	269
5 years in 10	>365	318	287
2 years in 10	>365	341	306
1 year in 10	>365	361	315

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aransas clay	1,477	0.3
2	Arents, smoothed, and Gullied land, 2 to 10 percent slopes	467	0.1
3	Clareville sandy clay loam, 0 to 1 percent slopes	24,261	4.5
4	Coy clay, 1 to 3 percent slopes	3,831	0.7
5	Edroy clay	4,990	0.9
6	Edroy clay, depressional	4,394	0.8
7	Goliad sandy clay loam, 0 to 1 percent slopes	5,536	1.0
8	Goliad sandy clay loam, 1 to 3 percent slopes	11,437	2.1
9	Kincheloe clay loam, 1 to 5 percent slopes	1,546	0.3
10	Lattas clay, 0 to 1 percent slopes	21,625	4.0
11	Lattas clay, 1 to 3 percent slopes	1,727	0.3
12	Leming loamy fine sand, 0 to 3 percent slopes	5,426	1.0
13	Monteola clay, 0 to 1 percent slopes	4,113	0.8
14	Monteola clay, 1 to 3 percent slopes	11,679	2.2
15	Nueces fine sand, 0 to 5 percent slopes	6,075	1.1
16	Odem fine sandy loam	8,164	1.5
17	Olmos very gravelly loam, 1 to 8 percent slopes	3,657	0.7
18	Orelia fine sandy loam, 0 to 1 percent slopes	99,555	18.5
19	Papagua fine sandy loam	8,565	1.6
20	Papalote loamy fine sand, 0 to 3 percent slopes	41,860	7.8
21	Papalote fine sandy loam, 0 to 1 percent slopes	41,066	7.6
22	Papalote fine sandy loam, 1 to 3 percent slopes	24,852	4.6
23	Parrita sandy clay loam, 0 to 3 percent slopes	19,047	3.5
24	Parrita-Olmos association, undulating	40,700	7.6
25	Pernitas sandy clay loam, 2 to 5 percent slopes	35,492	6.6
26	Pettus sandy clay loam, 2 to 5 percent slopes	6,480	1.2
27	Racombes sandy clay loam, 0 to 1 percent slopes	4,961	0.9
28	Sarita-Nueces association, undulating	3,204	0.6
29	Sinton sandy clay loam	5,494	1.0
30	Weesatche fine sandy loam, 1 to 3 percent slopes	58,945	10.9
31	Weesatche fine sandy loam, 3 to 5 percent slopes	6,228	1.2
32	Weesatche sandy clay loam, 0 to 1 percent slopes	3,175	0.6
33	Weesatche sandy clay loam, 1 to 3 percent slopes	18,851	3.5
	Total	538,880	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint	Grain sorghum	Flax	Pasture
	Lb	Bu	Bu	AUM*
1 Aransas	450	55	---	5.0
2 Arents and Gullied land	---	---	---	---
3 Clareville	450	55	16	---
4 Coy	400	60	---	---
5 Edroy	300	35	---	4.0
6 Edroy	---	---	---	---
7 Goliad	325	40	---	3.0
8 Goliad	275	35	---	2.5
9 Kincheloe	---	17	7	2.0
10 Lattas	400	60	15	4.0
11 Lattas	350	50	10	3.5
12 Leming	200	35	---	2.5
13 Monteola	400	55	15	3.5
14 Monteola	350	50	14	3.0
15 Nueces	200	25	---	3.0
16 Odem	300	45	---	4.0
17 Olmos	---	---	---	---
18 Orelia	325	45	10	4.0
19 Papagua	250	45	---	4.0
20 Papalote	200	40	7	5.0
21 Papalote	250	45	8	5.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Grain sorghum	Flax	Pasture
	Lb	Bu	Bu	AUM*
22---------- Papalote	200	40	7	5.0
23---------- Parrita	---	25	7	2.0
24:				
Parrita----------	---	25	7	2.0
Olmos----------	---	---	---	---
25---------- Pernitas	200	25	7	2.5
26---------- Pettus	---	20	---	1.5
27---------- Racombes	500	65	16	6.0
28:				
Sarita----------	---	---	---	---
Nueces----------	200	25	---	3.0
29---------- Sinton	350	70	---	6.0
30---------- Weesatche	350	55	8	4.0
31---------- Weesatche	300	50	7	3.5
32---------- Weesatche	350	55	10	4.0
33---------- Weesatche	350	55	8	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	201,749	83,354	18,619	66,804	32,972
III	283,163	168,576	114,587	---	---
IV	45,450	45,450	---	---	---
V	4,394	---	4,394	---	---
VI	---	---	---	---	---
VII	4,124	467	---	3,657	---
VIII	---	---	---	---	---

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
1 Aransas	Clayey Bottomland	8,000	6,500	4,500
3 Clareville	Clay Loam	5,800	5,000	3,000
4 Coy	Rolling Blackland	4,000	3,500	2,500
5 Edroy	Claypan Prairie	5,000	4,000	2,500
6 Edroy	Lakebed	5,000	4,000	3,000
7, 8 Goliad	Clay Loam	5,000	4,100	3,000
9 Kincheloe	Shallow	3,000	2,000	1,500
10, 11 Lattas	Blackland	4,500	4,000	3,000
12 Leming	Loamy Sand	4,500	4,000	2,000
13, 14 Monteola	Rolling Blackland	4,000	3,500	2,500
15 Nueces	Sandy	5,000	4,000	2,000
16 Odem	Loamy Bottomland	7,000	6,000	4,000
17 Olmos	Shallow Ridge	2,500	1,800	1,000
18 Orelia	Claypan Prairie	5,000	4,000	2,500
19 Papagua	Ramadero	5,200	3,500	2,500
20 Papalote	Loamy Sand	4,500	3,900	2,000
21, 22 Papalote	Tight Sandy Loam	4,800	4,000	2,000
23 Parrita	Shallow Sandy Loam	3,700	3,000	1,200
24:* Parrita	Shallow Sandy Loam	3,700	3,000	1,200
Olmos	Shallow Ridge	2,500	1,800	1,000
25 Pernitas	Gray Sandy Loam	4,500	3,500	2,500
26 Pettus	Shallow	3,200	2,700	1,500

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
27 Racombes	Clay Loam	6,000	5,000	2,500
28:*				
Sarita	Sandy	5,000	4,000	2,000
Nueces	Sandy	5,000	4,000	2,000
29 Sinton	Loamy Bottomland	7,000	6,000	4,000
30, 31 Weesatche	Sandy Loam	5,600	4,400	3,000
32, 33 Weesatche	Clay Loam	5,800	4,400	3,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Aransas	Severe: floods, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.
2:*				
Arents.				
Gullied land.				
3 Clareville	Slight	Slight	Slight	Slight.
4 Coy	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.
5, 6 Edroy	Severe: ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.
7 Goliad	Slight	Slight	Slight	Slight.
8 Goliad	Slight	Slight	Moderate: slope, cemented pan.	Slight.
9 Kincheloe	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope.	Slight.
10, 11 Lattas	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Moderate: too clayey.
12 Leming	Slight	Slight	Slight	Slight.
13, 14 Monteola	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.
15 Nueces	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
16 Odem	Severe: floods.	Slight	Slight	Slight.
17 Olmos	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.
18 Orelia	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: dusty.
19 Papagua	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
20, 21 Papalote	Slight	Slight	Slight	Slight.
22 Papalote	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
23 Parrita	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight.
24:*				
Parrita	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight.
Olmos	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.
25 Pernitas	Slight	Slight	Moderate: slope.	Slight.
26 Pettus	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight.
27 Racombes	Severe: floods.	Slight	Slight	Slight.
28:*				
Sarita	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Nueces	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
29 Sinton	Severe: floods.	Slight	Moderate: floods.	Slight.
30, 31 Weesatche	Slight	Slight	Moderate: slope.	Slight.
32 Weesatche	Slight	Slight	Slight	Slight.
33 Weesatche	Slight	Slight	Moderate: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
1 Aransas	Fair	Fair	Fair	Fair	Fair	Fair.
2:*						
Arents.						
Gullied land.						
3 Clareville	Good	Good	Fair	Good	Good	Fair.
4 Coy	Good	Good	Fair	Good	Good	Fair.
5 Edroy	Fair	Fair	Poor	Poor	Fair	Poor.
6 Edroy	Very poor	Poor	Poor	Poor	Poor	Poor.
7 Goliad	Good	Good	Good	Good	Good	Good.
8 Goliad	Fair	Good	Good	Good	Good	Good.
9 Kincheloe	Poor	Fair	Fair	Fair	Fair	Fair.
10, 11 Lattas	Fair	Good	Fair	Fair	Fair	Fair.
12 Leming	Fair	Good	Good	Good	Good	Good.
13, 14 Monteola	Fair	Good	Fair	Fair	Fair	Fair.
15 Nueces	Fair	Poor	Good	Good	Fair	Good.
16 Odem	Good	Good	Good	Good	Good	Good.
17 Olmos	Very poor	Very poor	Poor	Fair	Very poor	Poor.
18 Orelia	Fair	Fair	Good	Good	Fair	Good.
19 Papagua	Fair	Fair	Fair	Good	Fair	Fair.
20, 21, 22 Papalote	Good	Good	Good	Good	Good	Good.
23 Parrita	Fair	Good	Fair	Good	Fair	Fair.
24:*						
Parrita	Fair	Good	Fair	Good	Fair	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
24:*						
Olmos	Very poor	Very poor	Poor	Fair	Very poor	Poor.
25 Pernitas	Fair	Good	Fair	Good	Fair	Fair.
26 Pettus	Fair	Fair	Fair	Fair	Fair	Fair.
27 Racombes	Good	Good	Good	Good	Good	Good.
28:*						
Sarita	Fair	Fair	Fair	Good	Fair	Fair.
Nueces	Fair	Poor	Good	Good	Fair	Good.
29 Sinton	Good	Good	Good	Good	Good	Good.
30 Weesatche	Good	Good	Fair	Fair	Good	Fair.
31 Weesatche	Fair	Good	Fair	Fair	Fair	Fair.
32, 33 Weesatche	Good	Good	Fair	Fair	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Aransas	Severe: ponding.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: low strength, ponding, floods.
2:* Arents.					
Gullied land.					
3 Clareville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
4 Coy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
5, 6 Edroy	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
7, 8 Goliad	Moderate: cemented pan.	Moderate: shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
9 Kincheloe	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
10, 11 Lattas	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
12 Leming	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
13, 14 Monteola	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
15 Nueces	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight.
16 Odem	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
17 Olmos	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Moderate: slope, cemented pan, large stones.	Moderate: cemented pan, large stones.
18 Orelia	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.
19 Papagua	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
20, 21, 22 Papalote	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
23---------- Parrita	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan, low strength.
24:*					
Parrita----------	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan, low strength.
Olmos----------	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Moderate: slope, cemented pan, large stones.	Moderate: cemented pan, large stones.
25---------- Pernitas	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
26---------- Pettus	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: low strength, cemented pan.
27---------- Racombes	Slight----------	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods, shrink-swell.
28:*					
Sarita----------	Severe: cutbanks cave.	Slight----------	Moderate: shrink-swell.	Slight----------	Slight.
Nueces----------	Severe: cutbanks cave.	Slight----------	Moderate: shrink-swell.	Slight----------	Slight.
29---------- Sinton	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
30---------- Weesatche	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
31---------- Weesatche	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
32, 33---------- Weesatche	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.

* 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," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Aransas	Severe: floods, ponding, percs slowly.	Severe: floods, ponding.	Severe: floods, ponding, too clayey.	Severe: floods, ponding.	Poor: too clayey, hard to pack, ponding.
2:* Arents.					
Gullied land.					
3 Clareville	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
4 Coy	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
5, 6 Edroy	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
7, 8 Goliad	Severe: cemented pan, percs slowly.	Severe: cemented pan.	Moderate: cemented pan, too clayey.	Slight	Poor: thin layer.
9 Kincheloe	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
10 Lattas	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
11 Lattas	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
12 Leming	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
13 Monteola	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
14 Monteola	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
15 Nueces	Severe: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Poor: too sandy.
16 Odem	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
17 Olmos	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Poor: area reclaim, small stones.
18 Orelia	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19 Papagua	Severe: ponding, percs slowly.	Slight	Severe: ponding.	Severe: ponding.	Severe: ponding.
20, 21, 22 Papalote	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
23 Parrita	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: area reclaim.
24:*					
Parrita	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: area reclaim.
Olmos	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Poor: area reclaim, small stones.
25 Pernitas	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
26 Pettus	Severe: cemented pan.	Severe: seepage, cemented pan.	Severe: seepage.	Severe: seepage, cemented pan.	Poor: area reclaim, thin layer.
27 Racombes	Moderate: floods, percs slowly.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
28:*					
Sarita	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Severe: seepage, too sandy.
Nueces	Severe: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Poor: too sandy.
29 Sinton	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
30, 31 Weesatche	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
32 Weesatche	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
33 Weesatche	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1 Aransas	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
2:* Arents.				
Gullied land.				
3 Clareville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
4 Coy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
5, 6 Edroy	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
7, 8 Goliad	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
9 Kincheloe	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
10, 11 Lattas	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
12 Leming	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
13, 14 Monteola	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
15 Nueces	Fair: low strength.	Probable	Improbable: too sandy.	Poor: too sandy.
16 Odem	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
17 Olmos	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
18 Orelia	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
19 Papagua	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
20, 21, 22 Papalote	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
23 Parrita	Poor: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
24:*				
Parrita	Poor: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
Olmos	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
25 Pernitas	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
26 Pettus	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, excess lime.
27 Racombes	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
28:*				
Sarita	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Nueces	Fair: low strength.	Probable	Improbable: too sandy.	Poor: too sandy.
29 Sinton	Moderate: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
30, 31 Weesatche	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
32, 33 Weesatche	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1 Aransas	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, floods.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
2:*						
Arents.						
Gullied land.						
3 Clareville	Moderate: seepage.	Moderate: hard to pack.	Favorable	Favorable	Favorable	Favorable.
4 Coy	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
5, 6 Edroy	Moderate: seepage.	Moderate: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
7, 8 Goliad	Moderate: cemented pan, seepage.	Moderate: thin layer, hard to pack.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.
9 Kincheloe	Moderate: slope.	Moderate: hard to pack.	Percs slowly, slope.	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
10, 11 Lattas	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
12 Leming	Severe: seepage.	Moderate: hard to pack.	Deep to water	Droughty, fast intake, percs slowly.	Percs slowly	Droughty, percs slowly.
13, 14 Monteola	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
15 Nueces	Moderate: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
16 Odem	Severe: seepage.	Moderate: piping.	Deep to water	Floods	Favorable	Favorable.
17 Olmos	Severe: cemented pan.	Severe: thin layer.	Deep to water	Large stones, droughty, cemented pan.	Large stones, cemented pan.	Large stones, droughty, cemented pan.
18 Orelia	Slight	Moderate: excess salt.	Percs slowly, excess salt.	Percs slowly, excess salt, wetness.	Percs slowly, wetness.	Wetness, excess salt, percs slowly.
19 Papagua	Moderate: seepage.	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
20 Papalote	Slight	Moderate: hard to pack.	Deep to water	Fast intake, percs slowly.	Percs slowly	Percs slowly.
21, 22 Papalote	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
23 Parrita	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
24:*						
Parrita	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.
Olmos	Severe: cemented pan.	Severe: thin layer.	Deep to water	Large stones, droughty, cemented pan.	Large stones, cemented pan.	Large stones, droughty, cemented pan.
25 Pernitas	Moderate: seepage.	Moderate: hard to pack.	Slope	Favorable	Favorable	Favorable.
26 Pettus	Severe: seepage, cemented pan.	Moderate: thin layer.	Deep to water	Droughty, cemented pan.	Cemented pan	Droughty, cemented pan.
27 Racombes	Moderate: seepage.	Slight	Deep to water	Favorable	Favorable	Favorable.
28:*						
Sarita	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Droughty, fast intake.	Too sandy	Droughty.
Nueces	Moderate: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
29 Sinton	Severe: seepage.	Moderate: compressible, piping.	Floods	Floods	Favorable	Favorable.
30, 31, 32, 33 Weesatche	Moderate: seepage.	Slight	Deep to water	Favorable	Favorable	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
1---------- Aransas	0-60	Clay----------	CH	A-7-6	0	100	95-100	95-100	75-95	51-75	30-50
2:* Arents.											
Gullied land.											
3---------- Clareville	0-10	Sandy clay loam	CL, SC	A-6, A-7	0	98-100	95-100	90-100	45-70	32-48	15-27
	10-42	Clay loam, clay, sandy clay.	CL, CH	A-7	0	98-100	95-100	90-100	51-80	46-60	25-37
	42-60	Clay loam, loam	CL, CH	A-6, A-7	0	95-100	85-100	85-100	51-75	36-52	17-30
4---------- Coy	0-8	Clay----------	CL, CH	A-6, A-7-6	0	98-100	97-100	95-100	70-85	35-55	18-30
	8-64	Clay, clay loam, sandy clay.	CH, CL	A-7-6	0	98-100	97-100	95-100	70-90	42-62	27-42
5, 6---------- Edroy	0-23	Clay----------	CH	A-7-6	0	100	100	90-100	75-95	51-60	27-35
	23-41	Clay loam, clay, sandy clay.	CL, CH	A-7-6	0	100	95-100	90-100	70-90	41-53	20-30
	41-53	Sandy clay loam, clay loam, loam.	SC, CL	A-7-6, A-6	0	100	95-100	80-95	40-55	30-42	11-20
7, 8---------- Goliad	0-10	Sandy clay loam	SC, CL	A-6	0	100	100	75-100	40-65	30-39	11-18
	10-16	Sandy clay loam, sandy clay, clay loam.	SC, CL	A-7-6	0	95-100	90-100	85-100	45-70	41-48	20-26
	16-27	Sandy clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	85- 00	80-100	51-80	45-57	22-32
	27-33	Cemented---------	---	---	---	---	---	---	---	---	---
9---------- Kincheloe	0-8	Clay loam--------	CH, CL	A-7-6	0-15	90-100	90-100	90-100	75-95	45-66	25-41
	8-60	Shaly clay, clay	CH, CL	A-6, A-7-6	0-5	90-100	85-100	65-90	55-90	35-55	15-33
10, 11---------- Lattas	0-8	Clay----------	CH, SC, CL	A-7-6	0	100	95-100	85-100	45-85	41-65	25-46
	8-60	Clay, silty clay, clay loam.	CH	A-7-6	0	100	90-100	85-100	64-90	51-72	33-51
12---------- Leming	0-23	Loamy fine sand	SM-SC, SM	A-2-4	0	95-100	95-100	50-75	20-35	<30	NP-7
	23-45	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	95-100	80-95	45-60	41-55	20-30
	45-72	Sandy clay loam, sandy clay, clay loam.	CL, SC	A-6, A-7-6	0-10	95-100	90-100	80-95	40-60	30-45	11-25
13, 14---------- Monteola	0-6	Clay----------	CH	A-7-6	0-3	80-100	80-100	80-100	75-90	51-75	30-50
	6-65	Clay----------	CH	A-7-6	0-3	90-100	80-100	75-100	75-96	56-80	33-54
15---------- Nueces	0-34	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	34-70	Sandy clay loam, sandy loam.	SC	A-2-6, A-6, A-4	0	90-100	90-100	80-100	20-50	25-40	8-20
16---------- Odem	0-72	Fine sandy loam	SM-SC, SM	A-2-4	0	100	100	90-100	20-30	<25	NP-7
17---------- Olmos	0-10	Very gravelly loam.	GC, GM-GC, SC, SM-SC	A-2-4, A-2-6	0-30	35-75	25-55	25-55	20-35	25-35	7-15
	10-14	Cemented---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
18---------- Orelia	0-6	Fine sandy loam	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	98-100	95-100	80-100	33-60	22-35	6-19
	6-30	Sandy clay loam, clay loam.	CL, SC	A-7, A-6	0	98-100	90-100	80-100	47-75	35-50	20-30
	30-60	Sandy clay loam	CL	A-6, A-7	0	95-100	85-100	80-100	51-75	35-46	20-30
19---------- Papagua	0-10	Fine sandy loam	SM-SC, SC	A-2-4, A-4	0	95-100	95-100	90-100	25-50	<25	4-10
	10-48	Sandy clay, clay.	SC, CL	A-7-6	0	95-100	95-100	85-95	45-60	43-50	24-30
	48-80	Sandy clay loam, sandy clay.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-95	36-60	30-48	18-28
20---------- Papalote	0-14	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	90-100	50-100	15-35	<25	NP-6
	14-51	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	90-100	85-100	43-70	41-60	21-36
	51-75	Sandy clay loam, clay loam, sandy clay.	CL, SC	A-6, A-7-6	0	95-100	80-100	75-96	36-70	35-49	18-31
21, 22---------- Papalote	0-11	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	95-100	95-100	90-100	25-50	<25	NP-8
	11-50	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	90-100	85-100	43-70	41-60	21-36
	50-62	Sandy clay loam, clay loam, sandy clay.	CL, SC	A-6, A-7-6	0	95-100	80-100	75-96	36-70	35-49	18-31
23---------- Parrita	0-6	Sandy clay loam	SC, CL, SM-SC, CL-ML	A-2, A-4, A-6, A-2-4	0	100	100	80-100	31-55	25-35	7-15
	6-11	Sandy clay loam, sandy clay, clay.	CL, CH	A-6, A-7-6	0	100	100	80-100	51-60	38-55	17-30
	11-18	Sandy clay, clay	CL, CH	A-7-6	0	100	100	80-100	52-75	41-59	22-34
	18-25	Cemented---------	---	---	---	---	---	---	---	---	---
24:* Parrita---------	0-6	Fine sandy loam	SC, CL, SM-SC, CL-ML	A-2, A-4, A-6, A-2-4	0	100	100	80-100	31-55	26-35	7-15
	6-11	Sandy clay loam, sandy clay, clay.	CL, CH	A-6, A-7-6	0	100	100	80-100	51-60	38-55	17-30
	11-18	Sandy clay, clay	CL, CH	A-7-6	0	100	100	80-100	52-75	41-59	22-34
	18-25	Cemented---------	---	---	---	---	---	---	---	---	---
Olmos----------	0-10	Very gravelly loam.	GC, GM-GC, SC, SM-SC	A-2-4, A-2-6	0-30	35-75	25-55	25-55	20-35	25-35	7-15
	10-14	Cemented---------	---	---	---	---	---	---	---	---	---
25---------- Pernitas	0-10	Sandy clay loam	SC, CL	A-4, A-6	0	100	100	80-100	36-55	24-37	9-20
	10-25	Sandy clay, clay, clay loam.	CL, CH	A-6, A-7-6	0	98-100	95-100	85-98	53-75	33-57	16-23
	25-36	Clay loam, clay	CL, SC, CH	A-7-6, A-6	0	90-100	85-99	80-99	45-70	30-50	21-32
	36-60	Sandy clay, sandy clay loam.	SC, CL	A-7-6, A-2-7, A-6	0	75-100	70-99	60-98	30-67	35-50	17-27
26---------- Pettus	0-17	Sandy clay loam	CL, SC	A-6, A-7-6	0	80-100	75-100	55-97	40-65	27-43	11-21
	17-22	Very cobbly sandy clay loam, stony sandy clay loam, very cobbly loam.	SC, GC, CL	A-2-4, A-2-6, A-4, A-6	60-85	50-95	45-85	40-80	26-56	25-35	10-18
	22-60	Gravelly sandy clay loam, sandy clay loam, gravelly loam.	SC, GC, CL	A-2-4, A-2-6, A-4, A-6	0-10	50-95	45-85	40-80	26-56	25-35	10-18

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
27---------- Racombes	0-12	Sandy clay loam	CL, SC	A-4, A-6	0	100	100	95-100	45-65	27-35	8-15
	12-48	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	100	95-100	90-100	45-65	34-43	15-22
	48-60	Sandy clay loam, clay loam.	CL, SC	A-6	0	90-100	80-100	80-95	40-65	30-40	11-20
28:*											
Sarita----------	0-50	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	0	100	100	65-100	9-35	<25	NP-7
	50-72	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6	0	100	100	80-100	30-49	28-40	11-22
Nueces----------	0-34	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	34-70	Sandy clay loam, sandy loam.	SC	A-2-6, A-6, A-4	0	90-100	90-100	80-100	20-49	25-40	8-20
29---------- Sinton	0-28	Sandy clay loam	CL, SC	A-6	0	100	95-100	80-100	45-55	28-40	11-23
	28-72	Stratified loamy fine sand to sandy 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
30, 31---------- Weesatche	0-8	Fine sandy loam	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	65-98	28-65	28-45	13-28
	8-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	65-98	28-75	36-50	24-30
	34-60	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	55-100	28-80	33-50	21-30
32, 33---------- Weesatche	0-8	Sandy clay loam	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	65-98	28-65	28-45	13-28
	8-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	65-98	28-75	36-50	21-30
	34-60	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0	80-100	80-100	55-100	28-80	33-50	20-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm				Pct
1---------- Aransas	0-60	35-60	---	<0.06	0.12-0.18	7.9-8.4	<4	High--------	0.32	5	1-4
2:* Arents.											
Gullied land.											
3---------- Clareville	0-10	25-35	---	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate----	0.32	5	1-3
	10-42	35-45	---	0.2-0.6	0.15-0.20	6.6-8.4	<2	High--------	0.32		
	42-60	30-45	---	0.6-2.0	0.12-0.16	7.9-8.4	<4	Moderate----	0.32		
4---------- Coy	0-8	28-42	---	0.2-0.6	0.15-0.20	7.9-8.4	<2	Moderate----	0.32	5	1-3
	8-64	35-57	---	<0.06	0.14-0.18	7.9-8.4	<2	High--------	0.32		
5, 6---------- Edroy	0-23	40-55	---	<0.06	0.10-0.17	6.1-7.3	<8	High--------	0.32	5	1-4
	23-41	35-50	---	0.06-0.2	0.09-0.17	7.9-8.4	<8	High--------	0.32		
	41-53	20-35	---	0.06-0.2	0.08-0.16	7.9-8.4	<8	Moderate----	0.37		
7, 8---------- Goliad	0-10	20-32	---	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate----	0.17	2	1-3
	10-16	30-40	---	0.2-0.6	0.15-0.20	6.6-8.4	<2	Moderate----	0.24		
	16-27	37-50	---	0.2-0.6	0.15-0.20	7.4-8.4	<2	Moderate----	0.24		
	27-33	---	---	---	---	---	---	----------	----		
9---------- Kincheloe	0-8	35-55	---	<0.06	0.13-0.17	7.9-8.4	<4	High--------	0.32	3	---
	8-60	40-55	---	<0.06	0.08-0.12	7.9-8.4	<8	High--------	0.32		
10, 11---------- Lattas	0-8	28-50	---	0.06-0.2	0.12-0.18	7.9-8.4	<4	High--------	0.32	5	1-3
	8-60	35-55	---	<0.06	0.15-0.20	7.9-8.4	<4	High--------	0.32		
12---------- Leming	0-23	3-18	---	2.0-6.0	0.05-0.10	6.1-7.3	<2	Very low----	0.20	5	<1
	23-59	35-50	---	0.06-0.2	0.15-0.20	6.1-8.4	<2	Moderate----	0.32		
	59-72	27-45	---	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate----	0.32		
13, 14---------- Monteola	0-7	40-55	---	<0.06	0.10-0.20	7.9-9.0	<4	Very high	0.32	5	1-3
	7-60	40-60	---	<0.06	0.10-0.17	7.9-9.0	<4	Very high	0.37		
15---------- Nueces	0-34	2-12	---	2.0-6.0	0.05-0.10	5.6-7.3	<2	Low---------	0.17	5	<1
	34-75	18-30	---	0.2-0.6	0.12-0.17	6.6-8.4	<2	Moderate----	0.24		
16---------- Odem	0-72	7-18	---	2.0-6.0	0.10-0.16	6.1-8.4	<2	Low---------	0.24	5	1-3
17---------- Olmos	0-10	---	---	0.6-2.0	0.05-0.10	7.9-8.4	<2	Low---------	0.10	1	---
	10-14	---	---	---	---	---	---	----------	----		
18---------- Orelia	0-6	17-25	---	0.2-0.6	0.10-0.16	6.6-7.8	<4	Low---------	0.28	5	<1
	6-30	28-35	---	0.06-0.2	0.10-0.17	7.4-8.4	<8	Moderate----	0.32		
	30-60	20-35	---	<0.06	0.09-0.17	7.9-8.4	<12	Moderate----	0.32		
19---------- Papagua	0-10	5-18	---	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low---------	0.32	5	<.-1
	10-48	35-50	---	0.06-0.2	0.14-0.18	6.1-7.3	<2	High--------	0.32		
	48-80	30-45	---	0.06-0.6	0.12-0.18	7.4-8.4	<2	High--------	0.37		
20---------- Papalote	0-14	4-15	---	2.0-6.0	0.07-0.11	5.6-7.8	<2	Low---------	0.32	5	.5-1
	14-51	35-55	---	0.06-0.2	0.13-0.18	6.1-8.4	<2	Moderate----	0.32		
	51-75	30-40	---	0.06-0.2	0.12-0.17	6.6-8.4	<2	Moderate----	0.32		
21, 22---------- Papalote	0-11	6-17	---	2.0-6.0	0.11-0.15	5.6-7.8	<2	Low---------	0.32	5	.5-1
	11-50	35-55	---	0.06-0.2	0.13-0.18	6.1-8.4	<2	Moderate----	0.32		
	50-62	30-40	---	0.06-0.2	0.12-0.17	6.6-8.4	<2	Moderate----	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm				Pct
23---------- Parrita	0-6	16-30	---	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low---------	0.17	2	1-3
	6-11	30-48	---	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate----	0.24		
	11-18	37-52	---	0.2-0.6	0.12-0.18	7.4-8.4	<2	Moderate----	0.24		
	18-25	---	---	---	---	---	---	----------	----		
24:*											
Parrita----------	0-6	16-30	---	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low---------	0.17	2	1-3
	6-11	30-48	---	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate----	0.24		
	11-18	37-52	---	0.2-0.6	0.12-0.18	7.4-8.4	<2	Moderate----	0.24		
	18-25	---	---	---	---	---	---	----------	----		
Olmos----------	0-10	---	---	0.6-2.0	0.05-0.10	7.9-8.4	<2	Low---------	0.10	1	---
	10-14	---	---	---	---	---	---	----------	----		
25---------- Pernitas	0-10	20-32	---	0.6-2.0	0.11-0.16	7.9-8.4	<2	Low---------	0.20	3	1-3
	10-25	21-35	---	0.6-2.0	0.13-0.18	7.9-8.4	<2	Moderate----	0.20		
	25-36	25-40	---	0.6-2.0	0.13-0.19	7.9-8.4	<2	Moderate----	0.28		
	36-60	21-38	---	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low---------	0.32		
26---------- Pettus	0-17	22-38	---	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low---------	0.24	2	1-3
	17-22	18-26	---	0.6-2.0	0.02-0.05	7.9-8.4	<2	Low---------	0.10		
	22-60	15-26	---	0.6-6.0	0.08-0.12	7.9-8.4	<2	Low---------	0.24		
27---------- Racombes	0-12	16-28	---	0.6-2.0	0.14-0.19	6.6-7.8	<2	Low---------	0.28	5	1-3
	12-48	26-34	---	0.6-2.0	0.15-0.20	6.6-8.4	<4	Moderate----	0.32		
	48-60	25-34	---	0.6-2.0	0.15-0.20	7.9-8.4	<4	Low---------	0.32		
28:*											
Sarita----------	0-50	1-13	---	6.0-20	0.05-0.10	6.1-7.3	<2	Low---------	0.17	5	.5-1
	50-72	18-35	---	2.0-6.0	0.13-0.19	5.6-8.4	<2	Moderate----	0.24		
Nueces----------	0-34	2-12	---	2.0-6.0	0.05-0.10	5.6-7.3	<2	Low---------	0.17	5	<1
	34-75	18-30	---	0.2-0.6	0.12-0.17	6.6-8.4	<2	Moderate----	0.24		
29---------- Sinton	0-28	20-35	---	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low---------	0.28	5	1-3
	28-72	10-35	---	2.0-6.0	0.07-0.15	7.9-8.4	<2	Low---------	0.20		
30, 31, 32, 33--- Weesatche	0-8	14-26	---	0.6-2.0	0.12-0.17	6.6-7.8	<2	Moderate----	0.32	5	1-3
	8-34	22-35	---	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate----	0.32		
	34-60	20-33	---	0.6-2.0	0.10-0.15	7.9-8.4	<2	Moderate----	0.32		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
1*---------- Aransas	D	Occasional	Brief to very long.	Sep-May	+3-5.0	Apparent	Sep-Jun	>60	---	---	---	High-----	Low.
2:													
Arents.													
Gullied land.													
3---------- Clareville	C	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
4---------- Coy	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
5*---------- Edroy	D	None--------	---	---	+2-4.0	Apparent	Sep-May	>60	---	---	---	High-----	Low.
6*---------- Edroy	D	None--------	---	---	+2-4.0	Apparent	Sep-May	>60	---	---	---	High-----	Low.
7, 8---------- Goliad	C	None--------	---	---	>6.0	---	---	>60	---	20-40	Thin	High-----	Low.
9---------- Kincheloe	D	None--------	---	---	>6.0	---	---	20-40	Soft	---	---	High-----	Low.
10, 11---------- Lattas	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
12---------- Leming	C	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
13, 14---------- Monteola	D	None--------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
15---------- Nueces	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
16---------- Odem	A	Occasional	Brief-----	Sep-May	>6.0	---	---	>60	---	---	---	Moderate	Low.
17---------- Olmos	C	None--------	---	---	>6.0	---	---	>60	---	4-20	Thin	High-----	Low.
18---------- Orelia	D	None--------	---	---	0.5-1.0	Perched	Sep-May	>60	---	---	---	High-----	Low.
19*---------- Papagua	C	None--------	---	---	+1-1.5	Perched	Sep-May	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
					Ft			In		In			
20, 21, 22 Papalote	C	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
23 Parrita	D	None	---	---	>6.0	---	---	>60	---	12-20	Thin	High	Low.
24:													
Parrita	D	None	---	---	>6.0	---	---	>60	---	12-20	Thin	High	Low.
Olmos	C	None	---	---	>6.0	---	---	>60	---	4-20	Thin	High	Low.
25 Pernitas	C	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
26 Pettus	C	None	---	---	>6.0	---	---	>60	---	11-20	Thin	Moderate	Low.
27 Racombes	B	Rare	---	---	>6.0	---	---	>60	---	---	---	High	Low.
28:													
Sarita	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
Nueces	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
29 Sinton	B	Occasional	Brief	Sep-May	>6.0	---	---	>60	---	---	---	Moderate	Low.
30, 31, 32, 33 Weesatche	B	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.

* In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 17.--PHYSICAL PROPERTIES OF A SELECTED SOIL

[Dashes indicate data were not available]

Soil and sample numbers	Depth	Horizon	Particle size distribution (Percent less than 2 mm)							
			Sand						Silt (0.05-0.002)	Clay <0.002
			Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)	Total (2.0-0.05)		
	In									
Lattas clay*										
K378--------	0-11	Ap	0.3	2.0	2.2	25.9	11.2	41.6	18.0	40.4
K379--------	11-22	A12	0.4	2.0	2.0	23.6	9.9	37.9	18.3	43.8
K380--------	22-40	A13	0.4	2.0	2.1	23.1	9.6	37.2	19.7	43.1
K381--------	40-55	ACca	---	---	---	---	---	32.1	21.8	46.1
K382--------	55-72	Cca	0.1	1.3	1.9	22.2	9.5	35.0	21.1	43.9

* This pedon is not the one described as typical of the series.

TABLE 18.--CHEMICAL PROPERTIES OF A SELECTED SOIL

Soil and sample numbers	Depth	Horizon	Extractable bases			Sodium adsorption ratio	Cation exchange capacity	Calcium carbonate equivalent	Organic carbon	pH
			Magnesium	Sodium	Potassium					H_2O (1:1)
	In		Meg/100g				Meg/100g	Pct	Pct	
Lattas clay*										
K378---------	0-11	Ap	5.3	1.8	0.7	4	33.0	4.1	1.39	7.9
K379---------	11-22	A12	6.2	5.0	0.5	10	32.9	7.6	0.81	8.2
K380---------	22-40	A13	6.6	10.3	0.7	18	32.4	7.1	0.64	8.1
K381---------	40-55	ACca	5.5	11.7	0.8	17	31.3	7.1	0.29	7.8
K382---------	55-72	Cca	5.0	11.7	0.9	19	29.5	9.2	0.17	7.8

* This pedon is not the one described as typical of the series.

TABLE 19.--CLAY MINERALOGY OF A SELECTED SOIL

[Dashes indicate data were not available]

Soil and sample numbers	Depth	Horizon	Percentage of clay minerals*				
			Mont-morillonite	14Å intergrade	Kaolinite	Gibbsite	Quartz
	In						
Lattas clay**							
(0.002-0.0002mm)							
K378	0-11	Ap	<10%	<10%	<10%	---	>40%
K379	11-22	A12	<10%	<10%	<10%	---	>40%
K380	22-40	A13	<10%	<10%	<10%	---	>40%
K381	40-55	ACca	<10%	<10%	<10%	---	>40%
K382	55-72	Cca	<10%	<10%	<10%	---	>40%
(less than 0.0002mm)							
K378	0-11	Ap	>40%	---	<10%	---	<10%
K379	11-22	A12	>40%	---	---	---	---
K380	22-40	A13	>40%	---	---	---	---
K381	40-55	ACca	>40%	---	---	---	---
K382	55-72	Cca	>40%	---	---	---	---

* Average ratio of fine clay (<0.0002mm) to coarse clay (0.002 to 0.0002mm) is 2.55.
** This pedon is not the one described as typical of the series.

TABLE 20.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	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	Pct
Coy clay:[3] (S76TX-025-005)																	
Ap------- 0 to 8	A-7-6(21)	CH	100	100	100	100	99	74	72	55	45	51	29	2.64	13.0	16.0	1.8
B21t----- 8 to 40	A-7-6(22)	CL-CH	100	100	100	100	98	74	71	61	52	50	31	2.67	12.0	16.8	1.9
B3ca-----40 to 50	A-7-6(30)	CH	100	100	100	100	99	74	72	60	50	59	42	2.69	14.0	19.0	1.9
Cca------50 to 64	A-7-6(27)	CH	100	100	100	100	99	73	69	60	48	54	39	2.71	12.0	18.4	1.9
Lattas clay:[4] (S76TX-025-012)																	
A-------- 0 to 35	A-7-6(34)	CH	100	100	100	100	98	74	70	59	52	64	46	2.68	9.0	22.5	2.0
Ac-------35 to 50	A-7-6(39)	CH	100	100	100	100	98	76	73	59	52	70	51	2.70	11.0	22.8	2.0
C--------50 to 60	A-7-6(38)	CH	100	100	100	100	99	79	75	61	55	66	46	2.74	9.0	23.0	2.0
Monteola clay:[5] (S76TX-025-014)																	
A-------- 0 to 30	A-7-6(31)	CH	100	100	100	100	97	78	74	57	49	60	39	2.68	12.0	19.8	1.9
AC-------30 to 48	A-7-6(44)	CH	100	100	99	99	97	87	82	64	57	69	46	2.73	14.0	21.3	1.9
C--------48 to 60	A-7-6(58)	CH	100	100	100	100	100	96	91	69	62	80	52	2.72	17.0	22.4	1.8
Papalote loamy fine sand:[6] (S76TX-025-020)																	
A1------- 0 to 14	A-2-4(00)	SM	100	100	100	100	95	17	12	6	4	18	3	2.63	17.0	0.7	1.7
B21t-----14 to 35	A-7-6(07)	SC	100	100	100	100	96	43	40	35	33	44	28	2.66	16.0	13.2	1.8
B3ca-----35 to 75	A-6 (03)	SC	100	100	100	99	96	36	32	25	23	38	24	2.70	15.0	11.0	1.8
Parrita sandy clay loam:[7] (S76TX-025-021)																	
A1------- 0 to 6	A-2-4(00)	SM-SC	100	100	100	100	100	31	14	14	12	25	7	2.61	17.0	4.3	1.7
B2t------ 6 to 18	A-7-6(10)	CL	100	100	100	100	100	52	40	40	37	46	27	2.69	15.0	14.3	1.8
Ccam-----18 to 25	A-2-6(00)	GW-GC	49	35	25	20	17	8	4	4	4	36	20	2.66	20.0	7.8	1.7

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	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	Pct
Pernitas sandy clay loam:[8] (S76TX-025-022)																	
A1------- 0 to 10	A-6 (03)	SC	100	100	100	100	100	43	38	26	21	29	15	2.66	16.0	7.0	1.8
B2t-------10 to 36	A-6 (06)	CL	100	100	100	99	98	53	48	36	30	33	19	2.65	15.0	9.3	1.8
Cca-------36 to 60	A-6 (09)	CL	100	100	100	99	98	67	62	47	36	35	17	2.67	19.0	8.0	1.7
Weesatche fine sandy loam:[9] (S76TX-025-027)																	
Ap-------- 0 to 8	A-2-6(01)	SC	100	100	100	100	98	34	30	20	18	28	13	2.65	18.0	5.4	1.7
B2t------- 8 to 25	A-6 (04)	SC	100	100	100	100	98	42	38	28	26	36	21	2.65	17.0	9.4	1.7
B23tca---25 to 34	A-7-6(11)	CL	100	100	100	100	98	54	52	41	35	43	28	2.69	15.0	13.2	1.8
Cca-------34 to 60	A-6 (09)	CL	100	100	100	100	98	61	56	41	31	33	20	2.70	14.0	10.0	1.9

[1]For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3]Coy clay: From schoolhouse in Pawnee, 4 miles south on Farm Road 673, 2.9 miles south on county road, 50 feet east, in pasture.

[4]Lattas clay: 7.1 miles south and east on Farm Road 796 from its junction with U.S. 59, 0.3 mile north on county road, 150 yards east, in field.

[5]Monteola clay: From junction of Farm Road 673 and Farm Road 798 in Pawnee, 2 miles east on Farm Road 798, 2.75 miles north on county road, 150 feet northeast of road.

[6]Papalote loamy fine sand: 6.6 miles southeast on Texas 202 from U.S. 181 bypass, 0.5 mile south on private road, 75 yards east, in pasture.

[7]Parrita sandy clay loam: 8.5 miles north on Farm Road 673 from its junction with U.S. 59, 2.1 miles east and south on Farm Road 2824, 160 feet west, in rangeland.

[8]Pernitas sandy clay loam: From schoolhouse in Pawnee, 4 miles south on Farm Road 673, then 4.4 miles south and west on county road, 100 feet south, in rangeland.

[9]Weesatche fine sandy loam: 8.6 miles west and north on Farm Road 798 from its junction with U.S. 181 at Tulsita, 1.1 miles north on county road, 100 feet west, in field.

TABLE 21.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aransas	Fine, montmorillonitic (calcareous), hyperthermic Vertic Haplaquolls
Arents	Loamy, carbonatic, hyperthermic Arents
Clareville	Fine, montmorillonitic, hyperthermic Pachic Argiustolls
Coy	Fine, montmorillonitic, hyperthermic Vertic Argiustolls
Edroy	Fine, mixed, hyperthermic Vertic Haplaquolls
Goliad	Fine, mixed, hyperthermic Petrocalcic Paleustolls
Kincheloe	Fine, montmorillonitic, hyperthermic Vertic Ustochrepts
Lattas	Fine, montmorillonitic, hyperthermic Typic Pellusterts
Leming	Clayey, mixed, hyperthermic Aquic Arenic Paleustalfs
Monteola	Fine, montmorillonitic, hyperthermic Typic Pellusterts
*Nueces	Loamy, mixed, hyperthermic Aquic Arenic Paleustalfs
Odem	Coarse-loamy, mixed, hyperthermic Cumulic Haplustolls
Olmos	Loamy-skeletal, carbonatic, hyperthermic, shallow Petrocalcic Calciustolls
Orelia	Fine-loamy, mixed, hyperthermic Typic Ochraqualfs
Papagua	Fine, mixed, hyperthermic Typic Albaqualfs
Papalote	Fine, mixed, hyperthermic Aquic Paleustalfs
Parrita	Clayey, mixed, hyperthermic, shallow Petrocalcic Paleustolls
Pernitas	Fine-loamy, mixed, hyperthermic Typic Argiustolls
Pettus	Loamy-skeletal, carbonatic, hyperthermic Typic Calciustolls
Racombes	Fine-loamy, mixed, hyperthermic Pachic Argiustolls
*Sarita	Loamy, mixed, hyperthermic Grossarenic Paleustalfs
Sinton	Fine-loamy, mixed, hyperthermic Cumulic Haplustolls
Weesatche	Fine-loamy, mixed, hyperthermic Typic Argiustolls

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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